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Jessica J. McClelland

Otterbein University, jessrunner33@gmail.com

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Early Sport Specialization: Overuse Injury and Burnout

By:

Jessica McClelland

Department of Health and Sport Sciences

Otterbein University

Westerville, OH. 43081

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the Masters' of Science in Allied Health

Exercise and Health Science

Dr. Kim Fischer

Advisor

Signature

Dr. Paul Longenecker

Second Reader

Signature

Dr. Joan Rocks

MSAH Program Director

Signature

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Abstract

There are an increasing number of opportunities for today's youth to participate in year-round sport organizations that promote early sport specialization before the age of fifteen. Early sport specialization is linked to a higher rate of overuse injury of frequently used muscle groups. The physical, mental, and psychological demands of early sport specialization increase likelihood of burnout and cessation of sport participation. Early sport generalization allows physiological and psychological rest and recovery in youth athletes that lead to decreased injury rates and less burnout with more individuals continuing to participate in competitive sports throughout the collegiate years. The purpose of this research was to determine what effect, if any, early sport specialization in youth has on rate of overuse injury and burnout in NCAA Division III athletes at a small, private University. A 12-question, retrospective, written survey classified each participant as an early sport specialist or early sport generalist and gathered information on frequency of overuse injury and development of burnout during the high school and college competitive sport years. Statistical analysis indicated early sport generalists were more likely to participate in competitive collegiate athletics at the NCAA Division III Institution analyzed in this study (71.8%). Early sport specialists were more likely to experience burnout ($P = 0.088$) and may be more likely to develop overuse injury during the high school years ($P = 0.254$) but not the college years ($P=0.385$). It is unknown if early sport specialists are more likely to develop a greater number of overuse injuries throughout their competitive sport career than early sport generalists. Young athletes are encouraged to participate in multiple competitive sports but the results of this research were not statistically significant and further research needs to be done to support these conclusions.

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Statement of the Problem

Many young athletes have dreams of achieving elite level status in their respective sport and one day competing in that sport at the collegiate level and ultimately, the professional level. Parents of youth athletes actively seek advice about how to develop their son or daughter into an athlete skilled enough to earn a collegiate sport scholarship in order to ease the financial burden that higher education can place on a family. A 2015 survey conducted by National Public Radio indicated that 26% of parents whose child plays a sport in high school have dreams of their son or daughter becoming a professional athlete; in families where annual income is less than \$50,000, this percentage increases to 39% (Kelto, 2015). The reality is that only 1 of every 168 high school baseball players will get drafted to play Major League Baseball and only 1 of every 2,451 male high school basketball players will be drafted by the National Basketball Association (Kelto, 2015). Only 0.9% of all female NCAA basketball players are drafted to the Women's National Basketball Association. Less than 2% of high school athletes receive a college scholarship and only 2% of college athletes continue on to play a sport professionally (NCAA, 2014). Young athletes from 6-18 years of age and the parents of these athletes want guidance on how to become one of the few that earn a collegiate athletic scholarship as well as the opportunity to get paid to play at the professional level of sport.

Youth sports involving children from 6-18 years of age no longer operate the way they did in the past. It used to be that each sport had a designated season. For example, football was played in the fall followed by basketball in the winter and baseball in the spring. When fall season ended, athletes put the football away, picked up a basketball, and did not start training for football again until the following fall. The lines of traditional seasons have been blurred and completely erased in some cases. With the rise of year-round travel clubs, athletes can now play

a full season of baseball in the spring and fall while still training competitively for baseball in the summer and winter. Spacious and accommodating indoor facilities make it possible for athletes to continue training throughout the cold and snowy winter months with no interruption in focused training and instruction. Some organized year-round club teams for baseball were reported by Riddle (2014) to play more games in a given season than a professional baseball team will play. The purpose of this shift in youth sport is to develop elite athletes from a young age with exposure to college recruiters to be awarded an athletic scholarship.

The trend in youth sports today is for young athletes to train year round in a single sport with the exclusion of other sports beginning in early to middle childhood, well before 15 years of age (Hiro, 2012). This is known as early specialization of sport and is desirable to some athletes and parents of athletes because it is assumed that early specialization will increase development of skills which will ultimately increase scholarship opportunities. Parents are willing to spend thousands of dollars annually for their child to receive individualized and structured sports training and instruction with the expectation that it will literally pay off down the road (Riddle, 2014). Organized sports leagues are available for children as young as 3 years of age and year round youth sport organizations for children as young as 7-9 years of age are on the rise (Smith, 2014). Earlier sport specialization may be a result of pressure that comes from the realization that college coaches begin recruiting athletes before their high school career even begins (Sherman, 2012). This means that to be considered a top prospect worthy of a collegiate scholarship; an athlete must be elite enough to impress a college recruiter by the age of 14-15. Therefore, it seems that early specialization is a necessity.

Along with the rising trend of early sport specialization and year round club teams with highly organized and structured practices and instruction, the rate of injury and burnout among

youth athletes is increasing as well (Brenner & The Council on Sports Medicine and Fitness, 2007; Cote, Lidor, & Hackfort, 2009). Fifty percent of all youth sport injuries are diagnosed as overuse injuries which are caused by overtraining and insufficient time for recovery (Brenner, 2007). Youth athletes that experience overtraining and develop injuries from overuse are at risk of developing burnout from their sport. Burnout is described as the psychological, physiological, and hormonal changes that occur when the body is stressed too hard for too long without adequate time for recovery. Such appears to lead to loss of passion and dropout from sport (Brenner, 2007).

The USA Football League encourages youth to participate in more than one sport rather than specializing early and focusing on only one. It is claimed that participating in a variety of activities will build greater skill variety and total body muscle development which will increase overall athletic potential more than participating in only one sport activity repeatedly (Frollo, 2014). Multisport participation decreases risk of muscular imbalance and may actually increase potential to become an elite athlete later in life (Brenner, 2007; Cote et al., 2009).

