

# A case of early sports specialization in an adolescent athlete

Brad Ferguson, BSc, DC<sup>a</sup>

Paula J. Stern, BSc, DC, FCCS(C)<sup>b</sup>

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*Early sport specialization (ESS) refers to intense year round training in a specific sport with the exclusion of other sports at a young age. This approach to training is heavily debated and there are claims both in support and against ESS. ESS is considered to be more common in the modern day youth athlete and could be a source of overuse injuries and burnout. This case describes a 16 year old elite level baseball pitcher who engaged in high volume, intense training at a young age which lead to several significant throwing related injuries. The case highlights the historical context of ESS, the potential risk and benefits as well as the evidence for its effectiveness. It is important for health care professionals to be informed on the topic of ESS in order to educate athletes, parents, coaches and organizations of the potential risks and benefits.*

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**KEY WORDS:** sport specialization, youth, adolescent, baseball, chiropractic

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*La spécialisation précoce dans un sport (SPS) se réfère à l'entraînement intensif toute au long de l'année dans un sport particulier à l'exclusion des autres formes de sport dès le jeune âge. Cette approche de l'entraînement est fortement débattue et la SPS a ses détracteurs tout comme ses défenseurs. La SPS est considérée comme plus fréquente chez les jeunes athlètes de nos jours et pourrait être une source d'épuisement et de blessures dues à un surentraînement. Ce cas décrit un lanceur de baseball de 16 ans au niveau provincial qui a suivi un entraînement intense à un jeune âge qui lui a causé plusieurs blessures importantes liées au lancement. Le cas met en lumière le contexte historique de la SPS, les risques et les avantages potentiels, ainsi que les preuves de son efficacité. Il est important que les professionnels de la santé soient renseignés au sujet de la SPS afin de sensibiliser les athlètes, parents, entraîneurs et organisations aux risques et avantages potentiels.*

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**MOTS CLÉS :** spécialisation dans un sport, jeune, adolescent, baseball, chiropratique

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<sup>a</sup> Division of Graduate Studies, Sports Sciences, Canadian Memorial Chiropractic College

<sup>b</sup> Director, Graduate Studies, Canadian Memorial Chiropractic College

Corresponding author: Dr. Brad Ferguson

bferguson@cmcc.ca

T: (416) 482-2340 ext. 315 F: (416) 482-2560

6100 Leslie Street, Toronto, ON, Canada, M2H 3J1

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## Introduction

Early sport specialization (ESS) is a relatively new topic in the literature however its relevancy appears to be on the rise. There is no standardized definition for ESS, with authors providing their own interpretation.<sup>1,2,3,4</sup> However, the majority of definitions have a similar construct focusing on intense year round training in a specific sport, with the exclusion of other sports a young age. Figure 1 lists some of the common themes seen across the definitions.

The lack of a concrete definition has led to confusion over what qualifies as ESS. Currently, ESS can be viewed as a continuum and should be determined on an individual basis taking into account all factors listed in Figure 1.

ESS is gaining attention in the media and scientific literature. There is much debate whether or not ESS is necessary and/or appropriate for obtaining elite status in sports.<sup>2,5,6</sup> It is also questioned if ESS leads to more injuries and burnout in youth sports.<sup>7,8</sup>

ESS is a broad topic in the sports medicine realm. The purpose of this paper is to describe a specific case of ESS in a youth provincial baseball pitcher, highlight the potential outcomes of ESS and bring awareness of the current information to health care professionals.

## Case

A 16 year old elite level baseball pitcher presented to a sports chiropractor with several ailments including right (throwing arm) shoulder, right elbow, left hip and low back pain. All of these injuries impaired the athletes' performance and lead to significant time away from throwing.

The patient grew up in the Dominican Republic and began playing baseball at the age of five. He played baseball year round, at a frequency of 2-3 times per week mostly consisting of structured practice sessions. He became the top pitcher on the team and assumed a significant pitching role. In this league there was no pitching machine or pitching counts or limitations. At age 10, he moved to Canada. He joined a local city baseball league and became a dominant pitcher. His baseball volume dramatically decreased from year round baseball to playing only in the summer months. He began to notice some intermittent, low intensity low back and left hip pain. The pain did not impair his play so he ignored the symptoms. At the age of 14 his talent was recognized by an elite travel team within the city.

- High volume, intensity, duration of training at a young age
- Minimal rest or time off
- High structured training with emphasis on physical development
- May involve exclusion of other sports
- May be initiated by parents, coaches or trainer
- Goal of obtaining provincial status

Figure 1.

