The Aspen Institute's PROJECT PLAY
REIMAGINING YOUTH SPORTS IN AMERICA

RESEARCH BRIEF

What does the science say about athletic development in children?

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For parents and child athletes today, just about every signal from the prevailing youth sports culture supports the idea that high doses of one sport at an early age is the only pathway to athletic stardom. This message is often sent from coaches, entrepreneurs, private sports facility owners, anecdotal cases of child prodigies who went on to find success, the college sports industry, and best-selling authors such as Malcolm Gladwell who introduced the "10,000 hour rule" of "deliberate practice" to a mass audience. Indeed, the extent to which youth athletes need to specialize at a young age is one of the most thought-provoking and relevant debates in youth sport today (Horton, 2012), and researchers from around the world have contested the question for decades.

The debate bears relevance to the larger social question of how to get and keep more children active in sports into the teenage years. Introducing high doses of organized sports to children before the age of 13 can cost thousands of dollars a year, so children whose families have the resources to pursue traveling club teams, private coaches and expensive equipment inevitably acquire greater access to the sport pipeline that leads to scarce roster spots in college and even some high school sports. As the Sporting Goods Manufacturers Association (2010) has noted, youth sports has consolidated around its most committed participants, excluding many children.

The purpose of this research brief is to review the most relevant and important literature on the topic of developing children as athletes. This brief is organized around five prevailing questions regarding early specialization and the role of practice and play in the development of skill acquisition and expertise in sports. The brief draws upon over 50 published research papers, reviews, and book chapters. Key findings in response to each of the posed questions are offered. At the end of each section, a summary of the findings is offered as a key point and conclusion in response to the specific question. A complete list of works cited in the brief is also provided.

The published studies related to understanding sport expertise generally agree that sport talent development is a complex, dynamic, non-linear process, and that predicting sport talent years in advance of adulthood is a very difficult expectation. In fact, numerous factors often play an important and multiplicative role in the development of sport skills, and no formal pathway predicts success (Abbott, Button, Pepping, & Collins, 2005; Bailey et al., 2010).

The factors that shape sport skill expertise and performance are numerous and include biological factors (e.g., genetic ability, neurological adaptations), sociological factors (e.g., luck, critical incidents, socioeconomic status, relative age, geographical location), psychological factors (e.g., motivation, emotional control, perceived competence), and educational factors (e.g., coaching, mentoring, parental support). As demonstrated in this brief, the extremely complex nature of talent development often makes extreme, early focus on one sport a problematic approach to developing youth athletes in the United States.

Question 1: What are the benefits and drawbacks of early specialization?

Côté's Developmental Model of Sport Participation (DMSP), which was developed from studies of elite athletes in Canada and Australia in a number of sports including basketball, hockey and tennis, identifies three distinct stages of sport talent development. The first of these phases is the sampling phase and is defined as giving children between the ages of 6-12 years old the opportunity to sample various sports and high levels of play activities (Côté et al., 2009). This concept is often referred to as *early sampling* or e*arly diversification* in the research literature. *Early specialization* can be characterized as the inverse of early sampling in reference to the number of sports an athlete participates in and the amount of play involved. An early specialization pathway demands that children choose only one sport, is characterized by high levels of deliberate and focused practice (rather than play), and often focuses on performance at ages as early as 6 years old (Burgess & Naughton, 2010; Côté, et al., 2009; Subotnik, Olszewski-Kubilius, & Worrell, 2011).

The research literature provides some support for the early specialization pathway. The strongest support is found in sports in which peak performance occurs in adolescence or early adulthood (Côté & Fraser-Thomas, 2008). Specifically, early specialization in the sports of women's gymnastics and women's figure skating in particular has demonstrated the value of this pathway (Deakin & Cobley, 2003; Law, Côté, & Ericsson, 2007).

It is also safe to suggest that early specialization is likely the best path for athletes looking to achieve early age-group success. That is, if a young player's only goal is improve their current performance, early specialization in that sport will provide a young athlete, and their coach, the best chance of success in their age group (Côté & Fraser-Thomas, 2008). Thus, if a coach's goal is to win the 12-year-old baseball national championship, encouraging a child to limit or exclude participation in other sports to focus on developing baseball skills and tactics may be the most effective pathway to reaching that goal.