Former Atlanta Braves baseball pitcher, John Smoltz, made comments during his Hall of Fame acceptance speech on July 26, 2015 supporting early diversification of sport during youth. Smoltz is one of thousands of pitchers to receive Tommy John surgery after injuring his elbow in baseball, an event that can be career ending for some pitchers. Smoltz pleads with today's youth who are suffering an increased rate of overuse injury from sport. Injuries are occurring at an earlier age with many resulting in surgery. He stated, "*[It] is not normal to have a surgery at 14 and 15 years old, you have time, baseball's not a year-round sport, you have an opportunity to be athletic and play other sports*". Smoltz was quoted as saying that youth are... "*competing and maxing out too hard, too early, and that's why we're having these problems. So please, take*

care of those great future arms” (Smoltz, 2015). Smoltz is one example of many professional athletes that has a background of being a multisport athlete. He did not specialize in baseball at a young age but rather played many sports and was involved with a different sport each season. It was not until much later in life that he developed his elbow injury during his professional career. Athletes with a background like his learn to love the sport as a game rather than as a job. Playing remains enjoyable and the rate of burnout and attrition from sport decreases when athletes do not specialize before the age of 15 (Capranica & Miller-Stafford, 2011; Cote et al, 2009).

Aspiring youth athletes and their parents receive conflicting messages about the preferred course of action to take when pursuing an elite skill level in a sport. Youth athletes are told that if they wish to become elite in a sport and want to maximize their true potential, then they need to specialize early in life and practice year round to master the necessary skills. Otherwise they will not be skilled at an early enough age to earn a college athletic scholarship.

To the contrary, youth athletes are also taught by organizations such as the National Football League that if they wish to be the best then they need to be well rounded athletes and should participate in multiple sports throughout the competitive youth years from 6-14 years of age. This will develop and strengthen the total body rather than only selective musculoskeletal groups to avoid muscle imbalance and increase athletic potential while decreasing rates of injury and burnout. Young athletes and the parents of youth athletes are justifiably confused about the appropriate course of action to take to increase the chance of successfully becoming an elite athlete. When it comes to preparing an athlete to compete at the collegiate level of sport, is it better to specialize early in youth and focus solely on developing skills in one main sport? Or is

it more beneficial to specialize later in youth after developing a total athletic base cultivated from a multisport foundation to increase longevity of sport and avoid injury and burnout?

Literature Review

Early Sport Specialization

An athlete that focuses year-round on developing skills required solely for one sport with the exclusion of participating in other sports is considered to be a sport specialist. Any athlete that becomes a sport specialist before the age of 15 is considered to be an early sport specialist (Capranica & Miller-Stafford, 2011; Cote et al, 2009). This does not include an athlete that recreationally only plays one sport throughout the year. An early sport specialist learns, practices, and develops fundamental, sport-specific skills all throughout the year and does not competitively participate in other sports, though recreational participation in other sports may be included.

It is common knowledge that as an individual practices a certain skill, that person will be better able to perform the given skill. As the well-known adage says, “practice makes perfect”. Simple observation will reveal this to be the truth and is the reason why a person must practice often the things one wishes to perform well. This can include but is not limited to studying and practicing the mental skills necessary to ace a math test, practicing an instrument to perform well at a recital, or practicing a certain sport to further develop skills and perform better in a game. Without practice, the desired skill never develops. The 10 Year Rule mandates that at least 10 years of high level, specified training is necessary to reach the level of expert in various fields including sports (Kalinowski, 1985; Monsaas, 1985), music (Ericsson, Krampe, and Tesch-Romer, 1993; Sosniak, 1985), and mathematics (Gustin, 1985). Deliberate practice for 10 years is necessary to achieve the required skills needed to become an expert in any given field. Similarly, the 10,000 Hour Rule proposed by Ericsson et al. (1993) suggests that 10,000 hours of practice are required to reach expert level in any skill. While the two rules differ in the exact

amount of time needed to become an expert at a given skill, both convey the idea that the process of becoming an expert is a lengthy one.

Such a lengthy period of time to reach an expert skill level is required because of the Power Law of Practice. This Law states that learning and skill improvement occur rapidly in the initial stages of practice but this rate gradually and continuously decreases as practice continues. Once initial learning is complete, it takes more practice to improve learning and ability than it did in the beginning stages of skill development (Baker, 2003). Early sport specialists are aware that becoming an elite level athlete requires a tremendous time commitment. If these athletes want to be considered experts in their sport with the opportunity to compete collegiately and continue on to play in their sport professionally, then they need to begin putting in the required hours of practice early in life beginning at a young age. Otherwise, they may not accumulate the necessary amount of practice hours in time to attract a college recruiter who begins scouting athletes at 14-15 years of age, just as they are beginning to enter high school (Sherman, 2012).

Youth athlete participation in year round club sports has grown over the last decade while high school participation as a three sport athlete has declined tremendously during this time (Hiro, 2012). In 2002, it was estimated, on average, each high school in California had 20 student athletes that competed in three sports each year. In 2012, this average dropped to only five student athletes per school (Hiro, 2012). The reasoning for such a dramatic decrease in multisport participation was the increase in popularity and participation in year round club sport. Club sports monopolize time and prevent a student athlete from engaging in multiple sports throughout the year (Hiro, 2012). There is a level of commitment associated with club sport that requires increased time, money, focus on and loyalty to the singular sport of choice played at the

club level. According to research performed at the University of Michigan, the average amount of time spent playing or practicing an organized sport doubled from 1981-1997 (Smith, 2014).

The coaching available to young athletes at the club level is advertised as being superior to any other youth sport program. The purpose of this type of athletic environment is to provide individualized, sport-specific training opportunities to young athletes that are committed and determined to become elite in their sport of choice. This reputation of elite development and a high number of college showcase tournaments available provide young club sport athletes with access to college scouts so that they are more likely to be considered for athletic scholarships.