### *Typical aspects of early sport specialization*

As a young teenager he played for the local AAA baseball team as well as the elite travel team. During the off season he engaged in several high intensity, off season throwing programs to improve his arm strength. At this stage, he was participating in baseball training 10+ months a year. During this time, he began to notice gradual onset of right medial elbow pain. The pain was reported as low level allowing him to continue his training. Leading into the next baseball season, he reported not feeling 100% regarding his right elbow, low back or left hip. At this point he was playing on two teams (local AAA and the travel team) which lead to about 3-7 games per week and 2-3 practices per week. Near the end of the season, his pitching volume increased into the playoffs and the medial elbow pain intensified to the point that he could no longer throw. Even swinging a baseball bat was unbearable due to the elbow pain. He sought treatment from a sports physician and was encouraged not to throw for several months. He was uncertain of the exact diagnosis rendered but reported it was most likely an ulnar collateral ligament sprain.

He spent the following off season resting and rehabilitating his elbow. At the beginning of the next season his elbow pain significantly decreased and he was able to return to pitching. However, he reported not feeling up to his full potential. He returned to playing for both teams at this point at a similar frequency and intensity as the prior season. As this season progressed he began to experience gradual onset of right shoulder pain. He continued to pitch as the pain was low in intensity. In the middle of the season he was selected to go to a provincial level

tournament. He pitched at this event and reported “throwing his arm out” during one of the games. The shoulder pain was so severe that he could no longer throw. He was advised to rest by his sports physician and was referred for an MRA. His MRA revealed a type II SLAP (superior labrum anterior-posterior) lesion in his right shoulder. He was advised to rest for 3-4 weeks and begin rehabilitation. He returned to play after 3-4 weeks of rest in a limited role with this teams, mainly consisting of non-pitching positions and batting. At this point he presented to the local chiropractor with the list of ailments described above.

## Discussion

### *Epidemiology*

In general, today’s youth are becoming less active, but activity in youth organized sport is on the rise.<sup>9</sup> In the United States, youth participation in organized sports has dramatically increased over the past 25+ years from approximately 18 million children in 1987 to 60 million in 2008.<sup>9</sup> Children are engaging in organized athletics at a younger age. In 1987, children aged 6 and under made up 9% of all youth athletes in organized sports.<sup>9</sup> In 2008, this number grew to 14% highlighting the earlier entrance into organized sports.

There is no statistical data to confirm that ESS is occurring more commonly today than it was in the past. This is owing to the fact that categorizing ESS is difficult and the topic is relatively new in the literature. However, when looking at current evidence, it appears that ESS is becoming increasingly common in youth athletics.<sup>9,10,11</sup>

A group of US high school sports directors were surveyed and 78% reported an increase in sports specialization in high school athletes.<sup>10</sup> In 2008, it was reported that 75% of US high school sports programs were offered on a year round basis with increased usage of privately owned sports training facilities.<sup>9</sup> Suggesting that a more streamlined specialized approach to sport has been developing. There has been a study showing that it is common for youth athletes to specialize in a sport before the age of 10.<sup>11</sup> And that the youth are often playing year round, for multiple teams including provincial travel teams.<sup>9</sup>

### *The effectiveness and safety of ESS*

The effectiveness and safety of ESS is being debated and there are currently two main schools of thought (Figure

<b><u>Against Early Specialization</u></b>	<b><u>For Early Specialization</u></b>
<ul style="list-style-type: none"> <li>○ Avoid overuse injury</li> <li>○ Allow proper rest</li> <li>○ Cross sport skill development</li> <li>○ Maintain interest in sport</li> <li>○ Prevent social isolation</li> <li>○ Prevent burnout</li> <li>○ Prevent over-dependence</li> </ul>	<ul style="list-style-type: none"> <li>○ Gain competitive edge</li> <li>○ Develop and hone skills faster</li> <li>○ Early talent recognition</li> <li>○ Increase opportunity for scholarships or professional contracts</li> </ul>

Figure 2.

*Claims for and against early sports specialization.*<sup>3-6,8,11</sup>

2). The claims supporting ESS state that specializing at a very young age may allow faster skill development to help gain a competitive edge.<sup>4,5,6</sup> This advantage aids in acquiring talent recognition earlier leading to opportunities such as provincial programs, showcase teams, scholarships or professional contracts.

