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Early sport specialization (ESS) is an increasingly common occurrence in youth sports due to the perception that it increases a child's chances for attaining elite athletic success (Swindell et al., 2019; Waldron et al., 2020). However, a growing body of research has challenged this notion while also showing that ESS is associated with an elevated risk of sustaining a sport-related injury (Burwell et al., 2022; N. A. Jayanthi et al., 2019). Further exploration of the relationship between early sport specialization and chronic injury is warranted. Early sport specialization has also been associated with increased athlete burnout and decreased sport participation in adulthood (Giusti et al., 2020; Russell & Limle, 2013). However, the reasons behind these associations remain unclear. Therefore, the objectives of this study were to investigate the relationship between ESS and chronic injuries and to understand the underlying reasons and values that influence the decisions regarding sport specialization. A sample of college students was surveyed to determine their history of sport participation, specialization, and sport-related injury, along with their current levels of physical activity and sport participation. Questions explored their motivations for choosing to specialize in their sport as well as the reasons why those who no longer play their sport decided to quit. Data analysis focused on relationships between age and degree of specialization and the odds of a student still dealing with chronic effects of a sport-related injury. The study found that a high degree of early specialization was associated with significantly greater odds (OR = 2.53; 95% CI [1.24, 5.13]) of having sustained a chronic injury. The most significant factor that drove the decision to specialize early was enjoyment of their sport. Loss of enjoyment was the main reason cited for quitting a sport that they had once specialized in. These findings can be used to help educate

parents, coaches, and researchers regarding the potential drawbacks of their children specializing too early in a sport while also providing them insight into some of the reasons surrounding the specialization decision.

EARLY SPORT SPECIALIZATION AND CHRONIC INJURIES IN COLLEGE STUDENTS

by

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Approved by

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DEDICATION

To Meredith, whose loving sacrifice of time and energy over these last four years to care for our family enabled me to finish what I started. You are the best, the prettiest, and my favorite of all time.

To my boys, Malachi, Judah, and Asa, who didn't always know why Daddy couldn't play with them, but always had the biggest smiles when I could. Remember, there's nothing you can ever do to make me love you less.

To my parents, Gil and Norene Zinke, who always encouraged and supported me in my studies, and who taught me the most important things in life.

APPROVAL PAGE

This dissertation written by Timothy J. Zinke has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

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CHAPTER I: PROJECT OVERVIEW

Organized youth sports and high school athletics are a significant and growing part of American society, involving approximately 60 million children ages 6-18 (DiFiori et al., 2014; Rugg et al., 2018). Though high participation rates in youth sports are generally viewed as a positive development, an accompanying trend that has elicited concern among various healthcare professions is early sport specialization (ESS) (AMSSM Collaborative Research Network Youth Early Sport Specialization Summit et al., 2022). ESS is when a child who is prepubertal and/or younger than 12 participates in a single sport for at least eight months out of the year and does so to the exclusion of participation in other sports and limitation of free play (Popkin et al., 2019a). An athlete's degree of specialization is typically categorized as low, moderate, or high (N. A. Jayanthi et al., 2015).

A high degree of early sport specialization carries a myriad of risks for young athletes. These risks are both psychological (burnout, sport attrition, etc.) and physical (acute and overuse injuries) (DiFiori et al., 2014; Field et al., 2019; Lansdown et al., 2020; McGuine et al., 2017; Post et al., 2017; Rugg et al., 2021; Xiao et al., 2021). Acute injuries are those sustained at a specific instant (e.g. fractures, sprains, etc.) while overuse injuries typically happen due to repetitive microtrauma to tissues over time (e.g. stress fractures, tendinosis, etc.). In light of these increased risks, the American Academy of Pediatrics, the American Orthopedic Society for Sports Medicine, the National Athletic Trainers' Association, the National Strength and Conditioning Association, the International Society of Sport Psychology, and the American Medical Society for Sports Medicine all discourage youth athletes from early sport

specialization (Brenner et al., 2016; Côté et al., 2009; DiFiori et al., 2014; LaPrade et al., 2016; Lloyd et al., 2016; Valovich McLeod et al., 2011).

Despite the near universal recommendation from sports medicine organizations to avoid early specialization, the pressure on youth to specialize early continues largely unabated. The sociocultural factors driving this trend are complex and include the popularization of Deliberate Practice Theory, pursuit of college scholarships and professional careers, and economic pressures of a multi-billion dollar youth sport industry (Ericsson et al., 1993; Mosher et al., 2022; Research and Markets, 2019; Swindell et al., 2019; Waldron et al., 2020). While some researchers are beginning to challenge the notion that early specialization is needed to attain to elite levels of sport participation (Barth et al., 2022; DiFiori et al., 2017; Rugg et al., 2018, 2021; Swindell et al., 2019), further research is still required to understand the reasons why athletes choose to specialize early. Additionally, though burnout is often cited as a contributing factor, little is known about the reasons why athletes who did specialize early eventually quit their sport.

Another area that has still received only limited attention in research is the long-term impact of early sport specialization on physical health in terms of chronic injury, disability, and health-related quality of life (Burwell et al., 2022; Croci et al., 2021; Wilkins et al., 2022). As noted above, young athletes who have a high degree of sport specialization have shown higher incidence of injuries than those with low specialization. While this association is cause for immediate concern due to the various burdens that an injury places on an athlete, there may also be cause for long-term concern, given that previous injury has consistently been identified as a significant risk factor for subsequent injury (Emery et al., 2005; Kucera et al., 2005; Owoeye et al., 2018; Wikstrom et al., 2021). In other words, early sport specialization increases the odds of an athlete getting injured, which in turn could increase their odds of getting hurt again. Chronic

or recurring injuries at any joint can often lead to significant long-term musculoskeletal damage and dysfunction as well as physical impairment and disability. However, the potential relationship between early sport specialization, chronic, long-term injuries, and sport attrition requires further exploration.

Relevant Literature

Organized sports are an important part of youth culture in the United States. Approximately 60 million children between the ages of 6-18 participate in some form of organized sports (DiFiori et al., 2014). Though children often drop out of sports as they get older, the National Federation of State High School Associations still estimated that in 2018-19 there were nearly eight million high school students who participated in high school athletics, which is roughly a 33% increase over the last 20 years (Rugg et al., 2018). This is an encouraging trend due to the variety of benefits that are associated with youth involvement in sports. These benefits range from psychological and emotional, to physical, and even social (Eime et al., 2013; Guddal et al., 2019; Linker et al., 2022; Logan et al., 2019; McVeigh et al., 2019). Many of the positive effects of youth sport participation last into adulthood, meaning that increased levels of participation can have a significant long-term impact on public health (Bell et al., 2019; Gallant et al., 2022; Haynes et al., 2021; Howie et al., 2016; Jewett et al., 2014; Sabiston et al., 2016). These benefits of youth sport participation mean that the increase in involvement seen over the last two decades can generally be viewed as a positive trend.

However, not all changes to the nature of youth sports in our culture have been unequivocally good. Youth sports have also become increasingly structured, expensive, and competitive in comparison to previous generations, who more commonly played sports outside of school in a free, un-structured way without adult direction and oversight (Feeley et al., 2016).

The increasing demands of time and money that are placed on children and families in order to try and gain a competitive advantage in sports at a younger age has led some researchers to refer to this trend as "the professionalization of youth sports" (Popkin et al., 2019a). One result of this trend is the phenomenon of early sport specialization (ESS).

The estimated prevalence of ESS among single-sport high school and college athletes ranges from 20-35% based on the sport, with higher rates for team sport athletes (Meisel et al., 2022; Nagano & Oyama, 2023; Wilkins et al., 2022). Though researchers often vary in how they define ESS, it is generally characterized by a young athlete (prepubertal and/or <12 years old) considering one sport to be more important than other sports, participating in that sport for >8 months/year, and having only ever played that sport or given up all other sports to focus on that sport (LaPrade et al., 2016). Since multiple levels of sport specialization exist, the degree of an athlete's specialization is typically categorized as low, moderate, or high. This categorization is based on a three-question survey that asks: (1) "Can you pick a main sport?" (2) "Did you quit other sports to focus on a main sport?" (3) "Do you train >8 months in a year?" The number of affirmative answers corresponds to the degree of specialization, with 3 "yes" answers being classified as "high" specialization (N. A. Jayanthi et al., 2015).

There are a variety of sociocultural factors that have contributed to the trend of ESS in youth sports. Deliberate Practice Theory, introduced by Ericsson et al. in 1993 and popularized as the "10,000- hour rule" by Malcolm Gadwell's 2008 book Outliers, has profoundly shaped how practice at a young age is viewed (Smith, 2015; Waldron et al., 2020). Parents, often motivated by a desire to see their children receive college scholarships or become pro-athletes, believe that maximizing focused practice by having their child specialize early is the best path to that goal (Rugg et al., 2021; Swindell et al., 2019). Furthermore, youth sports, driven by high

fees for club and travel teams that often require year-round commitment, is now an incredibly lucrative business with a market size that rivals the NFL (Research and Markets, 2019). Thus, there are significant financial forces that encourage early specialization as well. In summary, the factors driving the early sport specialization trend are complex and manifold. Recently, Mosher et al. (2022) proposed a framework for understanding the reasons behind the decision to specialize early that takes into account the various antecedent conditions that can combine to increase the likelihood of early specialization. External factors such as a parent or coach's influence and perceived scholarship opportunities work together with internal factors such as the athlete's passion for their sport and drive to succeed to make early specialization seem the most logical path to take (Mosher et al., 2022; Swindell et al., 2019). Recognizing the complexity of this interplay, further research into the "why" question behind ESS should explore both sociocultural factors that encourage and promote ESS as well as individual values and beliefs that motivate the decision to specialize early.

What is interesting to note, however, is that the growth of ESS continues despite the fact that most sports medicine organizations are actively discouraging the practice (N. A. Jayanthi et al., 2019). The reason that ESS has created such concern among healthcare professionals and medical organizations is because of the increased risk of physical injury that it carries. These injuries can be either acute or overuse injuries, both of which can significantly affect an athlete's health and performance. Overuse injuries are those that lack a specific injury event, but instead arise from repetitive microtrauma to a specific part of the body. Examples of overuse injuries associated with ESS include strains, stress fractures, Osgood-Schlatter's syndrome, patellofemoral pain, Sinding-Larsen-Johansson syndrome, elbow ligament injuries, and osteochondritis dissecans (Bell et al., 2016; N. A. Jayanthi et al., 2019).