Overuse Injury

While early sport specialization has been associated with opportunity to achieve an elite level of skill at an earlier age, it has also been associated with increased rate of overuse injury from sport (Brenner, 2007; Cote et al., 2009; Difiori et al. 2014). Approximately 50% of all youth sport injuries are diagnosed as overuse injuries (Brenner, 2007). High impact sports such as running reported an even greater percentage of overuse injuries reaching 68% of total sports injury (Difiori et al., 2014). Data from research likely underestimates the number of overuse injuries suffered by youth sport participants because they are only reported in the literature if they result in loss of time from sport which is not something all overuse injuries require (Difiori et al., 2014).

Overuse injury was defined by Brenner (2007) as “microtraumatic damage to a bone, muscle, or tendon that has been subjected to repetitive stress without sufficient time to heal or undergo the natural reparative process” occurring in athletes when they become overtrained (p. 1243). Overuse injury is the result of “repetitive submaximal loading of the musculoskeletal system when rest is not adequate to allow for structural adaptation to take place” (Difiori et al.,

2014, p. 3) and may also affect bursa, neurovascular structures, and the physis which is commonly referred to as the human growth plate (Difiori et al., 2014). Examples of overuse injuries include stress fractures, tendonitis, small muscle tears, and bursitis. Physical activity is required for any youth to remain healthy and fit; however too much activity and repeated stress on the body without adequate recovery will become destructive and cause the body to breakdown.

The youth growth spurt is one of the greatest risk factors of overuse injuries. During this time, the body is rapidly changing in length, mass, and moments of inertia which lead to decreased coordination and differing biomechanics that affect body awareness (Difiori et al., 2014). As a whole, the growth spurt increases risk of injury during this time of learning and adjustment to a new body arrangement and how to function with proper biomechanics (Difiori et al., 2014). The dangers of overuse injury are more serious and severe during this time of growth because growing bones cannot handle as much stress as mature bones (Brenner, 2007). Overuse injuries are more common during peak growth velocity which occurs between 12-14 years of age (Myer, Faigenbaum, Ford, Best, Bergeron, & Hewett, 2011). Young athletes are not yet mature enough to recognize fatigue and poor performance as a warning sign of injury and are likely to continue overtraining to the point of injury (Brenner, 2007). Additional risk factors of overuse injury include increased training volume, increased work load, and possibly overscheduling which forces the young athlete to participate in too many physical activities or competitions in a short period of time without allowing sufficient time for bodily rest and recovery (Difiori et al., 2014). As youth athletes begin to specialize in sport early, they place themselves at greater risk for increased rate and severity of overuse injury.

Treatment of overuse injury requires total rest and recovery. It becomes necessary to take a break from sport and physical activity to allow time for the body to overcome the compounding stress that has been endured (Difiori et al., 2014). An athlete must be cautious in return to physical activity and sport to ensure enough recovery time has been allowed for the injury to fully heal properly. Once an overuse injury occurs, an athlete is more likely to re-suffer the same injury in the future. Even after total rest, some overuse injuries never fully heal and result in growth disturbance and joint deformity (Difiori et al., 2014). According to Emery et al. (2016), an average of 8% of youth athletes cease sport participation each year as a result of injury from sports. For any young athlete hoping to compete at the collegiate or professional level, this reality is devastating.

Burnout

Early sport diversification describes an athlete who does not specialize in a particular sport until after 15 years of age. Early sport specialization is associated with greater risk of burnout from sport than early sport diversification (Cote et al, 2009; Difiori et al., 2014; Myer, Roy, Hagel, Macpherson, & Nettel-Agguire, 2011). Burnout is a series of psychological, physiological, and hormonal changes that occur when the body is stressed too hard for too long without adequate time for recovery and adaptation (Brenner, 2007). In relation to sport, it is characterized by chronic physical and mental fatigue, decreased performance, loss of passion and desire for sport, and ultimately the cessation of participation in sport (Brenner, 2007). Sport specialization requires an increased percentage of organized sport participation and decreased percentage of non-structured activity which takes away the opportunity for young athletes to simply play and enjoy sport for the fun of the game (Myer et al, 2011).

Brenner (2007) suggest that overuse injury and burnout of youth athletes can be avoided by mandating a full and consecutive 2-3 month break from sport specific activity each year. This will allow recovery from the compounding stresses of long term sport involvement and is essential for maintaining the physical and mental health of an athlete. Physical activity can still be safely performed during this break period however, the focus should be on strength and conditioning, balance, and proprioception which is bodily awareness of movement and special orientation. There should be no focus on sport specific skills. When this break is not incorporated into the training regimen of a young athlete, risk of injury and burnout significantly increases.

Early Sport Diversification

Early diversification of sport leads to positively enhanced mental, emotional, and social development of the young athlete (Cote et al., 2009). Team sports teach an individual how to interact with peers and adults in both a group setting and in individual relationships. Every sport will have its own team dynamic and social atmosphere that provide exposure to varying types of behavior and social responses. When an athlete specializes and is exposed to a single team dynamic, this diversity is lost. Enhanced socialization skills obtained through participation on various sports teams has been related to increased leadership ability during the college years as well as increased psychological well-being and a sense of belonging.

Cote et al. (2009) report that early sport diversification builds intrinsic motivation and fosters enjoyment for sport. An individual athlete is allowed to play sport simply for the fun of it rather than being forced to focus on competition and winning. As a result, the athlete establishes a greater bond with sport and makes a personal decision to continue playing later in life. When the point of specialization does occur, the athlete will be self-determined to improve skill and

performance. Practice will not be viewed as a chore or responsibility but rather as a choice and source of enjoyment. Early sport diversification is linked to decreased rates of dropout from sport and continued participation in sport later in life (Brenner, 2007; Cote et al., 2009). The mean age of sport specialization of all UCLA athletes is 15.4 (UCLA, 2014). UCLA students who formerly played sports in high school but who do not participate in collegiate athletics specialized in sport at 14.2 years of age. So the average athlete who participated in college athletics did not specialize early. The average athlete that did specialize early did not become a collegiate athlete (UCLA, 2014).