Another potential benefit of the early specialization pathway involves the environmental and psychological domains of development. Scholars have shown that significant incidents during development can have an important effect on an athlete's attitudes and perceived competence (Bailey et al., 2010; Ollis, MacPherson, & Collins, 2006). These incidents can be acute incidents such as major wins or making a particular select team, but they can also be more chronic and include such experiences as poor coaching and excessive parental pressure (Bailey et al., 2010; Côté & Hay, 2002). Given the youth sport landscape that often rewards early success and performance with selections and identifications to elite teams or pools that may have access to better coaching and competition, one could argue that early specialization could be beneficial in achieving these short-term identification successes (Burgess & Naughton, 2010). Early critical incidents such as making a specific team could also lead to an increased self-esteem and intrinsic motivation as the athlete continues in the sport (Horton, 2012). Early samplers who may not achieve the same level of single-sport performance early in their career may not stand out and be selected for special opportunities, and thus subsequently lose interest or self-select out of continued competition. Thus, a young athlete may be deterred from further commitment in sport as a result of a lost opportunity.

Beyond the few benefits or specific contexts outlined above, the majority of the literature suggests that early specialization can have significant negative consequences on the development of an athlete over time. For example, studies have shown that an early specialization pathway can lead to increase burnout and drop out from sport (Gould, Udry, Tuffey, & Loehr, 1996), less enjoyment and higher rates of injury (Côté & Fraser-Thomas, 2008; Jayanthi, 2012; Law et al., 2007), social isolation (Wiersma, 2000); staleness (Henschen, 1998); physiological imbalances (Baker, 2003, Dalton, 1992); shortened careers (Carlson, 1988, Côté, Lidor, & Hackfort, 2009); limited range of motor skills (Wiersma, 2000), and even a decreased participation in sport activities in adulthood (Russell & Limle, 2013).

A series of recent studies by Jayanthi and his colleagues (Loyola University Health System, 2013) has provided the most compelling evidence of the relationship between specialization and athletic related injuries. For example, in one study of 124 tennis players, Jayanthi (2012) found that the athletes that suffered sport-related injuries spent an average of 12.6 hours per week in organized tennis and only 2.4 hours per week in free play or recreation. The uninjured players in this sample spent only 9.7 hours per week in organized tennis and 4.3 hours per week in unstructured free play.

Conclusions:

- *The research supports a few specific benefits and domains in which an early specialization pathway is advantageous*
- *The early specialization pathway fails to consider many of the physical, psychological, and social costs to young participants*
- *Early specialization reduces the chance that children will stay active in sports as adults*

Question 2: What are the benefits and drawbacks of early sampling?

Research suggests that early sampling can lead to numerous positive growth and developmental opportunities. Several researchers have also demonstrated that the early sampling pathway is beneficial to long-term talent development in sports. Specifically, an early sampling pathway has been associated with longer playing careers (Barynina & Vaitsekhovskii, 1992); enhanced peer relationships as college athletes (Wright & Côté, 2003); increased physical capacity and motor skill base (Bailey et al. 2010; Côté, et al., 2009); less sport-specific training in adolescence to reach elite status (Baker et al., 2003); increased ability to transfer motor and psychological skills to other sports (Burgess & Naughton, 2010; Fransen et al., 2012); and increased motivation, confidence, and self-direction (Côté, et al., 2009; Côté & Fraser-Thomas, 2008).

Research by Baker et al. (2003) advanced the notion that beneficial learning for specific aspects of particular sports, such as pattern recognition and decision-making, may require participation in multiple activities and sports. Specifically, their study of elite basketball and field hockey players indicated that those who participated in multiple sports when young (i.e., more sampling and deliberate play) required fewer than 10,000 hours of focused training and games in their ultimate sport to reach top levels. These athletes appeared to benefit from what the literature calls *skill transfer*. Schmidt & Wrisberg (2000) categorized the transferable skills of sports into perceptual (e.g, decision-making), movement (e.g, biomechanics), and conceptual (e.g., strategy) elements. Baker (2003) also suggests that physical conditioning could be added as a transferable performance element. A fair amount of research has supported that transfer might be the most compelling argument that could be made for athletes to engage in sport sampling, especially at a young age.