The relationship between overuse injuries and ESS is, by this point, well-established. Multiple studies have shown that level of specialization (high vs. moderate vs. low) is a significant risk factor for sustaining overuse injuries to both the upper and lower extremity (Kox et al., 2015; McGuine et al., 2017; O'Kane et al., 2017; Post, Struminger, et al., 2020). A case-control study of young athletes (age: M=13.7) across multiple sports who had specialized early also found that athletes who were highly specialized had higher odds of having sustained a serious overuse injury, defined as one for which a physician recommended at least 1 month rest from the sport (N. A. Jayanthi et al., 2015). Finally, two recent systematic reviews focused on early sport specialization found that rates of overuse injuries ranging from mild (e.g. Osgood-Schlatter's syndrome) to serious (e.g. stress fractures) were higher in athletes with high specialization (Bell, Post, et al., 2018; N. A. Jayanthi et al., 2019).

Research findings for the connection between ESS and acute injuries have been more mixed. As described earlier, an acute injury is when tissue is damaged at a specific instant due to some type of physical trauma. Acute injuries that have been linked with ESS to varying degrees include fractures, ligament sprains, and concussions (Okoruwa et al., 2022; Post et al., 2017). The severity of acute injuries appears to be greater among athletes who are highly specialized compared to those who aren't (Ahlquist et al., 2020; Frome et al., 2019; Xiao et al., 2021). A high degree of early specialization also appears to negatively impact the career longevity of professional athletes in some sports (Confino et al., 2019; Rugg et al., 2018). Some researchers have found an increased odds of having reported an acute injury when comparing athletes with high and low degrees of specialization (Bell, Lang, et al., 2018; Post et al., 2017). However, other studies have found no significant increase in acute injuries associated with ESS, leaving the picture somewhat less clear regarding the true nature of this relationship (N. A. Jayanthi et al.,

2015; McGuine et al., 2017). In summary, despite a few studies to the contrary, the bulk of evidence supports the view that a high degree of ESS increases the risk of injury in young athletes.

While the relationship between ESS and injuries is well-established, the reason for this relationship is still under debate. Some point to the high training volumes that are inherent in ESS as the primary reason for the increased injury risk, arguing that ESS simply means more athlete-exposures, which will naturally lead to more injuries (Ahlquist et al., 2020; Field et al., 2019; N. A. Jayanthi et al., 2015; Post et al., 2017). This view has led to the development of guidelines for how to properly manage training load in athletes who choose to specialize, as well as recommendations for appropriate limits on training volume to be implemented for young athletes (N. A. Jayanthi et al., 2021; Post et al., 2017). Another explanation of the increased rates of injuries in the ESS population is that exposure to a limited variety of movement patterns associated with a single sport leads to muscular imbalances in strength and flexibility and decreased overall motor skill competency (DiCesare et al., 2019; DiStefano et al., 2017; Frome et al., 2019; Kliethermes et al., 2020; Mosher et al., 2022; Myer et al., 2016; Waldron et al., 2020). In order to encourage diverse neuromuscular development in youth athletes, unstructured play and sport-sampling, where an athlete alternates among multiple different sports, has been increasingly advocated for the pre-adolescent years (Brenner et al., 2016; Côté et al., 2009; Myer et al., 2016). In conclusion, the observed relationship between ESS and injury risk is likely due to both high training volume and inadequate diversification in motor development resulting from limited activity patterns.

Much research has been done to elucidate the relationship between ESS and acute and overuse injuries, but an area that remains largely unexplored is the chronic, long-term effect of

those injuries. The strongest, most reliable predictor of injury risk in an athlete is previous injury (Kucera et al., 2005; Owoeye et al., 2018; Wikstrom et al., 2021). If youth who specialize early in their sport are at an increased risk of injury, both in frequency and severity, this would likely mean that they are at an increased risk for subsequent injury as well. Both severe acute injuries and repeated injuries to a joint can lead to chronic conditions marked by pain, limited sport participation, long-term dysfunction, and physical disability. A few studies have investigated this kind of chronic impact on different sporting populations, but findings have been mixed (Croci et al., 2021; Okoruwa et al., 2022; Wilkins et al., 2022). Though there is some preliminary evidence that early sport specialization may have a negative impact on later health-related quality of life, more research is needed to explore this relationship (Burwell et al., 2022; Sheppard et al., 2020; Sweeney et al., 2021).

One particular area of concern regarding the long-term impact of injuries associated with ESS is sport attrition. Athletes who specialized early in their sport are more likely to have quit their sport by the time they reach adulthood compared to those who did not specialize early (Russell & Limle, 2013). However, whether this higher rate of attrition is due to long-term effects of injury remains unknown. One recent study comparing specialized and non-specialized athletes found mixed results regarding the influence of injury on quitting a sport (Okoruwa et al., 2022). Others have proposed that psychological factors such as burnout might be the cause for higher sport attrition in those who specialize early in a sport (Brenner & the Council on Sports Medicine and Fitness, 2007; Giusti et al., 2020). Because of the importance of continued sport participation for long-term health, this gap in the current literature should be explored further.

It would be reasonable to expect that a population with a higher incidence of acute and overuse injuries would also have a higher rate of chronic injuries. If ESS is associated with

increased odds of developing chronic injuries, which can significantly impact future sport participation and health-related quality of life, then more people might begin to consider such a cost not worth the risk. However, as noted above, the factors influencing an individual's decision to specialize early in a sport are complex (Mosher et al., 2022). Further, little is known regarding why athletes who did specialize early eventually quit their sport, despite the fact that they are more likely to do so than those who did not specialize early (Russell & Limle, 2013).

Purpose and Aims

The objectives of this study were to investigate the relationship between ESS and chronic injuries and to understand the reasons why athletes choose to both specialize in and quit their sport.

Specific Aim #1: Determine the prevalence and estimated odds of chronic injury in college students who had a high degree of specialization in their sport at an early age.

Specific Aim #2: Investigate the reasons why students initially chose to specialize in their sport as a youth.

Specific Aim #3: Investigate the influence that injuries had on the decision of those who no longer play their sport to quit.

Methods

This study was a cross-sectional survey design to allow for a retrospective analysis of the relationship between degree of early sport specialization and a history of chronic injuries in college students. Ranked-order choices allowed investigation into reasons why students had chosen to specialize, and why they may have also given up playing their sport. The study was approved by the IRB at University of North Carolina – Greensboro. Formal reliance agreements were also obtained from other participating institutions prior to subject recruitment.

Preliminary Work

Following expert review, the survey was pilot tested with 40 current college students at the end of April 2023. Based on the pilot work, corrections were made to the display logic of the survey tool. Feedback was also solicited for question clarity, resulting in other minor changes to response options for selected questions. Overall, the results from the pilot testing indicated that the survey would be able to generate the data needed for the purposes of this study.

Participants

College students were the target population of this study. While many studies have examined the impact that ESS has on college athletes, relatively little is known about how it may have affected students who, for whatever reason, chose not to continue their sport in college. These participants were also far enough removed from when they first decided to specialize to allow for long-term effects to begin to manifest, but not so far out that they would be unable to recollect anything about their youth sports experiences. Inclusion criteria for the study were age ($\geq$18) and current enrollment in a college wellness class at a participating institution.

Survey Participants

A total of 322 completed surveys were collected. There were 85 freshmen, 103 sophomores, 64 juniors, 67 seniors, and 3 students of other classification who completed the survey. The age of participants ranged from 18-47 years of age, with the average age of a respondent being around 20 (M=20.4±3.5). Of the respondents, 30.1 % were biologically male and 69.3% were biologically female, with the remaining number choosing not to self-identify.

When self-describing their own current level of physical activity, 30.7% reported being very active (regular exercise 5-7 days/wk), 35.7% reported being moderately active (3-4 days/wk), 29.5% reported being somewhat active (1-2 days/wk), and 4% reported being inactive

(0 days/wk). Fifty-two survey participants (16.1%) currently played an intercollegiate sport at their institution. The distribution of sports can be found in Table 1.

Table 1. Distribution of sport type among student-athlete participants

	n = 52	% of total
Baseball/Softball	6	11.5
Basketball	9	17.3
Competitive Cheer	2	3.8
Cross Country/Track (mid/long distance)	3	5.8
Football	3	5.8
Golf	2	3.8
Lacrosse	1	1.9
Soccer	8	15.4
Tennis	4	7.7
Track (short distance) & Field	1	1.9
Volleyball	6	11.5
Wrestling	3	5.8
Other:	4	7.7

Survey

The assessment tool for this study was a questionnaire that focused on both ESS and chronic injuries (Appendix H). This questionnaire was developed based on survey tools used in previously published research (Buckley et al., 2017; Padaki et al., 2017; Swindell et al., 2019). It was then refined through pilot testing as noted above. The final version contained 30 questions, though not all subjects were required to answer each question. Depending on their responses, the questionnaire took subjects approximately 2-10 minutes to complete. Demographic information collected included age, academic year, athletic status, sporting history, and history of injury. Specifically, subjects were asked if they ever sustained an injury that continued to affect them for more than one year after the initial injury, or that they believe still affects their everyday life and function. They were also asked if they ever sustained an injury through participating in sports

that ultimately required surgery. Further questions investigated the nature and severity of such injuries. Recognizing that multiple factors can combine to influence decision-making, the rationale questions were presented in a ranked-choice format rather than a single- or multiple-select format. This approach not only allowed for multiple factors to be acknowledged but also helped identify which factors seemed to carry more weight.

Procedures

This survey was administered as part of a college wellness class that met the college's general education requirement. This ensured that results contained a mix of athlete and non-athlete responses. The survey was administered electronically using a web-based survey tool (Qualtrics, Provo, UT). Institutions that agreed to give the survey as part of their courses included one small liberal arts college and two Division I state universities in the mid-south region. The principal investigator reached out directly to the department heads at each institution for permission to distribute the survey in their classes. Once permission was obtained, the department head then connected the investigator with the individual instructors so that they could be provided with the needed instructions and materials (Appendix G). Instructors of the participating courses were allowed to offer students extra credit in their course for completing the survey.