Early sport diversification is correlated with increased likelihood of ultimately achieving elite level status in sport when age of peak performance occurs after full maturation (Cote et al., 2009). Examples of sports that fall into this category include ice hockey, field hockey, basketball, baseball, tennis, triathlon, running, and rowing. Gymnastics and figure skating are two sports where age of peak performance occurs before maturation and are therefore exceptions that would require early specialization to reach an elite level of performance (Cote et al., 2009). Capranica & Millard-Stafford (2011) reported that a large percentage of elites began specialized training after the initial timing of talent identification which occurs between 8-12 years of age. Furthermore, athletes who did not wait to specialize until after this time period were found to have less success in sport after this period of development.

Early sport diversification allows an athlete to participate in integrative neuromuscular training which is defined by Myer et al. (2011) as “general and specific strength and conditioning activities, such as resistance, dynamic stability, core focused strength, plyometric and agility, that are designed to enhance health and skill-related components of physical fitness” (p. 156). Participating in integrative neuromuscular training helps the athlete to master fundamental skills,

improve mechanics, and increase confidence in sport. Pre-adolescence may provide the optimal window for this type of motor skill learning, neuromuscular development, and muscular strength development that is long lasting throughout life and sport career. After full maturation this potential diminishes (Myer et al. 2011). Fransen, Pion, Vandendriessche, Vandorpe, Vaeyens, Lenoir, & Philippaerts (2012) reported that 10-12 year old boys that participated in various sport activities performed significantly better than sport specialists of the same age in the standing broad jump and in gross motor coordination. Time should be allotted early in youth sport development for this type of general training while maximum benefit can be reaped. This does not occur in sport specific training that early sport specialists participate in year round.

Research has indicated that early sport diversification is correlated with decreased rate of overuse injury (Brenner, 2007; Cote et al., 2009; Difiori et al., 2014), burnout and dropout from sport with increased longevity of sport (Cote et al., 2009; Difiori et al., 2014; Myer et al., 2011), and increased potential to reach elite level status of sport when compared to early sport specialists (Cote et al., 2009). Specific research on the overuse injury and burnout rates of early sport specialization versus early sport diversification at the NCAA Division III level has yet to be conducted.

Hypothesis

Based on review of the existing literature it is predicted that current NCAA division III student athletes that were early sport specialists will have suffered an increased rate of overuse injury and burnout from sport than current NCAA Division III student athletes that participated in early sport diversification and specialized later in life after 15 years of age.

Research Methodology

Participants

The participants of this study will include student athletes from all men's and women's sports teams at a small, private, Division III University. All fall, winter, and spring sports teams will be included in data collection. The men's sports teams that will contribute to data collection will be baseball, basketball, cross country, football, golf, lacrosse, soccer, tennis, and track and field. The women's sport teams that will contribute to data collection include basketball, cross country, golf, lacrosse, softball, soccer, tennis, track and field, and volleyball. There are 479 total student athletes competing at the University and it is expected that 80% or more will participate in the research study.

Instrument

A 12-question, retrospective, original survey will be administered to all participants. Copy of survey attached in Appendix A. It designates each participant as an early sport specialist or an early sport generalist. Any athlete that began training for a sport year round with the exclusion of competitive participation in any other sport will be labeled as an early sport specialist. The survey asks participants to list the total number of overuse injuries that developed from competitive sport participation during high school and then again during college. Past and present feelings of burnout from sport will be measured as well. A definition of burnout will be provided and participants will self-diagnose if they ever previously had or are currently experiencing feelings of burnout. Demographics of each participant will also be obtained including sport(s) currently played at the NCAA Division III level, how many sports were played in high school, academic status, age, gender, and race.

Internal validity will be tested by administering the survey to former collegiate student athletes and current athletic trainers who volunteered prior to the start of actual data collection. This will enable the researchers to change the wording of questions as needed to ensure that each question asks what it is intended to ask and that the participants will answer each question appropriately. Because every male and female sport team on campus is going to be included in data collection, the findings will be generalizable to the athletic population of the selected NCAA Division III University at large.

Procedures for Data Collection

The purpose and methodology of this research will be presented to the Athletic Director of the University to gain approval for the research and permission to use current student athletes as participants in the research. An announcement will be made to all head coaches during a monthly staff meeting to inform them of the research project and the desire to use current student athletes as participants in this study. This announcement will be followed up with individual conversations with each head coach either in person or via e-mail to gain permission for the researcher to use their current student athletes as participants in the research. After gaining permission from the head coach, a 15-minute meeting time will be established with each team either at the beginning or end of a practice session, team meeting, or team study hall when the majority of team members should be present. During the meeting, the researcher will read the oral instructions and administer a hard paper copy of the survey instrument for all student athletes to voluntarily complete and return to the researcher immediately upon completion. Objectivity will be ensured by providing the same oral and written instructions to all participants regardless of when they take the survey and who administers it to them. An informed consent form will be attached to the front of each survey that must be signed by each student athlete that

agrees to participate in the research study. Upon completion, the informed consent form will be separated from the survey to ensure data will remain anonymous and unable to be traced back to the participant.

When the survey is administered to the men's and women's cross country and track and field teams, one of the cross country and track and field coaches will administer the survey instead of the researcher. The researcher is currently a member of the cross country and track and field coaching staff and will be absent during data collection from these teams in an attempt to eliminate research bias and unnecessary pressure on the student athletes to participate in the research.

Statistical Analysis Tools

The statistical software to be used to analyze data is IBM Statistical Package for the Social Sciences (SPSS) version 22. Descriptive statistics describing the research population will be obtained. Further statistical analysis will be performed using age of sport specialization as the independent variable while overuse injury and burnout rates are used as dependent variables to retrospectively compare injury and burnout rates of early sport specialists to early sport generalists. A Chi Square analysis will be conducted to compare previous and current burnout rates between early sport specialists and early sport generalists, as well as the percentage of individuals that suffered overuse injury in high school and college separately. An Independent Sample T-Test will compare the average number of overuse injuries suffered by early sport specialists and early sport generalists. A 95% confidence interval will be used in all statistical testing.