The Path to Excellence study conducted by the USOC (Gibbons, Hill, McConnell, Forster, & Moore, 2002) demonstrated that a majority of Olympians from the 1980s and '90s cited playing multiple sports as young athletes and teenagers. Olympians also noted that having access to multiple sports programs as a kid was very beneficial to their development and training. In a more recent study, college athletes were surveyed regarding their participation in multiple sports as a youth athlete. Only 30 percent of the 296 athletes surveyed specialized in just one sport prior to the age of 12, and 88 percent participated in more than one sport as a child (American Medical Society for Sports Medicine, 2013). Similar findings were also noted in Malina's (2010) study on female Division I intercollegiate athletes. In this study, 83 percent of the athletes indicated playing more than one competitive sport as a youth.

Critical to the development of elite athletes was quality coaching at a young age, according to the USOC's Path to Excellence survey. The survey found that U.S. Olympians from 1984-98 indicated that excellent coaches ranked as the third-most important factor that contributed to their success as an Olympic athlete. Excellent coaches ranked just below *dedication and persistence* and *support of family and friends*. A similar but more recent retrospective study conducted on 673 elite athletes (including 51 Olympians) in Australia (Gulbin, Oldenziel, Weissensteiner, & Gagne, 2010) further emphasized how important coaching is even during the sampling phases of sport participation. A total of 67 percent of these athletes indicated that coaching was "critical and highly influential" to their talent development during their junior and local club level participation as athletes. The most important quality that was identified by the athletes citing the critical influence of a coach as a young athlete was their "*ability to motivate and encourage.*"

Conclusions:

- *Most athletes who achieved elite status as adults (college, Olympics) played multiple sports when they were young*
- *There are numerous potential benefits of adopting an early sampling pathway, including lifelong sport involvement and future elite sport success*
- *Early sampling activities can help maintain athlete motivation and enjoyment, and also lead to specific gains in skill development through skill transfer*
- *Excellent coaching at all ages is critical to achieving elite level success*

Question 3: What is the "10 year/10,000 hour rule" -- and is it required for sport mastery?

Anders Ericsson and many of his contemporaries have advanced that 10 years and 10,000 hours of focused and specific practice are often necessary for one to reach expert status in a particular domain. According to this model, participants can only reach their potential and succeed if they are exposed to this form of activity at an early age and maintain high volumes over time. Thus, the 10,000 hour notion is one that inevitably promotes early specialization. Gladwell's 2008 book, *Outliers: The Story of Success* explored this "rule" by citing the research of Ericsson, Krampe, Tesch-Romer (1993) – though Ericsson himself has never called it a "rule" – and provided anecdotal success stories of historical figures. Gladwell (2008, p. 41) wrote about it in the book as "the magic number of greatness," though recently (Gladwell, 2013) clarified his stance, writing that his analysis in *Outliers* was confined to those engaged in "cognitively demanding fields" and "that it is a mistake to assume that the ten-thousand-hour idea applies to every domain."

In the sport science literature, there is general support for the role of practice in athletic development and a strong positive relationship between the amount of practice time accumulated and elite sports performance (e.g., Hodges & Starkes, 1996; Starkes et al., 1996; Helsen, Starkes, & Hodges, 1998; Deakin & Cobley, 2003). However, as noted by Epstein (2013, p. 34) when summarizing some of the literature in this area, studies of athletes have tended to find that "the top competitors require far less than 10,000 hours of deliberate practice to reach elite status. According to the scientific literature, the average sport-specific hours to reach the international levels in basketball, field hockey and wrestling are closer to 4,000, 4,000 and 6,000, respectively." Further, a report on high-performance Australian athletes indicated that 28 percent of senior national athletes reach elite playing status within just four years of beginning their sport and that 69 percent of novice athletes developed into senior elite athletes in an average of 7.5 years (Oldenziel, Gagne, & Gulbin, 2004). Epstein's recent text cites others examples of athletes with unique and innate physical traits who achieved world-class status shortly after taking up a sport.