Subjects were provided with a consent form (Appendix E) describing the nature and purpose of the survey. Results from any surveys of subjects who did not provide consent were immediately and permanently deleted. The survey remained open from the middle of the fall semester in September until the end of November to allow for class sections that started later in the semester. Instructors of the courses were sent two reminders, one following the resumption of

classes after their respective fall breaks and one when there was one week remaining until the survey closed, asking them to please encourage their students to participate in the study.

Data Analysis

Data analysis was conducted using SPSS (Version 27, IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated to evaluate trends of youth sports participation and injury history. Prevalence of early sport specialization was determined based on subject responses to a set of three questions determining the age when 1) a primary sport selected; 2) participation in all other sports stopped; and 3) participation in the primary sport exceeded 8 months per year.

Primary Data Analysis for Specific Aim 1

Prevalence and the odds ratio with 95% confidence intervals were calculated for the association of chronic injuries with a high degree of early sports specialization.

Secondary Data Analysis for Specific Aim 1

Prevalence and the odds ratio with 95% confidence intervals were calculated for each other degree of early specialization (No, Low, and Moderate) and its association with chronic injury. Participants who did not meet any of the above criteria by age 12 were classified as "No ESS", those with only a primary sport were classified as "Low", and those with a primary sport plus one other positive criterion were classified as "moderate". "Moderate" was further subdivided into "volume" (primary sport + >8 months) and "sport" (primary sport + no other sports) to explore if one component had a more significant effect on odds of chronic injury than the other. Finally, prevalence and the odds ratio with 95% confidence intervals were also calculated for each degree of early specialization and its association with any history of injury, regardless of chronicity.

Primary Data Analysis for Specific Aims 2 and 3

Descriptive statistics were used to analyze the rationale questions and determine what reasons are most commonly provided and seem to have the greatest influence on the decision to specialize early as well as on the decision to give up a sport.

Findings and Discussion

The aim of this study was to examine the relationship between early sport specialization and chronic injury while also exploring the motivations that children and youth have for both choosing to specialize and also cease participating in their sport of choice. The discussion of findings will therefore first focus on the sporting and injury history of the survey participants. Then, reasons underlying the decision to specialize will be discussed, followed by reasons that a former athlete might no longer participate in his or her sport.

Sport Participation

Organized sports continue to be a significant part of childhood experience in American culture, with 270 (83.9%) participants reporting that they were involved in organized sports in some capacity as a child/youth compared to 52 (16.1%) who never played organized sports growing up. Soccer, basketball, and baseball/softball remain the most popular youth sports, with 39.8, 38.8, and 35.4% of participants, respectively, reporting participating in those sports (Table A5). Of the 270 respondents who did play sports as a child, 222 (82%) reported playing more than 1 sport, with the average child playing approximately 3 (M=2.77) sports throughout their childhood. As children get older, the amount of time dedicated to sports appears to increase, as 56.3% reported being involved in organized sports for at least 9 months out of the year between the ages of 12-18, while only 37.7% reported the same level of involvement between the ages of 6-12.

Injuries

Injuries continue to be a common part of the sporting experience, as 202 respondents (74.8%) reported sustaining an injury while participating in organized sports that caused them to miss at least one game or practice. Regarding more severe injuries, 53 respondents (19.6%) reported sustaining an injury that required them to have surgery. The main outcome of interest for this study was chronic injuries, which were defined as injuries that continued to affect an athlete for at least 1 year following their occurrence. One hundred twenty-nine people (47.8%) reported sustaining a chronic injury while participating in organized sports. The most common site for chronic injuries was the knee (30; 23.3%), followed by the ankle, low back, and shoulder (Table 3). Ligament sprains were the most common type of chronic injury (n=44), followed by musculotendinous strains and tears (n=30). Despite the ongoing impact of the injury, the vast majority (80.6%) of those with a chronic injury returned to their sport within 6 months of the initial injury. Recovery time appeared to be at least partly affected by participation volume, as the odds of a prolonged delay in returning to sport (>6 months before return) were significantly higher in those with a high volume of training (>8 months/year) at an early age (<12 years of age) (OR = 2.50; 95% CI [1.02, 6.11]). This naturally raises the question of how much continuing to play through injury contributes to injury chronicity, a topic that should be further explored in future research. Of the 129 people with chronic injuries, over half (n=77; 59.7%) reported that they still continued to experience pain at the time of the survey, making pain the most common long-term effect. The two other most common long-term effects were limited ROM/stiffness (n=58; 45%) and weakness (n=48; 37.2%). Only 21 people (16.3%) who had a chronic injury reported that they no longer experienced any effects from the initial injury.

Sport Specialization

The first criteria for assessing degree of specialization is whether or not an athlete has identified their primary sport. Of those who played organized sports during childhood and adolescence (n=270), 236 (87.4%) indicated that they had what they considered to be their primary sport. Most (n=168; 71.2%) reported deciding on their primary sport by the age 12, which would indicate that at least a low degree of early specialization has become fairly commonplace in American youth sports. Age 12 was the most common age (n=36) for deciding on a primary sport, and by age 15 virtually all athletes (96.6%) had determined their primary sport.

The second criteria determining degree of specialization is whether or not the athlete has played any other sport besides his or her primary sport, or if they have given up all other sports to focus solely on that sport. Fifty-six athletes (23.7% of those with a primary sport) reported never playing any sports besides their primary sport, while the other 76.3% reported multi-sport experience. Among the single-sport athletes, soccer was the most common sport of specialization (n=14; 25%). Only 7 (12.5%) of these athletes currently played an intercollegiate sport, and none of them were soccer players.

Among those with multi-sport experience (n=180), 141 (78.3%) eventually decided to give up all other sports to focus on their primary sport. Of those who gave up all other sports, 51 (36%) had done so by the age of 12. Age 14 was the most common age at which all other sports were foregone in favor of a primary sport.

The third specialization criteria is the number of months per year that the athlete participates in his or her sport in an organized capacity. If the training volume is greater than 8

months out of the year, then the athlete would be considered to be specialized. Of the 180[1] respondents, over half (57.2%) had begun playing their primary sport for >8 months/year by the age of 12. Though 12 was again the most common age at which this shift occurred (n=22; 12.2%), the second most common age where this happened was prior to age 6 (20; 11.1%). Only 15 athletes (8.3%) reported never reaching the point where they played their primary sport for more than 8 months out of the year.

Early Specialization

As discussed previously the degree of specialization is determined by how many of the three criteria for specialization an athlete meets. If they are positive for only one (e.g. only have a primary sport but do not play it for more than 8 months and still play other sports), they would be classified as low specialization. The degree of early specialization is based on how many criteria have been met by the age of 12. Results for prevalence of each degree are reported in Table 2.

Table 2. Prevalence of early specialization by degree

Degree of Early Specialization	**n = 270 (%)**
None (0/3)	87 (32.2)
Low (1/3)	45 (16.7)
Moderate (2/3)	96 (35.6)
Sport	50 (18.5)
Volume	46 (17.0)
High (3/3)	42 (15.6)

[1] The age at which they began playing their sport for more than 8 months was not reported for those who only ever played one sport.

ESS and Injuries

Table 3 reports the prevalence and odds ratio with 95% confidence interval for the association of each degree of early specialization with chronic injury. The first specific aim of this study was to investigate if a high degree of early specialization increased the odds of a participant reporting a chronic injury. Based on analysis of the survey data, the odds of reporting a chronic injury were significantly higher for those who had a high degree of early specialization than those who did not (OR=2.53; 95% CI [1.24, 5.13]). Conversely, the odds of having had a chronic injury were significantly lower for those with no early specialization reported compared to those who had at least some degree of early specialization (OR=0.39; 95% CI [0.23, 0.66]).

Table 3. Comparison of chronic injury odds based on degree of early specialization.

		Chronic Injury		**Odds Ratio**
		Yes	No	**[95% CI]**
No ESS		28	59	**0.39 [0.23, 0.66]**
Low ESS		22	23	1.05 [0.56, 2.00]
Moderate ESS		51	45	1.40 [0.85, 2.30]
	Sport	25	25	1.12 [0.60, 2.06]
	Volume	26	20	1.53 [0.81, 2.90]
High		28	14	**2.53 [1.24, 5.13]**

Note: Bold data represent significant values

Table 4 contains the data comparing the odds of having been injured based on a participant's degree of early specialization. A secondary aim of this study was to explore the relationship between degree of early specialization and odds of sustaining a sports injury. Those

with a moderate degree of early specialization were the only ones who had higher odds of having sustained an injury while playing sports compared to those who were not (OR=2.36; 95% CI [1.25, 4.48]). The single biggest factor influencing the odds of injury appears to be training volume, as the group who was classified as moderately specialized based on training volume had an odds ratio of 4.20 (95% CI [1.45, 12.19]) for history of sports injury. Though high specialization also had an elevated odds ratio for sustaining an injury, it did not reach a statistically significant level (OR=1.83; 95% CI [0.77, 4.33]). In contrast, those who had no early specialization had significantly lower odds of having had a sports injury compared to those with any degree of early specialization (OR=0.30; 95% CI [0.17, 0.53]).

Table 4. Comparison of injury odds based on degree of early specialization.

		Injury		Odds Ratio
		Yes	No	**[95% CI]**
No ESS		51	36	**0.30 [0.17, 0.53]**
Low ESS		35	10	1.22 [0.57, 2.61]
Moderate ESS		81	15	**2.37 [1.25, 4.48]**
	Sport	39	11	1.24 [0.60, 2.58]
	Volume	42	4	**4.20 [1.45, 12.19]**
High		35	7	1.83 [0.77, 4.33]

Note: Bold data represent significant values

Reasons for Specialization

Another specific aim for this study was to explore the reasons why children and youth are inclined to specialize in their sport. Recognizing that there is rarely one sole reason behind such

a decision, the respondents were allowed to select any reasons they felt contributed, and were then asked to rank their reasons in order of importance (1=Most Important). Table A6 shows the frequency and average rank of the most common reasons cited by study participants. Reasons given in the "Other" category can be found in Appendix I.

Of the 198 people who cited personal enjoyment as a reason, 71% listed it as their top reason for specializing. When listed as one of the top 2 reasons, that number rose to 86%. It was a top 3 reason for 95.5% of all respondents, highlighting just how central the experience of enjoyment is to our decision-making process. The perceived social element of youth sports specialization is also an important influence, with it being a top 3 reason for 80% of those who listed it as a factor in their decision. The prospect of college scholarships is also often associated with early sport specialization. Though the total number of people who listed scholarships as a reason was only 87, it was a top 3 reason for 71.3% of that group, with more people listing it as their number 1 reason (n=19) than friendships (n=17).