Limitations

The greatest limitation of the research project is time constraints. Data collection and analysis must be completed by April 2016 which meant the researcher only has three months to collect, analyze, and report on data. It is expected that not all student athletes will have the opportunity to participate because each sport team will only have one meeting with the researcher where the survey was administered to all who are present. If an athlete is unable to attend the meeting for various reasons, then they will not have another opportunity to participate at a later date due to time constraints. Not all sports teams are in season during the time period of data collection and it may be difficult to find a time when the whole team will meet together in the off season. This will most likely lead to smaller percentages of out-of-season sports teams participating in the survey. Another limitation is recall bias on the part of the participants. Depending on how long ago the participants graduated from high school, athletes will be asked to remember events that happened up to 8 years in the past. While participants may believe they are answering all survey questions truthfully, they may not have an accurate memory of events that happened so long ago.

Ethical Considerations

Research was approved by the Institutional Review Board of Otterbein University. All participants that participate in data collection must read and sign an informed consent form stating that participation is strictly voluntary, anonymous, and confidential. There are no negative consequences of any kind for any student athlete that chooses not to participate in the research. No names or other personal identifiers of the participants are linked to any survey. The researchers will be unaware of who submits which survey and no data is going to be

traceable back to an individual participant. No rewards or incentives will be offered to participants to incentivize participation in the survey.

One of the researchers is a member of the cross country and track and field coaching staff at the University. To ensure that participation in research remains unbiased and strictly voluntary, the researcher will not administer the survey to the cross country and track and field participants. Instead, an outside individual will collect data from these participants.

Results

Of the 287 student athletes that received a survey and were asked to participate in the research, 281 agreed to participate and contributed to data collection yielding a 97.9% response rate. Participants comprised 58.7% of the total student athlete population at the University. A total of 281 subjects participated in the research process. During data analysis it was realized that one subject was under 18 years of age and the data received from this subject was promptly discarded. This reduced the number of valid subjects to 280.

Demographics

The population surveyed had a mean age of 19.8 (SD=1.25). The sample population was comprised of 157 male athletes (57.1%) and 118 female athletes (42.9%). The sample population was composed of 100 freshman (35.7%), 77 sophomores (27.5%), 58 juniors (20.7%), 37 seniors (13.2%), and 3 graduate students (1.1%). The race of the sample population was comprised of 240 White/Caucasian (85.7%), 15 Black/African American (5.4%), 8 Multiracial (2.9%), 7 Hispanic (2.5%), 2 Asian/Pacific Islander (0.7%), 2 Other (0.7%), and 1 Native American/Alaskan Native (0.4%). All eleven sports at the University were represented with 54 track and field athletes (19.3%), 53 football players (18.9%), 35 lacrosse players (12.5%), 31 basketball players (11.1%), 28 cross country runners (10.0%), 24 baseball players (8.6%), 22 soccer players (7.9%), 20 tennis players (7.1%), 19 softball players (6.8%), 14 golfers (5.0%), and 12 volleyball players (4.3%). There were 37 athletes (13.5%) competing on more than one sport team at the collegiate level.

Descriptive Statistics

Injury Rates in High School

Early Sport Specialization. Of the 280 total participants in this study, 79 (28.2%) specialized in a sport early and reported the number of overuse injuries they developed during the high school competitive sport career. Of those that specialized early, 47 (59.5%) developed at least one overuse injury during their high school competitive sport career. The number of overuse injuries each early sport specialist developed in high school ranged from 1-17 total injuries with the mean number equaling 2.26 (SD=2.95).

Early Sport Diversification. Of the 280 total participants, 201 did not specialize early in sport and were labeled early sport generalists. There were 110 (54.7%) of the early sport generalists that developed at least one overuse injury during their high school sport career. The total number of overuse injuries reported per athlete during this time ranged from 1-19 injuries. The mean number of overuse injuries reported by this population equaled 2.57 injuries per athlete (SD=2.57).

Compare Rates. A Chi-Square Analysis was done to compare the number of early sport specialists and early sport generalists that were injured throughout their high school sport career to determine which group was more likely to develop an injury during this time. Although a greater percentage of early sport specialists were injured than early sport generalists, 59.5% and 54.7% respectively, the difference was not statistically significant (P-value = 0.254).

An Independent Samples T-test was conducted to compare the average number of injuries each individual developed during the high school competitive sport career for early sport specialists and early sport generalists, 2.26 and 2.57 injuries respectively. There was no statistical difference between the two groups (P-value = 0.500). Results of injury rates in high

school comparing early sport specialists and early sport generalists are summarized in Table 1 (page 35).

Injury Rates in College

Early Sport Specialization. There were 79 (28.2%) of the total 280 participants that specialized early in sport and reported the number of overuse injuries that had developed thus far throughout the collegiate sport career. A total of 33 (42.3%) of the early sport specialists developed at least one overuse injury throughout their collegiate sport career. Total number of injuries reported during the collegiate years ranged from 1-10 with the mean equaling 1.57 injuries per athlete (SD=2.82) during this time.

Early Sport Diversification. Out of the 201 early sport generalists that contributed to data collection, 97 (48.3%) of them developed at least one overuse injury thus far throughout the collegiate sport career. The total number of overuse injuries reported during this time period ranged between 1-21 total injuries per person. The mean number of overuse injuries developed per person during collegiate athletics was 2.24 injuries (SD=2.62).

Compare Rates. A Chi-Square Analysis was done to compare the number of early sport specialists and early sport generalists that were injured throughout their competitive collegiate sport career to determine which group was more likely to develop an injury during this time. A greater percentage of early sport generalists were injured than early sport specialists, 42.3% and 48.3% respectively. However, the difference was not statistically significant (P-value = 0.385).

An Independent Samples T-test was conducted to compare the average number of injuries each individual reported during the collegiate competitive sport career for early sport specialists and early sport generalists, 1.57 and 2.24 injuries respectively. There was no statistical difference between the two groups (P-value = 0.175).