Some of the shortcomings of this "rule" explaining sport expertise were recently reviewed in Tucker and Collins'(2012) research on the role of training and genes in sport success published in the *British Journal of Sports Medicine.* Their conclusion on the rule of deliberate practice suggested that "the concept of a minimum volume of training required for expert performance, and in particular the concept of 10,000 hours, is flawed, based on the body of evidence suggesting that among individuals who have achieved similar performance levels, training times are rarely similar" (p. 560).

In a recent editorial to critiques of his work, Ericsson (2012) suggests that Gladwell misrepresented one of his studies in *Outliers* and that there is actually "nothing magical about exactly 10,000 h" (p. 2). Further, he suggests that it is possible to reach an international level of performance in much less time in specific domains. Unfortunately, the 'popular internet view' (Ericsson, 2012) of the 10,000-hour notion often dismisses the role of numerous factors that interact to shape skill acquisition such as genetic ability, maturation, coaching, parental support, and even general skills like physical fitness, and rather contributes sport expertise to only one element -- engagement in deliberate practice.

Conclusions:

- *The research supports a strong positive relationship between the accumulation of practice and elite performance in sports*
- *Research is lacking in support of the notion that athletes need to achieve 10,000 hours of deliberate practice to reach elite status*
- *Other factors including genetic advantage and coaching often shape the athletic future of children*

Question 4: What is the role of "deliberate play" in the acquisition of sport skills?

Côté and his colleagues recently provided a succinct definition of Ericsson's concept of "deliberate practice" as "highly structured activity that requires effort, generates no immediate rewards, and is motivated by the goal of improving performance rather than inherent enjoyment" (Côté et al., 2009, pg. 8). In contrast is the concept of "deliberate play," which Côté introduced to the literature in 1999. He described the concept as activities that are intrinsically motivating, designed to maximize fun and enjoyment, and provide immediate gratification. Deliberate play often requires minimal equipment, allows for flexibility, and allows participants to experiment with rules, tactics, participant sizes and ages (Bailey et al. 2010; Côté, et al., 2009). A program featuring deliberate play during early sport experiences supports an early sampling pathway for talent development.

Authors have argued that deliberate play activities contribute to general motor skill and control and physical conditioning in similar ways to primitive forms of physical activity such as jumping, running, and climbing. Thus, similar to learning that occurs in primitive forms of play, athletes engaged in deliberate play may improve their endurance, strength, motor control, emotional control, and creativity (Côté, Baker, & Abernethy, 2007). Côté, Baker, and Abernethy (2003) also have shown that deliberate play, especially in team sports settings, can lead to enhanced creativity when competing. Further, studies have also shown that athletes that participated in greater levels of deliberate play as a youth were superior decision-makers in the sport of Australian Rules football when compared to those that did not experience a great deal of deliberate play (Berry & Abernethy, 1993). It has also been shown that athletes participating in deliberate play activities, such as unstructured pick-up games, typically spend more time on task than athletes in structured practices overseen by a coach (Côté, Baker, & Abernethy, 2007).

Soberlak & Côté's (2003) study on professional ice hockey players indicated that some of these players spent more than 10,000 hours involved in sports (including hockey) before the age of 20. However, deliberate play accounted for approximately 3,500 of the hours on average and time spent playing sports other than hockey totaled 2,300 hours. Only about 3,000 hours were spent in organized and structured hockey practice during their development as youth athletes. Baker et al.'s (2003) study also demonstrated that expert decision-makers in the team sports of basketball and field hockey specialized in their sport late after first experiencing a broad base of sports in the sampling years. In both of the studies cited above, it was shown that elite athletes indicated that the majority of the time spent participating in deliberate practice occurred once they reached adolescence, and not as a child under the age of 12. In fact, in the Soberlak and Côté study, only about 450 hours of the sport-specific practice time accumulated by these athletes was achieved before the age of 12 years old.