Reasons for Quitting

In addition to learning more about the reasons that drive children to specialize in a sport, this study also aimed to elucidate why children who have specialized their sport eventually choose to quit. A total of 190 respondents met the criteria of having had a primary sport, but now no longer playing it at the intercollegiate level. Similar to the previous section, these subjects were asked to provide their reasons for quitting and then rank those reasons in order of importance (1= Most important). Table A7 depicts the most common reasons that the participants in this study gave for why they no longer played the sport in which they had once specialized along with the average rank for each reason. Reasons given in the "Other" category can be found in Appendix I.

Corresponding to the main reason that children initially specialized, the most common reason cited for discontinuing participation in their primary sport was “loss of motivation or enjoyment” (n=98). The two other most common reasons were “increased stress” (n=72) and “pressure and expectations for performance” (n=64). It is easy to see the relationship of these three factors, as the pressure to perform likely increased stress, and high levels of stress are typically inversely associated with level of enjoyment. Sixty-one people cited “loss of enjoyment” as the number one factor influencing their decision. The three most common reasons noted above accounted for the primary reason for over half of all respondents (n=99; 52%). Though fewer people (n=42) cited “experience of injury” as a reason for quitting, for those that did cite it, 40.5% listed it as the number one reason for stopping. The only other common reason (cited at least 40 times) that was cited by a higher relative percentage of people as their top reason was “loss of enjoyment”. Finally, among those who had experienced a chronic injury, “experience of injury” had the second highest number people ranking it as a top 2 reason (n=26), trailing only loss of enjoyment (n=41).

Discussion

Researchers have recently begun to investigate some of the longer-lasting effects that ESS might have on health (Croci et al., 2021; Okoruwa et al., 2022; Wilkins et al., 2022). Each of these studies looked at a sample within a specific sport (baseball, soccer, and baseball, respectively). The current study expands on this knowledge, finding a significantly increased odds of reporting a chronic injury among those who had a high degree of ESS across a wide array of sports, allowing the findings to be more generalizable. Not only are young athletes who become highly specialized at an early age more likely to get hurt, they are also more likely to stay hurt for an extended period of time. In fact, 84% of those who sustained a chronic injury

playing sports reported that they were still experiencing effects from the initial injury at the time of our survey.

The finding of high ESS increasing the odds of chronic injury is similar to that of Okoruwa et al. (2022), who found a non-significant increase in the odds of a chronic injury in highly specialized female adolescent soccer players. The higher odds ratio in the present study is likely due to the difference in how chronic injury was defined, as well as the population being studied. Sampling college students rather than adolescent athletes allows more of an athlete's career to elapse, increasing the amount of time in which a chronic injury might take place. It is possible that some of the younger athletes in the Okoruwa study will go on to sustain a chronic injury at some point before their collegiate years. However, the prevalence of chronic injuries found in each study was markedly similar (31% vs. 29%). Due to the significant impact that chronic injuries are having in youth sports, further research of this phenomenon is warranted.

The increased odds of chronic injury in those who had a high degree of ESS may be a contributing factor underlying the findings of Burwell et al. (2022) that college athletes who specialized early reported a decreased health related quality of life (HRQoL) compared to those who specialized late. An individual who continues to deal the effects of an injury, such as pain, loss of range of motion, etc., for at least a year will likely see a decrease in their overall QoL as a result. One indication from the results of the present study that chronic injury may contribute to a lower HRQoL is that nearly 60% of those who sustained a chronic injury reported still being in pain at the time of the survey. Only 16% reported that they no longer experienced any effects from the initial injury.

This impact on HRQoL may also be connected to sport attrition. As noted above, 42 people cited "experience of injury" as the reason that they quit playing their sport, with the

average ranking of that reason being 2.14. Of these 42 people, 80% reported sustaining a chronic injury. Seventy-six percent of those who had a chronic injury and quit their sport due to injury were still experiencing pain at the time that they took the survey. However, it is important to note that while "experience of injury" as a reason for quitting could be in reference to them dealing with the ongoing effects of said injury, it could also be referencing the traumatic experience of the injury or fear of re-injury. It is also not possible from this data to determine the degree to which the chronicity of the injury influences the decision to quit. Thus, additional research into how exactly an experience of injury contributes to these people quitting their sport would help shed more light on this topic. What is clear, however, is that the effects of ESS, such as an increased in the odds of chronic injury, are not just limited to college athletes. While Burwell et al. (2022) looked specifically at college athletes, the present study shows that ESS is common even among those who do not go on to play an intercollegiate sport. Thus, one area of further research could be an investigation into the HRQoL of non-athletes who were highly specialized in a sport from an early age.

A high degree of early sport specialization is already associated with higher rates of overuse injuries as well as greater severity of those injuries (Bell, Post, et al., 2018; N. A. Jayanthi et al., 2015). While the current study did not distinguish between overuse or acute injuries for those who reported being injured, it did find that the odds ratio for reporting a sports injury was higher for those who were moderately specialized rather than highly specialized. This is in contrast to most published studies which have found that high specialization is associated with the highest likelihood of getting injured (McGuine et al., 2017; Post, Struminger, et al., 2020). It is important to note, however, that most of these studies looked at current level of specialization and its relationship to overuse injuries rather than looking an athlete's degree of

early specialization. Another possible explanation for the difference between the current study and previously published studies is that, for the current study, athletes who only ever played a single sport did not report the age at which they began playing that sport for more than 8 months. Thus, it is possible that some of the athletes who were categorized as "moderate" should actually be in the "high" category for ESS, which could in turn lead to different odds ratios for those two categories. Among those who were moderately specialized, a high training volume appears to have the biggest influence on the odds of getting injured (OR=4.20; 95% CI [1.45,12.19]), which aligns with what previous studies have found (Field et al., 2019; Post, Struminger, et al., 2020).

Seeking to better understand why young athletes pursue early specialization in their sport, Mosher et al. (2022) proposed a framework for understanding the reasons behind the decision to specialize early that takes into account both internal (enjoyment, motivation, etc.) and external factors (social pressure, sociocultural norms, etc.) that influence the athlete. Consistent with their findings, the present study identified the internal factor of "personal enjoyment" as the most consistent and strongest influence behind an athlete's decision to specialize. The internal factor of "personal skill level" was also a highly influential reason driving specialization. Mosher et al. (2022) highlighted the role that social pressure can play, which was confirmed in this study as the influence of friendships and parents were both in the top 5 for reasons why an athlete specialized. The final top 5 reason was "desire for college sport participation/scholarship", which is another oft-cited reason discussed in the literature on ESS (Rugg et al., 2021; Swindell et al., 2019). Although much attention has been given to the pressure that a coach may put on an athlete to specialize (Padaki et al., 2017; Post, Trigsted, et al., 2020), the results of the present study indicate that the actual influence that a coach has over the decision appears to be marginal at

best. In conclusion, the present study affirms and reinforces the argument that the influences on the decision to specialize are a complex combination of both internal and external factors that exert varying degrees of influence on each individual athlete.

One way that that clinicians such as athletic trainers might apply the findings of the present study would be to screen for early sport specialization level in incoming athletes. While injury history is commonly reported in preparticipation forms, adding additional questions about early sport specialization may provide the sports medicine staff with a better picture of the athlete's overall development. Questions about chronic injuries may also alert the clinicians to potential long-term quality of life issues that an athlete is dealing with that may not be readily apparent from typical questions about history of injury. Given that ESS has also been associated with higher levels of burnout (Giusti et al., 2020), questions about ESS may also help clinicians identify these athletes who are at increased risk so that they can implement strategies to provide mental health support. Since the current study found that the main reasons athletes give their sport up are a combination of loss of enjoyment, pressure to perform, and increased stress, the aim of these strategies would be to equip athletes to manage stress and maintain or improve their overall enjoyment of their sport.

In addition to benefitting clinicians working with athletes who have already gone through early sport specialization, the findings of this study can also help researchers in the field of ESS to better educate youth sports stakeholders regarding the long-term impact of ESS. Currently, experts recommend delaying sport specialization until at least puberty, using the early childhood years to encourage overall athletic development through the practice of sport sampling instead (Anderson & Mayo, 2015; Côté et al., 2009; Güllich et al., 2022). This recommendation finds additional support in the findings of the current study, as a high degree of early specialization did

not significantly increase the odds that an individual would go on to play an intercollegiate sport (OR=1.469; 95% CI [0.668, 3.229]). The lack of clear and demonstrable benefit for high early specialization, combined with its increased association with chronic injuries, would seem to evince the wisdom in the recommendation to gradually increase an athlete's training load once they begin to reach full skeletal maturity (N. Jayanthi et al., 2022).

Finally, there are important considerations here for exercise science professionals and educators like myself who desire to encourage people of all ages to be physically active. A lifetime of participation in physical activity is one of the best ways for individuals to steward their own bodies, and participation in youth sports is often an important first step to help people onto that path (Russell & Limle, 2013). Thus, it is important to understand how to create a positive, enjoyable youth sports experience for people, as this is related to the likelihood that they will continue with sport participation into adulthood (Russell & Limle, 2013). As the current study has shown, loss of enjoyment is the number one reason why an individual gives up a sport that they had once loved enough to specialize in. Unfortunately, the mental and physical toll of early sport specialization means that it often leads to decreased enjoyment and ultimately dropout (Giusti et al., 2020; Russell & Limle, 2013). In contrast, sport sampling in the early years combined with the promotion of unstructured play for children, rather than all sport participation being highly organized, helps to develop factors such as self-efficacy and intrinsic motivation that are predictive of long-term enjoyment and participation in sport. Equipped with this knowledge, educators can gently encourage youth sports stakeholders, such as coaches, administrators, and parents, to resist the urge to have children specialize in a sport as early as possible. Instead they can promote the value of early diversification and unstructured play for the benefit of a child's long-term physical and mental well-being.