The claims against ESS state that specializing at a very young age could lead to more physical and psychosocial problems and stall athletic development.<sup>3</sup> ESS may lead to more overuse injuries and burnout from excessive training at a young age.<sup>8</sup> Claims against ESS support diversification in sports in order to sample many sports, develop a variety of motor skills and maintain interest in sport by keeping it fun.<sup>11</sup>

### *Roots and Societal Influences on ESS*

There are several different theories and rationales for the occurrence of ESS in North America. The main theory is a misinterpretation of a popular study done by Ericsson et al in 1993.<sup>5</sup> Ericsson investigated what factors helped predict expert performance. His results stated that high volumes of deliberate practice (defined as specific, focused, skill based practice) at a very young age was the strongest predictor of becoming an expert performer. This study led to the famous “10,000 hour rule”. Specifically, beginning a task at a very young age (before age 5-7) and acquiring high volumes of deliberate practice (5,000-

10,000 hours) resulted in the likelihood of an individual becoming an expert. It was shown that it was difficult to become a master at a task if one began late and did not acquire many deliberate training hours. However, there is no specific number of hours that was proven as enough to master a task. The number of hours varies on the person, the task and type of training.<sup>5</sup> Of note, these studies were done to determine expert status on musicians, mathematicians, chess players and were not performed on athletes. It does not necessarily indicate how to become to a better athlete, which often requires a diverse set of skills, and appropriate physical development. Regardless, this research by Ericsson et al, has made its way to the sports training world with the belief that early acquisition of training hours will lead to greater success.

When examining what leads a child to become involved in ESS there are multiple factors to consider. It was found the parents are the strongest initiator of sport for youth provincial athletes.<sup>12</sup> However, coaches are typically the first to recognize a child athlete as “gifted” or “special” and encourage specialization.<sup>10,12</sup> It is not commonly the athlete that encourages specialization before the age of 10. Before this age the athlete is typically not psychologically mature to understand the importance, responsibility, commitment and ramifications of year round training in sport.<sup>6</sup> It is also important to note that our modern day media driven, commercialized society plays a role in encouraging ESS. There are endless commercials, advertisements, training programs being geared towards specialized sports training targeting youth athletes.

### ***Position Statements and Evidence***

There have been lists of associations, organizations and authorities that have provided positions statements on ESS (Figure 3).<sup>7,13-17</sup> All position statements are slightly different but there is not one single position statement that supports early sports specialization. All of the position statements state that there is no evidence to support that ESS leads to improved outcomes in athletics compared to a late specialization model. A position statement by the American Medical Society for Sports Medicine (AMSSM) states that ESS “may increase the risk for overuse injury and burnout and should be avoided at younger ages.” However, AMSSM also recognizes that ESS may be necessary for early entry sports such as gymnastics, diving and figure skating since the nature of these sports

### **Position Statements Against ESS<sup>7, 13-17</sup>**

- American Medical Society for Sports Medicine
- American Academy of Pediatrics
- National Athletic Trainers Association
- International Society for Sports Psychology
- World Health Organization
- International Federation of Sports Medicine
- National Association for Sports and Physical Education

Figure 3.

*Position Statements from various authorities on early sports specialization.*

require peak performance at a young age.<sup>7</sup> Other positions statements encourage early sports diversification to help develop multiple athletic skills and maintain motivation and engagement in sport as well as standard periods of rest from any single sport.<sup>13-17</sup>

There are some limitations to the position statements listed in Figure 3. The current state of the literature on ESS is not robust. Therefore, the position statements consist of consensus based expert opinion of the literature from a non-systematic approach. This approach can lead to various forms of bias and is on the lower end of the level of evidence hierarchy. There are also some inherent issues when examining ESS in the literature. When examining the literature the majority of studies are of poor design. They often have heterogeneous populations and do not separate results based off specific sport. Since the studies are commonly retrospective in design, there are recall bias issues regarding training habits and injury reporting. As well, the definition for ESS varies within studies. ESS can be described as year round training, playing only one sport, or high volume deliberate training at young age. Lastly, ESS is expected to be not as common in the past. Therefore you are less likely to find high level athletes attributing their success to ESS in more dated literature.

### ***Developing a Sport Specific Approach***

With the limited evidence surrounding the topic, ESS could be approached from a sport specific standpoint. All sports have their own inherent demands, risks and cultures that must be considered. Therefore, when consid-

ering what age is appropriate to initiate specialization, it is critical to look at each sport differently. It is essential to understand the typical ages for talent recognition, peak performance and length of typical career. Diverse examples would be comparing gymnastics and golf. Gymnastics is an early entry sport that has an age of peak performance at a very young age, especially for females. Gymnastics also has a short career, with peak performance lasting a short period. Golf on the other hand is a sport that has an age of peak performance extending into the 4th and 5th decades of life, with a much longer career length. Therefore, these sports are hard to compare when discussing aspects of sport specialization. It is also important to always consider that each individual athlete is different and responds to different training volumes and demands differently.