It should also be reported that 61 participants (21.7%) did not indicate the number of overuse injuries developed throughout their high school and college sport careers. These participants did list what overuse injuries they developed during both high school and college, but not how many times they developed each injury. In this circumstance, the researcher assumed that all overuse injuries listed occurred only once. Results comparing injury rates of early sport specialists and early sport generalists in college are summarized in Table 2 (page 35).

Burnout

Early Sport Specialization. Seventy Eight (98.7%) of the 79 early sport specialists indicated whether they have had previous or current feelings of burnout from their sport. Of the 78 early sport specialists, 17 (21.8%) claimed that they experienced previous burnout from their sport. An additional 11 (14.1%) admitted to having current feelings of burnout from their sport. A total of five individuals (6.4%) indicated that they experienced both previous and current feelings of burnout. There were 12 participants (15.4%) that had experienced previous burnout but were not experiencing current burnout. There were six early sport specialists (7.7%) that had not experienced previous burnout but who did have current feelings of burnout. Finally, the remaining 55 early sport specialists (70.5%) did not report having previous or current feelings of burnout from sport.

Early Sport Diversification. Of the 201 early sport generalists, 196 (97.5%) reported on previous or current feelings of burnout from sport. Out of those 196 participants, 26 (13.3%) claimed to have had previous burnout from their sport. Furthermore, 24 (12.2%) reported having current feelings of burnout from sport. There were nine (4.6%) that experienced both previous and current feelings of burnout, 18 (9.2%) that experienced previous but not current burnout from sport, 16 (8.2%) that did not experience previous burnout but was experiencing current

burnout from sport, and 154 (78.6%) that did not claim to experience previous or current feelings of burnout from sport.

Compare Rates. A Chi-Square Analysis was done to compare the number of early sport specialists and early sport generalists that self-reported previous burnout at any point during their competitive sport career to determine which group was more likely to experience previous burnout. A greater percentage of early sport specialists experienced previous burnout than early sport generalists, 21.8% and 13.3% respectively. The difference was not statistically significant (P-value = 0.088). Results comparing previous burnout rates of early sport specialists and early sport generalists are summarized in Table 3 (page 36).

A Chi-Square Analysis was also done to compare the number of early sport specialists and early sport generalists that self-reported current feelings of burnout in their competitive collegiate sport to determine which group was more likely to experience current burnout from sport. A greater percentage of early sport specialists experienced current burnout than early sport generalists, 14.1% and 12.2% respectively. The difference was not statistically significant (P-value = 0.622). Results comparing current feelings of burnout between early sport specialists and early sport generalists are summarized in Table 4 (page 36).

Analysis/Discussion

Discussion

Overuse Injury

It was hypothesized that early sport specialists would be more likely to develop overuse injuries from competitive sports than early sport generalists. Results of the research were divided into two categories, overuse injuries that occurred in high school and overuse injuries that occurred in college. Results indicated that during the high school competitive sport career, early sport specialists were more likely to develop overuse injuries than early sport generalists. Of all the early sport specialists, 59.5% developed overuse injury in high school while only 54.7% of early sport generalists developed overuse injury during this time. This result however was not found to be statistically significant ($P\text{-value} = 0.254$). Even though the above result is not statistically significant, it did support prior research and the hypothesis that early sport specialists are more susceptible to overuse injury than early sport generalists of the same age (Brenner, 2007; Cote et al., 2009; Difiori et al., 2014).

The research did not support the hypothesis that early sport specialists are more likely to develop overuse injury at the collegiate level than early sport generalists. Only 42.3% of early sport specialists reported at least one overuse injury so far throughout their competitive collegiate sport career at the time of data collection while 48.3% of early sport generalists reported at least one overuse injury during their collegiate sport career. This result is in opposition to current literature but was not statistically significant ($P\text{-value} = 0.385$).

It was hypothesized that if early sport specialists were more likely to develop overuse injury than early sport generalists, then early sport specialists would also be more likely to develop a higher number of overuse injuries than early sport specialists. Results for number of

injuries developed per group were again divided into high school and college. During the high school competitive sport career, early sport specialists developed an average of 2.26 injuries per person ($SD = 2.95$) while early sport generalists developed 2.57 ($SD = 2.57$) injuries per person on average. Results did not support the hypothesis or the current literature on the subject but were similar between groups and were not found to be statistically significant ($P\text{-value} = 0.500$). Results were similar during the collegiate sport career. Early sport specialists developed an average of only 1.57 injuries per athlete ($SD = 2.82$), while early sport generalists developed 2.24 injuries per person on average ($SD = 2.62$). Results were not statistically significant ($P\text{-value} = 0.175$).

Burnout Rates

Based on a review of the current literature, it was hypothesized that early sport specialists are more likely to experience burnout from their sport than early sport generalists. This assessment was broken down into two categories, previous burnout and current feelings of burnout from sport. If a participant ever previously chose to stop playing their competitive sport for any period of time specifically due to burnout from the sport, then they were labeled as being previously burnt out from their sport. Current burnout is more difficult to assess in individuals that are still actively playing their sport because cessation of the sport is typically used as the method of measurement. This was accomplished by providing a definition of burnout and asking participants to self-declare if they were currently experiencing all the symptoms of burnout. This was determined by perceived feelings of burnout that were self-reported by the participant.

Of all early sport specialists, 21.8% previously experienced burnout from their sport at some point during their competitive career while only 13.3% of early sport generalists experienced it. This supports the hypothesis that early sport specialists are more likely to

burnout than early sport generalists. The result was not statistically significant however, it is only marginally outside the range of being accepted as such (P -value = 0.088).

Evaluation of current burnout from sport followed the same pattern as previous burnout from sport. 14.1% of early sport specialists reported current feelings of burnout while only 12.2% of early sport generalists were experiencing current feelings of burnout from sport. This was also not found to be statistically significant and was less significant than previous burnout. However, previous and current burnout from sport both support the current literature and the hypothesis that early sport specialists are more likely to experience burnout from sport than early sport generalists (Cote et al, 2009; Difiori et al., 2014; Myer et al., 2011).