Côté and Fraser-Thomas (2008) suggest that athletes in sports in which peak performance occurs after the age of 20 should strive to attain 10,000 hours total involvement in sports generally, which includes development of skills through both deliberate play and deliberate practice, competition, and participation in other sports. Further, athletes can reach their expertise even if the amount of time devoted to deliberate practice in the 10,000 hours of involvement equals less than half of the cumulative hours devoted to the sport upon reaching peak performance. These authors prescribe that as a general rule, deliberate play and participation in other sports should constitute 80 percent of the total time spent on sports activity before the age of 12, move to 50 percent between the ages of 13-15, then, as the need to specialize becomes real, 20 percent of time after the age of 16.

Conclusions:

- *Deliberate play promotes creativity and decision-making skills in team sports*
- *Athletes who reach the highest levels of sport often benefitted from regular doses of deliberate play that stands apart from formal training and organized competition*
- *For maximum developmental benefits, a majority of the time spent on deliberate practice should be obtained beginning in adolescence and not as a child athlete*

Question 5: What's the best evidence supporting "Long Term Athletic Development"?

Over the past three decades, several scholars have advanced athlete and participant development models. In the social sciences in particular, the value in advancing models is that they help to make sense of multiple factors that may shape a phenomenon, and often provide potential relationships or a causal sequence of important factors (Bailey et al., 2010). National sports development programs are often depicted and disseminated in a form of a descriptive model, which aim to help policy makers and practitioners make informed decisions and ideally explain and predict future behaviors and relationships in their sports.

One of the most influential and widely used athlete development models is Balyi's Long Term Athlete Development (LTAD) model (Balyi & Hamilton, 2004). Bailey et al. (2010) suggest that this particular model can be described as a physiologically grounded development model, as it outlines factors related to adaptation and optimal training. Several other models have been advanced that approach athlete development from different disciplinary backgrounds such as Côté's DMSP which is grounded in social psychology; Abbott, Collins, Sowerby, and Martindale's (2007) Psychological Characteristics of Developing Excellence, which is grounded in performance psychology theory; and Bailey and Moreley's (2006) Model of Talent Development which is grounded in educational literature. Bailey et al's (2010) monograph provides an excellent review of each of these models and their value to athlete development.

Several governing bodies and talent development systems from around the world embrace a version of LTAD in their sport development systems, including programs and initiatives in the United Kingdom, Canada, and Australia (Arellano, 2010). Recently, a few U.S.-based sport governing bodies, most notably USA Hockey, have promoted LTAD models or aspects of such models to their membership. According to Lang and Light (2010), the goal of the LTAD "is to ensure that children learn fundamental skills during their optimal physical development stages as this is seen as being pivotal for long-term athletic improvement" (p. 390). LTAD is purported to be a valuable model for both elite athlete development and also for maximizing involvement in sport across the lifespan (Canadian Sport Centres, 2011; Stafford, 2005). However, as it is still relatively new, the LTAD concept is considered to be primarily a theoretical or descriptive model, as little empirical scholarly research has been published either corroborating or refuting many of the relationships and concepts in the model (Bailey et al., 2010; Ford et al., 2011; Lang & Light, 2010).

The LTAD model is one that acknowledges a trajectory for athlete development factors over time and alongside biological growth. The model also describes physiological adaptations through the maximization of training in specific "windows of opportunity" during the development years (Ford et al., 2011). One of biggest strengths of the model is that it distinguishes between early-specialization and late-specialization sports and outlines distinct phases for both pathways (Balyi, 2001; Bailey et al., 2010). The first phase of LTAD for late specializers suggests an early sampling pathway, which focuses on overall development of an athlete's physical capacities (e.g., appropriate running and throwing techniques) and evolves into a phase for older boys and girls that focuses on learning fundamental sports skills (e.g., basic flexibility). Each of the subsequent phases prescribes age-appropriate objectives for developmental factors such as training, competition, and skills (Balyi, 2001). Interestingly, the Canadian Sport for Life initiative has built their sport development system on LTAD and expanded the number of phases to include a phase for kids younger than 6 years old termed *active start*, and has also added two phases for athletes with physical disabilities, thus demonstrating the adaptability of many of the principles in LTAD to multiple contexts.