Conclusion

Organized sports for youth and children are a significant part of American culture. Sport specialization is a common-place occurrence, but for many this is taking place at a fairly young age. While the health risks of becoming highly specialized at an early age have been reported elsewhere (Ahlquist et al., 2020; McLellan et al., 2022), this study also found that the odds of having sustained a chronic injury that continued to affect the athlete for at least one year were 2.5 times greater in those who were highly specialized by the age of 12. Those who had no degree of early specialization had significantly lower odds for both injuries in general (OR=0.30) and chronic injuries specifically (OR=0.39). These findings shed some preliminary light on the potential long-term negative impact that early sport specialization can have on the health of young athletes. Furthermore, though "loss of enjoyment" was by far the most common reason for quitting, approximately 20% of those who sustained a chronic injury cited "experience of injury" as the number one or two reason why they no longer played their sport at the intercollegiate level. Only 21% of those who had a high degree of early specialization and also sustained a chronic injury went on to eventually play an intercollegiate sport. Thus, greater emphasis should be placed on encouraging young athletes to delay the decision to specialize, both for the sake of health and also longevity of their careers.

CHAPTER II: DISSEMINATION

The findings from this dissertation were presented to the study participants in order to educate them about the long-term effects of early sport specialization. The findings were shared in the form of a PDF handout that concisely summarized the conclusions and recommendations based on the study (Appendix J). Because the survey participants remained anonymous, the handout was sent to the instructors of the classes where the survey was distributed. These instructors could then provide the handout to their entire class, regardless of whether a student took the survey or whether their responses were used for data collection. Regarding youth sports, these college students are key stakeholders as the next generation of parents and youth sport coaches. Ensuring that they are well-educated regarding healthy youth sport participation will help them to make better informed decisions concerning when and to what degree they would encourage the next generation of children to specialize in a sport. The handout provides a brief explanation of what early sports specialization is, summarizes what is known about the relationship between early sport specialization and injuries including the findings of the present study, discusses the connection between early sport specialization and the attainment of elite levels in sport, and offers recommendations for healthy and enjoyable sport participation for children. The following section is an expanded explanation of the content found on the handout.

Early Sport Specialization: What Future Parents and Coaches Should Know

Youth sports are a central experience in the lives of millions of children in our country. They provide opportunities for fun physical activity, meaningful social interaction, and emotional and psychological development that can often have a long-lasting, life-shaping impact. However, the last several decades have seen a shift in the culture of youth sports with increasing

emphasis placed on early pursuit of high performance and skill development through highly structured, adult-organized sporting activities. This trend has been described as the "professionalization of youth sports" (Popkin et al., 2019a). Driven by research in deliberate practice theory (commonly articulated as the "10,000-hour rule"), this professionalization has been accompanied by greater pressure for children to specialize in their sport at an early age. Such specialization is marketed as the best pathway for a child to achieve elite status.

Early Sport Specialization

Sport specialization is typically categorized by degree, based on a three-question scale: 1. Do you have a primary sport? 2. Have you only ever played your primary sport, or have you given up all other sports to focus on your primary sport? 3. Do you play your primary sport in an organized capacity for at least 8 months out of the year? The degree of specialization is assigned based on how many questions are answered with a "yes". One "yes" would be categorized as low specialization, two would be moderate, and three would be high (N. A. Jayanthi et al., 2015).

While it is generally acknowledged that a child hoping to attain to elite levels of sport will need to specialize at some point in their career depending on their sport, there is no firm consensus yet as to when that age should be. However, what most researchers agree on is that specialization should generally take place after a child has reached skeletal maturity. Specializing before this point is commonly referred to as "early" sport specialization (ESS). Thus, the American Orthopaedic Society of Sports Medicine defines ESS as a child specializing in a sport before puberty and/or the age of 12 (LaPrade et al., 2016).

ESS and Injury

Despite its growth and popularity, ESS is almost universally discouraged by sports medicine associations and organizations. The primary reason for this is that children who

specialize too early are at a significant risk for increased injury. In particular, the rates of overuse injuries (those without a specific mechanism or injury incident) are significantly higher in youth with a high degree of early specialization (Bell, Post, et al., 2018). This relationship also holds for those with a moderate degree of early specialization, albeit to a lesser degree (Bell, Post, et al., 2018). The severity of these overuse injuries also appears to be related to ESS, with high specializers more likely to have an overuse injury that kept them out of their sport for at least 1 month (N. A. Jayanthi et al., 2015).

In addition to the increased risk for injury, the present study also found that athletes who had a high degree of early specialization had significantly higher odds of reporting a chronic injury, defined as an injury that continued to affect the athlete for at least one year post-injury, compared to those who were not highly specialized. Conversely, those with no degree of early specialization had significantly lower odds of having had a chronic injury.

The two main paradigms that are used to explain this association of high early specialization and chronic injury focus on training volume and neuromotor development. Advocates for the training volume paradigm argue that the increased physical load from high training volumes associated with early specialization contribute to injury (Ahlquist et al., 2020; Field et al., 2019; N. A. Jayanthi et al., 2015; Post et al., 2017). Findings from the current study may lend support to this view, while also adding that high training volume is also associated with prolonged recovery time and may contribute to injury chronicity as well.

The neuromotor paradigm points to inadequate development of a diverse array of movement patterns early on due to specialization in a single sport as a predisposing factor for future injuries to occur. (DiCesare et al., 2019; DiStefano et al., 2017; Frome et al., 2019; Kliethermes et al., 2020; Mosher et al., 2022; Myer et al., 2016; Waldron et al., 2020).

Unfortunately, the limitations of this study prevented it from fully exploring the effect that only participating in a single sport might have on chronic injuries. Further research into this aspect of early sport specialization is certainly warranted.

While our understanding of the reasons behind why early sport specialization is associated with chronic injuries continues to develop, what is becoming clear is that the physical impact of early sport specialization likely extends far beyond simply sustaining an injury through sport participation. Based on existing research and the findings of this current study, several key recommendations can be made to parents, coaches, and children who are considering the prospect of early sport specialization

Recommendations for Physical Health

Delay becoming highly specialized until at least puberty: Current expert recommendations are to use pre-pubertal years as a time to sample a variety of sports to develop fundamental skills (Anderson & Mayo, 2015). Training load should be increased gradually once the athlete begins to reach skeletal maturity (N. Jayanthi et al., 2022).Though a select few sports may require early specialization for elite performance (e.g. gymnastics, figure skating), most do not. Therefore, we should allow a child's body to go through puberty with its accompanying musculoskeletal and hormonal changes prior to them becoming highly specialized in a sport. These recommendations are supported by findings from the current study which found a high degree of early specialization during the pre-pubertal years to be a significant factor associated with chronic sports injuries.

If injured, allow appropriate time to heal: This study found that over 80% of those who had a chronic injury reported returning to full participation in their sport within 6

months of the injury. While additional research is warranted, it is likely that inadequate healing of the initial injury prior to resumption of sporting activity contributed to the injury symptoms persisting for at least 1 year.

Take breaks: In season, experts recommended restricting the total workload hours each week (competition + training) to fewer than a child's age to reduce injury risk (N. Jayanthi et al., 2022). In addition, allowing a child time away from an organized sport (i.e. an off-season) allows for physical recovery and healing of injury. The findings from the current study of an association between high training volumes and prolonged injury recovery may also support the current recommendations.

Increase training volume gradually as the child matures: The recommended competition-to-training ratio is <1:3, recognizing that competition is significantly more physically demanding (N. Jayanthi et al., 2022). Total workload volume should be increased slowly, particularly during periods of accelerated physical growth (N. Jayanthi et al., 2022).

Regularly monitor for signs of developing overuse injuries: Athletes should be coached on being mindful of how their body is feeling, and encouraged to report signs or symptoms of injury, rather than pressured to continue playing through them (Myer et al., 2016). If identified early, overuse injuries are typically easily treatable, but they progressively worsen the longer they go untreated.

ESS and Sport Participation

In addition to concerns over the physical toll that ESS takes on the young athlete, increased attention is now being given to the mental impact that ESS has on youth as well. ESS has now been linked with an increase in the likelihood of both burnout (Giusti et al., 2020) and

sport attrition (Russell & Limle, 2013) among young athletes. Thus, despite the perception that ESS opens up the pathway for longer-lasting participation in sport at higher levels of competition, the reality appears to be the opposite. In the present study, only 23.8% of college students who had a high degree of early specialization went on the play their sport at the intercollegiate level, whereas 82% of the college athletes surveyed did not specialize in their sport until they were 12 or older. Despite enjoyment of the sport being the main reason that the overwhelming majority of youth chose to specialize in their sport, loss of enjoyment was the main reason what those who no longer played their sport gave it up after previously choosing to specialize. Due to the potential impact that ESS can have on long-term sport participation, several recommendations can be made here as well.

Recommendations for Encouraging Long-term Sport Participation

Take breaks: Allowing a child time away from their sport creates a mental break, which can help to avoid staleness and prevent future burnout (Bell et al., 2021).

Promote fun, unstructured play over organized participation: Unstructured play that is child-led helps a child to develop self-efficacy and intrinsic motivation when it comes to their sport. These factors are associated with increased enjoyment, which is key for long-term participation (Anderson & Mayo, 2015).

Encourage sport sampling for a child early on: Varying the sports that a child plays throughout the year can help avoid staleness. It also helps with skill development in later years, though a child's initial progress may appear slower (Anderson & Mayo, 2015). This will, in turn, decrease the amount of sport-specific practice they'll need when they get older in order to master their sport (Côté et al., 2009).

Monitor mental and emotional status of young athletes: Have regular conversations with children about their attitudes and feelings toward their sport. If negative attitudes are developing, consider participation breaks or alternative activities (Caine et al., 2016). The current study found that loss of enjoyment, increased stress, and feeling pressure to perform were the three most common reasons cited for athletes quitting their sport. Regular conversations with coaches and parents could help detect these changing attitudes sooner, allowing for early intervention to hopefully restore a more positive outlook for the athlete.

Emphasize the value of enjoyment and fun at early ages: Studies have found that those who had a more positive perception of their experience in youth sports were more likely to report enjoying physical activity as an adult (Russell & Limle, 2013). While there is certainly a role for healthy competition in youth sports, the early formative years should focus on making sport as positive an experience as possible (Côté et al., 2009).

Celebrate teammates' success over focusing on individual achievement: The social aspect of sport participation is a key ingredient in helping make it enjoyable. Teaching children early on about the value of the team as a whole can give them a more robust appreciation for sport participation that transcends their individual achievements. In the current study, friendships were the second most commonly cited reason for why children chose to specialize in their sport. Thus, teaching children how to use sports to strengthen their bonds of friendship can use that pre-existing value as a way to deepen their connection and commitment to their sport.