Limitations

A limitation that was discovered after completion of the data collection process was that not all participants indicated the number of overuse injuries suffered throughout their high school and college sport careers. In this circumstance, the researcher assumed that all overuse injuries listed occurred only once. It is possible that they each occurred more than once but without the proper data it cannot be known. Also, with regard to the participants that have chronic recurring overuse injuries, some of these athletes listed a recurring injury as being only one injury while others listed each recurrence as a separate injury. The total number of overuse injuries suffered by this population is likely to be skewed and underrepresented in this research. However, determination of whether a participant was injured or not injured was unaffected. And while recall bias is likely to affect accurate memory of the exact number of overuse injuries that developed throughout an entire sport career, remembering if any overuse injuries developed or not throughout a sport career is more reliable. So data reporting on the number of injuries

developed on average per group is less reliable than data describing the percentage of each group that developed overuse injury.

A second limitation realized after the completion of data collection was that even though a definition of overuse injury was provided to all participants, some listed injuries that were not classified as overuse injury but rather acute injury such as a concussion or broken ankle. It was left to the discretion of the researcher to determine which injuries were classified as overuse injury and subsequently included in data analysis.

Participants were at various stages of their collegiate sport career when they participated in data collection from freshman to graduate student. This will affect the number of injuries suffered thus far in their collegiate career. Older participants have had more time to potentially develop overuse injuries while younger participants have had less time. So the average number of injuries suffered during the collegiate career will reflect having data points from various stages of time. This would be difficult to assess in this research because the vast majority of participants were freshman and sophomores with very few seniors and graduate students. This is unlike the data collected describing overuse injuries from the high school career because all participants already finished high school and had an equal amount of time to develop injury or not.

Another limitation of this research is that athletes who are currently burnt out from their sport are likely to no longer be playing their sport at the competitive level. In this case, many athletes who are currently burnt out would not have participated in the research because only current athletes were invited to participate in the survey. This explains why current burnout is less prevalent than previous burnout for both early sport specialists and early sport generalists and may explain why the results were less significant for current burnout than previous burnout.

Based on observation of the researcher, participants rushed through the survey and seemed to only skim through each question. This caused parts of questions and definitions to be missed by the participants and may explain why 20% of participants only indicated which overuse injuries they developed and not how many. It may also explain why some of the injuries reported did not fit the definition of overuse injury that was provided. The survey questions were lengthy and should have been simplified as well as more direct.

Use of Results

The purpose of this research was to determine if it is better for aspiring young athletes to become early sport specialists or early sport generalists to develop into the best athlete possible while avoiding overuse injury and burnout from sport. Based on the research findings, although not statistically significant, early sport specialists may be more likely to develop overuse injury in high school but not in college than early sport generalists. Early sport specialists are more likely to experience burnout at any point during the competitive high school and collegiate sport career than early sport generalists. Over 70% of all participating athletes at this Division III Institution were early sport generalists. This indicates that early sport generalists are more likely to progress their competitive sport career to the NCAA Division III level of collegiate athletics than early sport specialists. It is possible that many early sport specialists ceased competitive sport participation before reaching the college years due to injury, burnout, or both. However, there is also the potential that early sport specialists did continue competitive sport competition throughout the collegiate years at either the Division II or Division I level of competition. Without further research this cannot be known.

Based on the information that is available through the research, early sport generalists are more likely to continue their competitive sport career into college, avoid burnout, and potentially

decrease risk of overuse injury. For this reason, it is recommended to young athletes and the parents of young athletes that they participate in multiple sports during childhood and not specialize in a sport until 15 years of age or later. This research can serve as a foundation for future research that can be done to more clearly define the scope of overuse injury and burnout in sport as it pertains to early sport specialization and early sport generalization.

Further Research

Additional research to be done in the future includes breaking down the results and analyzing them by sport. Time did not allow for this to be analyzed in the current research. Eleven different sports were represented in the research and each one may have a slightly different effect on injury and burnout rate on the individuals that specialized early. Because all eleven sports were analyzed collectively as a whole, various patterns across different sports may have been canceled out and could explain why none of the results were statistically significant. It would also be beneficial to increase the sample size and include participants from various NCAA Division III Institutions public and private, large and small, from differing geographic locations, and composed of athletes that come from various socioeconomic backgrounds to make the results generalizable to NCAA Division III at large and not solely the Institution researched in this project.

It may also be beneficial to distinguish between varying degrees of early sport specialist. Anyone who specializes before the age of 15 is an early sport specialist. Further analysis of the data will indicate if there is a difference in injury rate or burnout rate between individuals that specialized at age 14 who barely qualify as being an early sport specialist, and those who specialized much younger at age 10 for example.

Another suggestion for future research involves retesting the same sample population in the future. Three years in the future, the freshman from this study will be seniors. A retest could be administered at that time to determine injury and burnout rates at the end of the collegiate competitive sport career. These results can then be compared to the first test from their freshman year to obtain a more reliable assessment of burnout during the college years. A re-test of the same individuals would determine how many stopped playing their sport. A qualitative component of the re-test would be to determine how many stopped playing their sport as a result of burnout and would indicate whether early sport specialists or early sport generalists are more likely to compete throughout all four years of the competitive collegiate sport career. A more complete picture of injury rates during the collegiate career could also be obtained at this time.

Conclusion

Early sport generalists are more likely than early sport specialists to participate in competitive collegiate athletics at the NCAA Division III Institution analyzed for this study. Early sport specialists may be more likely to develop overuse injuries from sport than early sport generalists. Early sport specialists are more likely to experience burnout from sport and cease competing in their sport than early sport generalists. It is unknown if early sport specialization correlates to developing an increased number of overuse injuries. Young athletes are encouraged to participate in multiple sports during youth and not to specialize until the age of 15 or later. It is recommended that parents of young athletes also encourage this behavior. The results of this research are not statistically significant and further research is needed to support these conclusions.

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Appendix A

Informed Consent

The Department of Health and Sport Sciences at Otterbein University supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty and you may choose not to answer specific questions.