Based on some of the findings previously outlined in this research brief, it could be argued that programs based on LTAD would provide many beneficial developmental opportunities. For example, LTAD encourages early sampling, acknowledges training and practice (i.e., deliberate practice) loads throughout childhood and adolescence, and discourages early specialization. There is some scientific support for a number of principles outlined in the LTAD model especially related to the development of physical literacy and fundamental movement skills in early childhood (see Ford et al., 2011). However, there is also some emerging scientific work that questions some of the principles and processes outlined in LTAD, especially in the sport of swimming (Lang & Light, 2010). Lang and Light's study noted that the impact of excessive training volumes in the third stage of development, the *Training to Train* stage, of the prescribed LTAD program "*The Swimmer Pathway*" in English swimming, compromised the development of good swimming technique and to some extent motivation. The

review by Ford et al. also outlines a number of physical components that are important to development but missing from the LTAD model, such as power development.

Others have argued that some LTAD models, as well as other athlete development models, need to better recognize that talent development in youth is multifactorial and complex, and includes the interaction of numerous biological, social and psychological factors (Bailey et al., 2010). Importantly, Bailey et al. suggest that the limitations of LTAD are not necessarily in the content of the model, but rather the scope and application of the principles in the model. The work by Lang and Light also strongly supported the potential misapplication and misunderstanding of practitioners using LTAD grounded programming as a limitation of the model.

In their review of LTAD research, Ford et al. conclude that "it is crucial that the LTAD model is seen as a 'work in progress' and the challenge, particularly for pediatric exercise scientists, is to question, test, and revise the model." (p. 389). Given the emerging research that is testing LTAD principles in practice, Ford et al's recommendation appears to be timely and sound advice to sport scientists, policy makers and practitioners as they address barriers that limit access to healthy and sustained sports activity.

Conclusions:

- *LTAD has been increasingly adopted for use by national sport development initiatives*
- *The model is very descriptive in nature, and continued research testing of variables and relationships in the model will continue to improve and revise the model*
- *Models that include the multiplicative, complex, and multifactorial nature of talent development may prove to be the most valuable to children*

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Michael Sagas, Professor and Chair of the Department of Tourism, Recreation and Sport Management, authored this research brief on behalf of the Aspen Institute's Project Play. Editorial observations were provided by Tom Farrey, director of the Aspen Institute's Sports & Society Program. SPARC undergraduate student researcher Yasamin Sabeti assisted in the collection and analysis of many of the manuscripts cited in the brief. The SPARC is an interdisciplinary research collaborative within the Sport Management Program in the Department of Tourism, Recreation and Sport Management at the University of Florida. SPARC is comprised of Sport Management faculty within the UF Sport Management Program, as well as research and policy experts serving as associate members from both within and external to the University of Florida. SPARC serves to bring together talented faculty, and cohesion to individual research efforts and successes. Dr. J.O. Spengler serves as the Director of SPARC and Dr. Michael Sagas provides support and oversight to the collaborative. The purpose of SPARC is to produce relevant and timely research that addresses sport as a facilitator of the physical, social, and emotional health of individuals, and the economic health of communities. SPARC is the official research partner of the Aspen Institute's Project Play.

The Aspen Institute's PROJECT PLAY REIMAGINING YOUTH SPORTS IN AMERICA

The Aspen Institute's Project Play is a two-year project that will lay the foundation for the nation to get and keep more children involved in sports, with a focus on addressing the epidemic of physical inactivity. The Sports & Society Program will convene sport, policy and other leaders in a series of roundtable and other events, and in late 2014 produce a framework for action that can help U.S. stakeholders create "Sport for All, Play for Life" communities. Project partners include the Robert Wood Johnson Foundation, David & Lucile Packard Foundation, ESPN, the Clinton Health Matters Initiative, Nike, and the University of Florida's Sport & Policy Research Collaborative. More: www.AspenProjectPlay.org

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