Help children develop a healthy perspective on their sport: Athletic status is often a central part of the identity of many youth athletes (Côté et al., 2009). Douma & Zylstra (2024) suggest that regularly reminding athletes that their self-worth and value does not depend on their athletic performance can decrease the pressure they feel to perform and the stress associated with maintaining that identity, both of which were found in the current study to be key contributing reasons for giving up a specialized sport.

Conclusion

Having disseminated my initial findings to the survey participants in the form of a handout (Appendix J), I have continued to review the results of this study and refine the presentation of the material with the goal of eventually developing it into a full lecture that I can give to students in the classes that I teach. As I noted above, in my primary role as an exercise science faculty member, I am tasked with educating students about how to properly steward their bodies through a physically active lifestyle. However, I want the benefits of their education to extend beyond themselves so that they can also think about how to help others be more physically active. These students are the parents and coaches of the future who will be responsible for shaping the youth sports experience of the next generation. Thus, it is paramount that they be well informed regarding early sport specialization so that they can better support and guide the children of the future as they participate in sport.

CHAPTER III: ACTION PLAN

The aims of this study were to investigate the prevalence and estimated odds of chronic injuries in college students who had a high degree of early specialization and to explore the reasons underlying their decisions both to specialize in and stop participating in their sport. The results of the study demonstrated significantly greater odds of chronic injury were associated with high early specialization. Enjoyment, or lack thereof, was the most significant factor in specialization decisions. These findings can help youth sport stakeholders better understand some of the risks associated with early specialization, while also providing them with insight into how to best proactively support sport participation patterns that lead to lifelong enjoyment. The findings regarding chronic injuries can also provide a valuable contribution to the ongoing scholarly conversation regarding the physical effects of early sport specialization. As such, it is important to develop a plan for how these findings will continue to be shared in both the local and broader community of the researcher. This plan will be organized by the target groups for dissemination of the research findings.

Youth Sport Stakeholders

This group primarily consists of parents, coaches, and organizations who are directly involved with youth sports. The attitudes and decisions of these stakeholders play a significant role in shaping the sporting experiences of children and youth, and they therefore need to be well-informed regarding the option of early sport specialization.

College Students

As discussed in the previous chapter, college students represent the future generation of parents and coaches, and are thus an appropriate target for dissemination of findings. Additionally, the college students who took part in the survey are also entitled to directly benefit

from their participation. This benefit takes the form of receiving an informational handout explaining the results of the study and giving recommendations regarding early sport specialization.

As a second method for communicating the study findings to college students, I plan to develop the content of this dissertation into a seminar that I can present to students in my Dynamics of Fitness class. This class explores the importance of lifelong fitness and physical activity, and thus the topic of early sport specialization and how it relates to sport participation in adulthood is particularly relevant. Furthermore, once the seminar is developed, it can be presented at other institutions in the form of a guest lecture as well. I also teach a class called Care and Prevention of Injuries in which the topic of youth sport specialization is highly relevant. This has already enabled me to have important discussions with students about early sport specialization and its long-term effects.

Parents and Coaches

While it is important to educate future parents and coaches in the form of college students (though some may also already be in that role as well), current coaches and parents whose children are involved in youth sports can also benefit from the findings of this study. My primary means of sharing my findings with this group will be through the development of a brochure that can be distributed by youth sport organizations who are willing to partner in the project. For example, having previously coached and had my children participate there, I have a strong relationship with the president of a recreational youth soccer organization in Hixson, TN. He has expressed a willingness to partner with me in helping to educate the coaches and parents of children in his organization about the benefits and drawbacks of early sport specialization. The plan is to supply him with the brochures that summarize the study findings in an accessible way

for parents and coaches and provide helpful recommendations regarding sport participation for their children. If any of them have further questions, they will be given my contact information for follow up.

Having recently relocated from Tennessee to Indiana, my hope is to develop similar relationships in my new local community that will create opportunities to connect with stakeholders in youth sport organizations. To this end, I volunteered to coach in my son's youth soccer league this spring in order to start building connections with parents, coaches, and organizers. Once these connections are established, I can work to set up an educational meeting for parents regarding early sport specialization to open up dialogue and future conversations on the topic.

Professional Collaboration

While I take steps at a personal level to help my research have an impact on my local community, I also hope to develop professional collaborations and networks to further the reach of my findings.

Local Community

The college where I work hosts a monthly Faculty Forum where faculty across campus can present their current research to their colleagues. These forums are also open to the public. My aim would be to present my findings at a Faculty Forum next fall to bring attention to my research and raise awareness about the topic of early sport specialization among my colleagues on campus. This could potentially open doors to interdisciplinary collaboration with faculty who may be interested in other aspects of early sport specialization, such as its psychological, social, or economic impact.

My college also houses a community-facing center whose mission is to bring knowledge about physical wellness, exercise, and health to our local community. I have already had several discussions with the center's director about hosting educational seminars for local parents and coaches. The dean of our school has also expressed a desire to help me build a working partnership with a local youth sports organization leader who is passionate about developing healthy, effective, and sustainable youth sports programs in our community.

Professional Presentations

Looking beyond my immediate community, my aim is to introduce my findings into the broader scholarly conversation surrounding early sport specialization. This can effectively be achieved through presenting my findings at various regional or national professional conferences. As a member of the American College of Sports Medicine, presenting at either their regional or national conference could provide an excellent opportunity for me to connect with other researchers in the field. Other target conferences could include the National Athletic Trainers' Association's regional and national conventions, the National Alliance for Youth Sports Congress, the North American Coach Development Summit, or the national convention for SHAPE America. Presentation format at each conference or convention may vary, but one possibility would be to convert my visual abstract into poster format for ease of presentation.

Research Publication

In addition to opportunities to present my findings in-person, another effective means of disseminating my research would be to seek publication in journals that frequently publish research related to early sport specialization. Examples of these journals include Orthopaedic Journal of Sports Medicine, Sports Health, Journal of Athletic Training, and Journal of Sport

Rehabilitation. Publication in a peer-reviewed journal will broaden the reach of my research, hopefully expanding the impact that it has on the field.

Conclusion

The goal of this action plan is to establish a pathway for educating youth sport stakeholders, both present and future, concerning the long-term effects of early sport specialization while also contributing to the ongoing research conversation regarding this important topic. As both a parent and coach of young children who places a high value on youth sports participation, I am acutely aware of the pressures and joys associated with youth sports. While each parent will ultimately decide their child's path for sport, I want to help ensure that those decisions are well-informed by the most accurate knowledge available. Because of my unique role as both a researcher and a stakeholder, I find myself being both a guide and a traveler on this special journey that we call "youth sports", and thus I want to make sure that I carry out my various responsibilities along the way to the best of my ability.

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APPENDIX A: TABLE OF YOUTH SPORT PARTICIPATION RATES

Sport	n = 270
Baseball/Softball	114 (35.4)
Basketball	125 (38.8)
Bowling	6 (1.9)
Competitive Cheerleading	46 (14.3)
Cross Country/Track (mid-long distance)	57 (17.7)
Football	47 (14.6)
Golf	27 (8.4)
Gymnastics	63 (19.6)
Ice Hockey	1 (0.3)
Lacrosse	9 (2.8)
Soccer	128 (39.8)
Swimming/Diving	39 (12.1)
Tennis	34 (10.6)
Track (short distance) & Field	60 (18.6)
Volleyball	73 (22.7)
Wrestling	21 (6.5)
Other: _____	42 (13)

Table A5. Youth participation rates by sport.

Note: Percentage totals do not equal 100% due to many respondents participating in multiple sports throughout childhood.

APPENDIX B: TABLE OF COMMON REASONS FOR SPECIALIZATION

	N	Average Rank
Personal Enjoyment	198	1.50
Friendships	145	2.59
Skill level in primary sport	136	2.93
Desire to play in college/earn a college scholarship	87	2.70
Parental influence	86	3.19
Health benefits	80	3.26
Coach's influence	68	4.10
Desire to be a professional athlete	34	3.53
Lack of time for other sports	30	3.67
Lack of skill in others sports	30	4.50
Concern for injury playing other sports	11	4.73
Climate/weather conditions	8	3.75
Injury sustained while playing another sport	5	2.60
Other (Please specify):	5	2.60

Table A6. Common reasons for specializing in a single sport.

APPENDIX C: TABLE OF COMMON REASONS FOR QUITTING

	N	Average Rank
Loss of motivation or enjoyment	98	1.62
Increased stress	72	2.26
Pressure and expectations for performance	64	2.48
Desire to participate in other activities	54	2.76
Level of competition was too high	45	2.91
Not enough time with friends/family	43	2.93
Experience of injury	43	2.14
Too expensive	33	3.00
High training volume	31	3.87
Lack of ability	29	2.72
Fear of potential injury	24	3.08
Other (Please specify):	16	1.31
Sport was not offered at your college	12	1.75
Desire to play other sports	9	4.00

Table A7. Common reasons for discontinuing participation

APPENDIX D: RESEARCHER POSITIONALITY STATEMENT

For my dissertation, I chose to investigate the relationship between early sport specialization and chronic injuries. At the personal level, I find this topic relevant and interesting because I currently have two young sons who have already begun to participate in organized sports. As their father, I want to help them succeed and also protect them when needed, and so I want to be as knowledgeable as I can about the growing trend of early specialization we are seeing in youth sports.

As a kinesiology professional, this topic connects with my work both as an exercise science faculty member and as an athletic trainer. As a professor, one of my main objectives is to advocate for physical activity across a lifetime. Youth sports are one of the best ways to encourage and develop lifelong habits of physical activity (Haynes et al., 2021). Thus, whether I am teaching students in the classroom who will one day be parents contemplating putting their kids into a youth sport program, or if I am engaging directly with parents in the community as a scholarly advocate, I want to provide the best and wisest counsel regarding the approach to youth sport participation and specialization. Chronic injuries are also an important concept for me to understand in my professorial role. As an advocate for physical activity, it is important for me to be aware of various barriers that people may encounter when trying to be active. Chronic injuries may be one such barrier.