We are interested in studying the competitive sport background of NCAA Division III student athletes at a small private Institution by gathering data from a retrospective survey. Participants will be asked questions regarding what competitive sports were played, when, and how often. Questions will also ask about sport injury background and potential feelings of burnout from competitive sport participation. Data will be used to assess a correlation between competitive sport background and injury and burnout rates in youth sports.

Your participation is solicited although strictly voluntary. We assure you that your name will not be associated in any way with the research findings. The information will be identified only by a code number.

If you would like additional information concerning this study before or after it is complete, please feel free to contact me by phone or mail.

Sincerely,

Jess McClelland, Student Investigator
Jessica.McClelland@Otterbein.edu
(540)809-0640

Signature of subject agreeing to participate

With my signature I affirm that I am at least 18 years of age.

Competitive Sport Background Survey

Directions: Please answer the questions below as they relate to your past competitive sport and injury history; doing so to the best of your memory and ability. By completing this form you acknowledge participating in this confidential and anonymous survey. Thank you for your participation.

1. At what age did you **start** practicing and competing in your sport of choice year round?

2. At what age did you **stop** participating **competitively** in any other sport? (Other than your main sport of choice) _____
3. Which of the following overuse injuries, caused by competitive sport participation, did you suffer throughout your **high school** sport career? Write on the line the number of times you had each injury. If you did not have a certain injury then please leave that line blank. (*Overuse injury is the result of repetitive stress on the body over time, without sufficient time to heal*)

____ I did not suffer any overuse injuries throughout my high school sport career
____ Lower Extremity Stress Fracture
____ Upper Extremity Stress Fracture
____ Lower Extremity Tendonitis (Patellar, Achilles, etc...)
____ Upper Extremity Tendonitis (Rotator Cuff, Elbow, etc...)
____ Iliotibial (IT) Band Syndrome
____ Medial Tibial Stress Syndrome (Shin Splints)
____ Plantar Fasciitis
____ Bursitis
____ Other Please List: _____
4. Which of the following overuse injuries, caused by competitive sport participation, have you suffered so far throughout your **collegiate** sport career? Write on the line the number of times you have had each injury. If you did not have a certain injury then please leave that line blank. (*Overuse injury is the result of repetitive stress on the body over time, without sufficient time to heal*)

____ I have not suffered any overuse injuries throughout my collegiate sport career
____ Lower Extremity Stress Fracture
____ Upper Extremity Stress Fracture
____ Lower Extremity Tendonitis (Patellar, Achilles, etc...)
____ Upper Extremity Tendonitis (Rotator Cuff, Elbow, etc...)
____ Iliotibial (IT) Band Syndrome
____ Medial Tibial Stress Syndrome (Shin Splints)
____ Plantar Fasciitis
____ Bursitis
____ Other, Please List: _____

5. Did you ever choose not to participate in your current sport of choice for a period of time because you experienced **burnout** from your sport? (*Burnout occurs when the body is greatly stressed without sufficient time for recovery and is characterized by chronic physical and mental fatigue, decreased performance, and loss of passion and desire for sport*)
____ Yes
____ No
6. Do you **currently** feel that you are experiencing burnout from your sport of choice?
____ Yes
____ No
7. What sport(s) do you participate in at the NCAA Division III level?
____ Baseball
____ Basketball
____ Cross Country
____ Football
____ Golf
____ Lacrosse
____ Soccer
____ Softball
____ Tennis
____ Track and Field
____ Volleyball
8. What is your current academic status?
____ Freshman
____ Sophomore
____ Junior
____ Senior
____ Graduate Student
9. What is your age? _____
10. What is your gender?
____ Female
____ Male
11. What is your race?
____ Asian/Pacific Islander
____ Black/African American
____ Hispanic
____ Multiracial
____ Native American/ Alaskan Native
____ White/Caucasian
____ Other

Appendix B

Table 1: Injury Rates in High School

	Specialists	Generalists	Significance
Number Injured	47/79	110/201	P=0.254
Percent Injured	59.5	54.7	
Mean Number of Injuries	2.26*	2.57*	P=0.500
Standard Deviation	2.95	2.57	
Range	1-17	1-19	

*61 participants (21.7%) did not report number of overuse injuries

The number and percent of participants who reported development of one or more overuse injury during the competitive high school sport career were separated into early sport specialists and early sport generalists. The mean number of overuse injuries developed per person for each group is reported as well. Results were not statistically significant.

Table 2: Injury Rates in College

	Specialists	Generalists	Significance
Number Injured	33/79	97/201	P=0.385
Percent Injured	42.3	48.3	
Mean Number of Injuries	1.57*	2.24*	P=0.175
Standard Deviation	2.82	2.62	
Range	1-10	1-21	

* 61 participants (21.7%) did not report number of overuse injuries

The number and percent of participants who reported development of one or more overuse injury during the competitive collegiate sport career were separated into early sport specialists and early sport generalists. The mean number of overuse injuries developed per person for each group is reported as well. Results were not statistically significant.

Table 3: Rate of Previous Burnout

	Yes		No	
Specialists	17	21.5%	62	78.50%
Generalists	26	13.3%	170	86.70%
Total	43	15.6%	232	84.4%

The number and percent of participants that reported being previously burnt out to the point of having to take a break from their sport are reported under the “Yes” column. Those that did not develop previous burnout are reported under the “No” column. Results are further broken down into Early Sport Specialists, Early Sport Generalists, and the total population. Results not statistically significant ($P=0.088$).

Table 4: Rate of Current Burnout

	Yes		No	
Specialists	11	14.1%	67	85.90%
Generalists	24	12.2%	170	86.70%
Total	35	12.8%	237	86.5%

The number and percent of participants that reported current feelings of burnout from their sport are reported under the “Yes” column. Those that do not currently feel they are burnt out are reported under the “No” column. Results are further broken down into Early Sport Specialists, Early Sport Generalists, and the total population. Results not statistically significant ($P=0.622$).