When applying this logic to the case discussed in this paper, one must understand ESS within a baseball pitching context. Typically in baseball pitching, talent recognition for collegiate baseball (NCAA) occurs in the latter years of high school (ages 15-18) with peak performance in pitching occurring the mid-late twenties and retirement usually before the age of 40. Therefore it is important for a young pitcher to display talent at a fairly young age in order to be recognized. But they must also have the longevity to perform well into their thirties. However, only approximately 6% of high school pitchers in the USA will pitch at the NCAA level<sup>18</sup>; with even fewer going to professional leagues. Up to 50% of youth pitchers will report shoulder or elbow joint pain throughout the course of a season. This correlates with approximately 15% of all pitching appearances.<sup>19</sup> Also 5-8% of youth pitchers will suffer injuries severe enough to end their pitching careers or require shoulder/elbow surgery.<sup>20</sup> Due to the fact that 70-80% of pitching injuries are progressive, many youth pitchers are pitching through pain or discomfort leading to significant arm pain and disability.<sup>21</sup> Therefore, understanding risk factors to help predict these injuries at such a young age is key. There are four main studies that discuss pitching habits and injury rates in youth pitchers.<sup>19,20,22,23</sup> The summary of the results of these four studies showing the risk factors for arm injury in youth pitchers is presented in Figure 4.

The results from these studies help illustrate that there are modifiable risk factors for pitching practices in youth pitchers. The odds ratios in Figure 4 display the odds of

<b>Risk of Developing Elbow or Shoulder Pain</b>	
<b>Risk Factor</b>	<b>Odds Ratio</b>
Regularly Throwing with Arm Fatigue	6 (3.5-10.1)
Throwing >600 pitches/year	3.4 (0.84-14.12)
Throwing > 75 pitches/game	3.2 (1.84-5.61)
Playing for a second team	2.8 (1.26-4.38)

  

<b>Risk of Elbow/Shoulder Surgery or Retirement</b>	
<b>Risk Factor</b>	<b>Odds Ratio (95% CI)</b>
Regularly Throwing with Arm Fatigue	36 (5.92-221.22)
Throwing >8 months/year	5 (1.39-18.32)
Throwing > 80 pitches/game	3.8 (1.36-10.77)
Throwing > 100 innings/year	3.5 (1.16-10.44)
Playing catcher and pitcher	2.7 (0.93-4.47)
Pitch velocity > 85 mph	2.5 (0.94-7.02)

Figure 4.  
Summarizing the modifiable risk factors for injury in youth pitchers.<sup>19-20, 22-23</sup>

an adolescent pitcher becoming injured if they engaged in these behaviours. These statistics are important as they highlight what pitching and training habits can be mitigated to reduce injury. The risk factors identified in Figure 4 can be monitored in youth pitchers to help prevent injuries.

When applying these risk factors to the case, the 16 year old pitcher had several of the risk factors for significant injury. He was regularly throwing while fatigued, playing for more than one team and throwing for greater than 8 months per year. He could have also been exceeding pitch count numbers but this was not recorded. The combination of risk factors placed this athlete at significant risk for injury.

This example helps illustrate a sport and athlete specific approach that can be taken when examining ESS. Al-



though this paper focuses on pitching, these concepts can be applied to other sports and athletes. To gain an understanding of what training levels are age appropriate, looking at the inherent demands and risks of the sport as well as determining the potential risk factors for injury within that sport are key. An excellent resource from Canada Sport for Life highlights the appropriate training habits of Canadian youth. It is called the Long Term Athlete Development (LTAD) model.<sup>24</sup> This model is based off six stages of athletic development:

1. FUNdamental stage
2. Learning to train
3. Training to train
4. Training to compete
5. Training to win
6. Retirement/retainment

The focus of the early stages of the model is encouraging activity in many sports in a fun and engaging manner. While the later stages focus on sport specific skills, intense training and high level competition. The stages can be applied and modified to any sport and provide an excellent template when considering appropriate athletic development.

Lastly, it is important for all parties involved in the athlete's life to be on the same page. This involves coaches, parents, medical staff, trainers and of course the athlete. Specializing in sport at any age involves a lot of time, money and dedication. Therefore, it is paramount that realistic goals are set for the athlete, pros and cons of ESS are discussed and expectations are clear for all parties.

### *Conclusion*

It is common for chiropractors to treat adolescent athletes. Therefore, it is important to be educated on how young athletes can perform their sport in a safe and effective manner. Chiropractors must take a sport and athlete specific approach when providing advice on the correct time to specialize. In today's world, sports are becoming increasingly popular, competitive and demanding. Youth are engaging in sports at a much younger age and taking on higher training loads with more specialized approach. There are currently claims both for and against specializing in sport at a young age. Presently, there is no evidence to support ESS and it is not supported by any authoritative body. To become an elite athlete, there may be situations when sport specialization is necessary. However, under-

standing when to specialize and focusing on the right training at the right time is imperative to promote long term success for the athlete.

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