My position as a certified athletic trainer also connects with the focus of my dissertation, since chronic injuries can often have a significant impact on the ability of athletes to play their sport. If athletic trainers can identify a population whose odds of having a chronic injury are higher, then treatment interventions can be targeted more directly to those athletes. Patient-centered care is also one of my highest values as an athletic trainer. Researchers are increasingly

decrying the “professionalization of youth sports” (Popkin et al., 2019b), where the organizational structure of youth athletics is becoming increasingly driven by business and financial considerations rather than what is best for the athletes. This approach that pushes children toward early specialization is being increasingly linked with a substantially higher injury risk. Thus, as an athletic trainer who is responsible for caring for the needs of his athletes first and foremost, I believe that scholarly engagement and advocacy regarding the topic of early sport specialization is consistent with my values. However, my background in athletic training may also introduce biases against ESS because of its link with injuries. In order to counter this bias, I can have my methods, results, and conclusions independently reviewed by other professionals who are not athletic trainers and may not share this bias. I am also using quantitative rather than qualitative methods to increase the objectivity of the survey responses.

APPENDIX E: INFORMED CONSENT

Informed Consent

Project Title: Early Sport Specialization and Chronic Injuries in College Students

Principal Investigator: T.J. Zinke, MS, ATC

Faculty Advisor: Dr. Scott Ross

What is this all about?

I am asking you to participate in this research study because I want to learn more about the relationship between early sport specialization and long-term injuries. This research project will only take about 10 minutes and will involve you completing an online questionnaire. Your participation in this research project is voluntary.

How will this negatively affect me?

The only potential risk would be breach of confidentiality. However, these risks will be minimized through the use of a QR code to access the survey which prevents Qualtrics from tracking identifiable information. The "Anonymous Responses" setting in Qualtrics has also been turned on as an extra precaution. All data collected will be de-identified, and only the PI will have access to the data. The data will be stored in Qualtrics, which is approved by the University for storing this type of data.

If a breach of confidentiality were to occur, there are no anticipated legal or financial affects from an accidental data disclosure. Social or personal effects could be the principal investigator learning about your injury history, as well as learning personal information such as why you chose to participate in a sport or quit a sport. However, to reiterate, there are several steps and protections in place to prevent this from happening.

What do I get out of this research project?

You and/or society will gain a better understanding of the long-term impact that specializing early in a sport has on children. You will also be provided with an initial summary of the findings of this study to help you learn more about the long-term effects of early sport specialization.

Will I get paid for participating?

There is no compensation for your participation in this study.

What about my confidentiality?

We will do everything possible to make sure that your information is kept confidential. All information obtained in this study is strictly confidential unless disclosure is required by law. Because you will access the survey using a QR code, your response cannot be traced back to you. We will not ask any information on the questionnaire that could be used to identify you as an individual. Additionally, only the principal investigator will have access to the questionnaire responses.

Absolute confidentiality of data provided through the Internet cannot be guaranteed due to the limited protections of Internet access. Please be sure to close your browser when finished so no one will be able to see what you have been doing.

You can learn more about the security of the software used for the questionnaire here.

What if I do not want to be in this research study?

You do not have to be part of this project. This project is voluntary and it is up to you to decide to participate in this research project. If you agree to participate at any time in this project you may stop participating without penalty.

What if I have questions?

You can ask T.J. Zinke [tjzinke@uncg.edu] **AND** Dr. Scott Ross [seross@uncg.edu] anything about the study. If you have concerns about how you have been treated in this study call the Office of Research Integrity Director at 1-855-251-2351.

Agreement to Participate

Your participation in this study is completely voluntary, and you can withdraw at any time. To take this survey, you must be at least 18 years old

By selecting "I consent", you confirm that you meet this criterion and that you consent to having the de-identified data from your responses used in this research study.

If you select “I do not consent” you may still complete the survey, but your data will not be used for research purposes.

APPENDIX F: RECRUITMENT SCRIPT

Hello,

My name is T.J. Zinke and I am a doctoral student at the University of North Carolina at Greensboro. My fellow researchers and I would like to invite you to participate in a research study about the long-term effects of early sport specialization. In order to be eligible to participate in this study, you must be 18 years or older, English-speaking, and enrolled in a college wellness course at one of the participating institutions: University of North Carolina at Greensboro, University of Tennessee - Chattanooga, or Bryan College.

Through this study, we hope to better understand the association of early sport specialization and chronic injuries, while also learning about the reasons why young people choose to specialize in their sport. We also hope to better understand why they may not continue with that sport into college. The purpose of this survey is to collect information regarding injury history, age and level of sport specialization as a youth, and current level of sport participation.

You can access the survey using the QR code below. Access via QR code ensures that the survey cannot track your identifying information, making your responses anonymous. The survey is 30 questions long and should take you approximately 10 minutes to complete, though based on your responses you may not be required to answer all 30 questions. The information you will share with us if you participate in this study will be kept completely confidential to the full extent of the law. There is no financial compensation for completing this study, but as a participant you will be provided with an initial summary of the findings as well as other information about the benefits and risks of early sport specialization through your class.

If you have any questions about this study, please contact the principal investigator of this study, T.J. Zinke, MS, ATC [tjzinke@uncg.edu].

APPENDIX G: SAMPLE FACULTY EMAIL

Hello,

My name is T.J. Zinke and I am currently a doctoral student at UNCG. First off, I want to thank you for your willingness to have this survey distributed to the students in your class. I have attached to this email a document containing the recruitment script and the QR code for this survey. If you are administering the survey as part of a face-to-face class, please read the attached recruitment script to the class prior to giving them QR code. If you are administering it in an online class, please include the recruitment script with the QR code when you make it available for your students to access.

Even though the survey focuses on early sport specialization, students who did not participate in youth sports may still take this survey. Based on the survey progression logic, their time requirement to finish the survey will just be significantly less than those who did participate in youth sports. Students may also elect not to have their responses used for research data, but that will not prevent them from being able to take the survey and receive any credit being offered.

I have included a confirmation page at the end of the survey that students can screenshot and submit to you if you are offering any type of credit to them for completing the survey. If you have any questions or concerns, please do not hesitate to contact me at tjzinke@uncg.edu.

Thanks again!

T.J. Zinke, MS, ATC

Doctoral Candidate

Ed.D. in Kinesiology

APPENDIX H: EARLY SPORT SPECIALIZATION QUESTIONNAIRE

Demographic Information

1. Age: _____

2. Academic Year (Please circle one):
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior
   e. Other

3. Biological Sex (Please circle one):
   a. Male
   b. Female
   c. Prefer not to answer

4. How would you describe your current level of weekly physical activity? (Please circle one)
   a. Very Active (Regularly exercise >20 minutes 5-7 days/wk)
   b. Moderately Active (3-4 days/wk)
   c. Somewhat Active (1-2 days/wk)
   d. Inactive (0 days/wk)

5. Do you currently play an intercollegiate sport (does not include club sports)?
   a. Yes
   b. No
   (If yes, please answer #6. If no, skip to question #7)

6. Please indicate the sport(s) that you play as an intercollegiate athlete. (Choose all that apply)
   a. Baseball/Softball
   b. Basketball
   c. Bowling
   d. Competitive Cheerleading
   e. Cross Country/Track (mid-long distance)
   f. Football
   g. Golf
   h. Gymnastics
   i. Ice Hockey
   j. Lacrosse
   k. Soccer
   l. Swimming/Diving
   m. Tennis
   n. Track (short distance) & Field
   o. Volleyball
   p. Wrestling
   q. Other: _____

Sporting History

For the following questions, "organized sports" refers to sporting activities coordinated and supervised by adults

7. Did you participate in organized sports as a child/youth?
   a. Yes
   b. No

   (*If your answer is "No", you do not need to complete the rest of the questionnaire*)

8. If so, please select all the sports you played in an organized capacity as a child/youth:
   a. Baseball/Softball
   b. Basketball
   c. Bowling
   d. Competitive Cheerleading
   e. Cross Country/Track (mid-long distance)
   f. Football
   g. Golf
   h. Gymnastics
   i. Ice Hockey
   j. Lacrosse
   k. Soccer
   l. Swimming/Diving
   m. Tennis
   n. Track (short distance) & Field
   o. Volleyball
   p. Wrestling
   q. Other: _____

9. On average, how many months out of the year were you involved in organized sports as a child (Age 6-12)? (Please circle one)
   a. 1-2 months
   b. 3-4 months
   c. 5-6 months
   d. 7-8 months
   e. 9-10 months
   f. 11-12 months

10. On average, how many months out of the year were you involved in organized sports as a youth (Age 12-18)? (Please circle one)
    a. 1-2 months
    b. 3-4 months
    c. 5-6 months
    d. 7-8 months
    e. 9-10 months
    f. 11-12 months

11. Did you have a sport which you considered your primary sport growing up? Y N

12. If yes, please select which sport. If you had different primary sports at different times throughout your childhood, please select the sport that you played for the longest period of time:
    a. Baseball/Softball
    b. Basketball
    c. Bowling
    d. Competitive Cheerleading
    e. Cross Country/Track (mid-long distance)
    f. Football
    g. Golf
    h. Gymnastics
    i. Ice Hockey
    j. Lacrosse
    k. Soccer
    l. Swimming/Diving
    m. Tennis
    n. Track (short distance) & Field
    o. Volleyball
    p. Wrestling
    q. Other: _____

Injury History

13. Did you ever sustain an injury while participating in organized sports that caused you to miss at least one practice or game?
    Y N

14. Did you ever sustain an injury while participating in organized sports that required you to have surgery? Y N

15. While participating in organized sports, did you ever sustain an injury that continued to affect you (pain, weakness, reduced function, joint giving way, etc.) for at least 1 year after the initial injury? (If "N", proceed to question 16)
    Y N

    If you answered "Y" to the above question, please answer the following questions regarding the injury. If you sustained multiple injuries that fit the criteria for question 12, please only answer for the one that you believe has affected you the most.

    a. When did the injury occur? (mm/yyyy) _____
    b. Which body part was injured? (Circle one)
        i. Foot/Toes
        ii. Ankle
        iii. Lower Leg/Calf
        iv. Knee
        v. Thigh/Hamstring
        vi. Hip/Groin/Pelvis
        vii. Low Back

viii. Abdomen
ix. Chest/Collarbone/Ribs
x. Shoulder
xi. Upper Arm
xii. Elbow
xiii. Forearm
xiv. Wrist
xv. Hand/Fingers
xvi. Neck
xvii. Face
xviii. Head
xix. Other: _____

c. What was the nature of the injury?
i. Broken bone/fracture
ii. Stress fracture
iii. Dislocation/Subluxation
iv. Ligament Sprain
v. Muscle/Tendon Tear
vi. Contusion (e.g. dead leg, bone bruise, etc.)
vii. Concussion/Brain injury
viii. Cartilage Damage (includes labrum and meniscus tears)
ix. Other: _____

d. Who diagnosed your injury? (Select all that apply)
i. Physician
ii. Physician assistant/Nurse practitioner
iii. Physical therapist
iv. Athletic trainer
v. Chiropractor
vi. Coach
vii. Parent
viii. Self
ix. Other: _____

e. How soon after your initial injury were you able to return to playing your sport? (Circle one)
i. <1 week
ii. <2 weeks
iii. <1 month
iv. <3 months
v. <6 months
vi. <9 months
vii. <1 year
viii. >1 year

f. What effects of that injury are you still experiencing on a regular basis? (Select all that apply)
i. Pain
ii. Limited range of motion/Stiffness
iii. Weakness
iv. Instability/Giving way
v. Swelling
vi. Loss of function
vii. None
viii. Other: _____

Early Specialization

If you answered "No" to question 9, you may skip this section

16. At approximately what age did you decide that you had a primary sport?
    a. <6
    b. 6
    c. 7
    d. 8
    e. 9
    f. 10
    g. 11
    h. 12
    i. 13
    j. 14
    k. 15
    l. 16
    m. 17

17. Did you ever participate in any other organized sports besides your primary sport? Y N

18. If so, at approximately what age did you give up all other organized sports to focus solely on your primary sport?
    a. <6
    b. 6
    c. 7
    d. 8
    e. 9
    f. 10
    g. 11
    h. 12
    i. 13
    j. 14
    k. 15
    l. 16
    m. 17
    n. Never

19. At approximately what age did you begin to play your primary sport in an organized capacity (e.g. club team, travel team) for more than 8 months out of the year?
    a. <6
    b. 6
    c. 7
    d. 8
    e. 9
    f. 10
    g. 11
    h. 12
    i. 13
    j. 14

k. 15
l. 16
m. 17
n. Never

20. Which of the following were significant reasons that influenced your decision to specialize in your primary sport, either by giving up all other sports to focus on it or by playing it >8 months/year? (Select all that apply and rank in order of importance; 1 = Most important)
    a. Personal enjoyment
    b. Friendships
    c. Health benefits
    d. Parental influence
    e. Coach's influence
    f. Climate/weather conditions
    g. Lack of time for other sports
    h. Desire to play in college/earn a college scholarship
    i. Desire to be a professional athlete
    j. Concern for injury playing other sports
    k. Injury sustained while playing another sport
    l. Skill level in primary sport
    m. Lack of skill in other sports
    n. Other: _____

21. If you had a primary sport growing up but do not currently play your primary sport competitively at the intercollegiate level, please indicate your level of participation in it. (Please circle one)
    a. Competitively (e.g. club sport)
    b. Recreationally (e.g. intramural)
    c. Do not participate in it at all

22. If you had a primary sport growing up but do not currently play your primary sport competitively at the intercollegiate level, which of the following were significant factors that influenced your decision to not continue playing? (Select all that apply and rank in order of importance; 1 = Most important)
    a. Loss of motivation or enjoyment
    b. Increased stress
    c. Pressure and expectations for performance
    d. High training volume
    e. Not enough time with friends/family
    f. Level of competition was too high
    g. Experience of injury
    h. Fear of potential injury
    i. Desire to play other sports
    j. Desire to participate in other activities
    k. Lack of ability
    l. Too expensive
    m. Sport was not offered at your college
    n. Other: _____

APPENDIX I: "OTHER" SURVEY RESPONSES

Question 20

"Which of the following were significant reasons that influenced your decision to specialize in your primary sport, either by giving up all other sports to focus on it or by playing it >8 months/year?"

- Y
- Financial
- Focusing on school more because I think it's important
- More of an individual sport rather than relying on a team
- The dance studio was my happy place and away from my family dance was my therapy

Question 22

"If you had a primary sport growing up but do not currently play your primary sport competitively at the intercollegiate level, which of the following were significant factors that influenced your decision to not continue playing?"

- Did not want to play in college but I still have love for the sport some days when I'm free I will grab some friends and play
- No longer interested
- Not enough time
- Injury
- Focused on school
- I played intercollegiate basketball but as a result of an injury I stopped playing and did not return
- College coach
- I just did not want to
- Didn't make my college cheer team
- Medically retired
- Career ending injury (did not occur while dancing, very ironic)
- Wanted to enjoy college
- I never sent in film to any college
- Had to pay to do my sport in college no scholarships
- Focused on school

APPENDIX J: RESULTS HANDOUT

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Early Sport Specialization and Chronic Injuries: Preliminary Findings

T.J. Zinke, MS, ATC
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What is Early Sport Specialization?

- "Sport specialization is intentional and focused participation in a single sport for a majority of the year that restricts opportunities for engagement in other sports and activities." (Bell et al., 2021)
  - Doing this by the age of 12 would be considered early sport specialization (ESS)

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Bell, D. R., Snedden, T. R., Biese, K. M., Nelson, E., Watson, A. M., Brooks, A., McGuine, T. A., Brown, R. L., & Kliethermes, S. A. (2021). Consensus definition of sport specialization in youth athletes using a Delphi approach. *Journal of Athletic Training*, *56*(11), 1239–1251. https://doi.org/10.4085/1062-6050-0725.20

3 Qualifying Criteria for "Specialization"

1. Chooses a "primary sport"
2. Only ever plays that sport or quits all other sports to focus on that sport
3. Participates in that sport for >8 mo./yr.

Degrees of Specialization

- High: 3 out of 3 criteria met (ESS-H)
- Moderate: 2 out of 3 (ESS-M)
- Low: 1 out of 3 (ESS-L)

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Early Sport Specialization and Injuries

- What we know:
  - Children who specialize early are at increased injury risk. (Jayanthi et al., 2019)
  - Higher levels of burnout are reported among children who specialized early in their sport. (DiFiori et al., 2014)

Jayanthi, N. A., Post, E. G., Laury, T. C., & Fabricant, P. D. (2019). Health consequences of youth sport specialization. *Journal of Athletic Training, 54*(10), 1040–1049. https://doi.org/10.4085/1062-6050-380-18

DiFiori, J. P., Benjamin, H. J., Brenner, J. S., Gregory, A., Jayanthi, N., Landry, G. L., & Luke, A. (2014). Overuse injuries and burnout in youth sports: A position statement from the American Medical Society for Sports Medicine. *British Journal of Sports Medicine, 48*(4), 287–288. https://doi.org/10.1136/bjsports-2013-093299

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Early Sport Specialization and Injuries

- What we learned about ESS-H in the present study:
  - 2 out of 3 students reported a chronic injury that continued to affect them for at least 1 year.
  - 2.5 times greater odds that they sustained a chronic injury
  - Over two-thirds cited loss of motivation or enjoyment as a reason that they no longer played their sport in college
    - Listed as number 1 or 2 reason for almost all respondents

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What About "The Next Level"?

- Childhood/adolescent success does not predict future elite performance.
- ~82% of college athletes did not specialize in their sport until at least 12
- No difference in college scholarship attainment between those who specialize early and those who do not
- In the present study, only 23.8% college students who were ESS-H went on to even play an intercollegiate sport

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Rugg, C. M., Coughlan, M. J., Li, J. N., Hame, S. L., & Feeley, B. T. (2021). Early sport specialization among former National Collegiate Athletic Association athletes: Trends, scholarship attainment, injury, and attrition. *The American Journal of Sports Medicine*, *49*(4), 1049–1058. https://doi.org/10.1177/0363546520988727

Recommendations for Healthy Participation

1. Take breaks from organized play (i.e. offseason)
2. Rotate through different sports during childhood (sport sampling)
3. If specializing, wait until at least after puberty
4. Regularly check in with your child to make sure they are still enjoying their sport

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Take Breaks

- In season, restrict total workload hours (competition + training) to fewer hours than child's age
- Time away from organized sport allows for physical recovery and healing of injury
- Mental break helps to avoid staleness and future burnout
- Fun, unstructured play develops self-efficacy and intrinsic motivation, increasing enjoyment
  - Good predictors of continued participation

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Anderson, D. I., & Mayo, A. M. (2015). A skill acquisition perspective on early specialization in sport. *Kinesiology Review*, *4*(3), 230–247. https://doi.org/10.1123/kr.2015-0026

Sample a Variety of Sports

- Encourage the child to try a variety of different sports while young
  - E.g. Volleyball in fall, basketball in winter, tennis in spring, swimming in summer
- Decreases amount of sport-specific practice needed in the future for mastery
  - Initial progress may be slower
  - Diverse experiences improve future learning capabilities
- Promotes skill transfer between sports

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Anderson, D. I., & Mayo, A. M. (2015). A skill acquisition perspective on early specialization in sport. *Kinesiology Review*, *4*(3), 230–247. https://doi.org/10.1123/kr.2015-0026

Wait to Specialize

- Age 6-12: Sampling years – try a variety of sports to develop fundamental skills
- Age 13-15: Specializing years - begin to specialize in a sport if desired
  - Increase training volume gradually
  - Maintain competition-to-training ratio of <1:3
- Age 16+: Investing years – deepen commitment to the sport through more rigorous training
- Some sports (women's figure skating, women's gymnastics) require ESS

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Anderson, D. I., & Mayo, A. M. (2015). A skill acquisition perspective on early specialization in sport. *Kinesiology Review*, *4*(3), 230–247. https://doi.org/10.1123/kr.2015-0026


Monitor Psychological State
• Have regular conversations with children about attitudes/feelings toward their sport
• Find alternative sports/activities if negative attitudes are developing
• Emphasize value of enjoyment and fun at early ages
• Celebrate teammates' success and promote social value of sport participation
• Frequently remind that self-worth/value does not depend on athletic performance
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Caine, D., Walch, T., & Sabato, T. (2016). The elite young athlete: Strategies to ensure physical and emotional health. Open Access Journal of Sports Medicine, Volume 7, 99–113. https://doi.org/10.2147/OAJSM.S96821