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Place but not Date of Birth Influences the Development and Emergence of Athletic Talent in American Football

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The purpose of this study was to examine the birthplace and relative age effects in National Football League (NFL) players. The place and date of birth of NFL players in the United States were analyzed with Monte Carlo simulations to determine if either factor was predictive of the probability of reaching the elite level in this sport. Consistent with previous findings on professional North American athletes in baseball, ice hockey, basketball, and golf, players born in cities with populations of less than 500,000 were significantly over-represented in the NFL, whereas players born in cities with populations over 500,000 were significantly under-represented. Unlike many other sports, no relative age effects were found for the NFL. Small cities, in particular, appeared to possess characteristics that facilitate the development and/or emergence of athletic talent in American football. Possible psychosocial factors mediating the birthplace effect are discussed as are implications for the development of sporting expertise.

Contextual factors related to the timing and location of initial exposure to a sport may have an enduring effect on both individuals' persistence and commitment to the sport and their chances of reaching the highest playing standards in the sport (Côté, Baker, & Abernethy, 2007). It has been known for some time that for some sports, *when* one is born can have a powerful influence on achievement. Individuals who are relatively older than their peers (i.e., have a

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birthdate closer to the cut-off date for junior age group classifications) are frequently over-represented in elite teams, both at junior and senior levels. For example, Grondin, Deshaies, and Nault (1984), in analyzing the birthdates of professional ice hockey players, noted a highly skewed distribution of birthdates. Those born early in the competition year (with the cut-off date of January 1) were over-represented in the National Hockey League (NHL), indicating that relatively older athletes were advantaged in reaching the professional ranks compared to relatively younger players. Similar relative age effects have also been reported with junior ice hockey players (Baker & Logan, 2007; Sherar, Bruner, Munroe-Chandler, & Baxter-Jones, 2007), and in a number of other sports including baseball (Daniel & Janssen, 1987; Grondin & Koren, 2000; Thompson, Barnsley, & Stebelsky, 1991), soccer (Barnsley, Thompson, & Legault, 1992; Dudink, 1994; Helsen, Starkes, & Van Winckel, 1998; Musch & Hay, 1999; Verhulst, 1992), cricket (Edwards, 1994), tennis and swimming (Baxter-Jones, 1995), as well as in other domains, such as academic achievement (e.g., Bell & Daniels, 1990). Although most sports show a bias toward individuals who are relatively older and more mature, this bias may be reversed for some sports, such as gymnastics, where younger, less mature individuals may be biomechanically advantaged (Baxter-Jones, 1995; Baxter-Jones & Helms, 1996).

A tight coupling appears to exist between relative age, attainment, and perceptions of "talent." For example, Musch and Hay (1999) and Helsen, Hodges, Van Winckel, and Starkes (2000) showed that when the cut-off date in soccer leagues changed, the birthday distribution of its top players shifted accordingly. Explanations of talent in relative age effect are generally related to biological maturation advantages and concomitant advantages with respect to early experience of success and enhancement of self-concept (Musch & Grondin, 2001). Relatively older players enjoy benefits in relation to greater skill development, enhanced levels of self-confidence, and increased self-efficacy (Bandura, 1977), whereas relatively younger players are at risk of becoming discouraged and prematurely dropping out of the sport (Barnsley & Thompson, 1988; Thompson et al., 1991). For example, coaches may select relatively older children who are physically larger than their relatively younger counterparts. This could result in more direct attention by coaches and increased playing time which may in turn lead to increased skill development (Starkes, 2000).

Some evidence exists to suggest that not only when people are born but also *where* they are born can contribute to the attainment of sporting expertise. Evidence of a birthplace effect in sport was originally proposed in Curtis and Birch's (1987) study of over 1,000 Canadian and American hockey players. Curtis and Birch found that Canadian NHL and Olympic players born in regions with a population of less than 1,000 and over 500,000 were under-represented when compared with the population distribution of the entire country. They also found that U.S. Olympic team players were over-represented in smaller cities but under-represented in larger cities. In a qualitative study, Carlson (1988) found that eight of 10 elite Swedish tennis players were born in smaller cities. The athletes from rural environments reported easy and unlimited access to facilities that resulted in more playing time when compared to athletes from urban centers. Over-representation of athletes who were born in smaller towns or regional areas has also been reported more recently for various Australian national teams (Abernethy & Farrow, 2005).

Côté, MacDonald, Baker, and Abernethy (2006) analyzed the birthplace of 2,240 North American athletes participating in professional hockey, baseball, basketball, and golf and found that athletes born in cities of less than 500,000 were systematically over-represented by 34.3% (compared to population norms). Conversely, those born in cities over 500,000 were systematically under-represented by 34.1%. Côté et al., also reported that effects due to place of birth were stronger and independent of those found in the same sample for relative age.

Côté and colleagues suggested that birthplace provides a proxy measure for the developmental circumstances of athletes with athletes born (and raised) in areas of lower population enjoying a number of conditions known to be favorable to expert skill learning, including ready access to spaces supporting unlimited and variable play and practice opportunities, early exposure to competition against adults, and broad cross-sport experience. As illustrated by Kyttä (2002), favorable conditions may be less prevalent for children growing up in larger cities where youth frequently report less facility access and environmental support for sport than youth in small towns and country settings. Environmental factors that differ across city sizes may affect youth development differently.

The Côté et al. (2006) study did not include analysis of athletes from the National Football League (NFL), even though this is one of the major sports in the United States. Approximately 360,000 American youth participate annually in the Pop Warner football program alone (Pop Warner, 2006). The purpose of this study was to use the methodology developed by Côté and colleagues (2006) to investigate birthplace and birthdate effects in the NFL. The NFL provides not only a further test to examine the generality of the birthplace effect (and its power in comparison to the relative age effect), but understanding how birthplace and birthdate affect American football may also provide additional insight into contextual effects on the development of sporting expertise. In turn, this may have a practical impact on how football is introduced to children. To our knowledge, there is no previous published work examining birthplace effects on NFL players. An additional purpose of this study was to examine the relative age effect across city sizes. One previous study (Stanaway & Hines, 1995) conducted on a small ($n = 167$) sample of retired American football players inducted into the Hall of Fame examined relative age but did not find any evidence of relative age effects for this sport. In the present study, relative age analyses were conducted both independent of city size and across city sizes (<500,000 and >500,000 inhabitants). Differences in relative age effects across city sizes would suggest that large and small cities may support different selection mechanisms and promote different experiences for young athletes.

METHOD

Participants

This study focused on the 2,144 players who were listed on the playing rosters of the 32 teams in the NFL at the end of October, 2004.

Procedure

Data on the birthdate and birthplace of all players were collected from team web sites under the league's official homepage (www.nfl.com). Birthdate data were collected for all the players but 175 cases were excluded due to either the player being born outside of the United States or information on either birthplace or city size being unavailable. To maintain consistency, the relative age sample was restricted to the 1,969 U.S.-born players included in the birthplace analysis. The city size of the birthplace for each player was based on U.S. Census data collected from a demographics web site (www.freedemographics.com), as per the approach used by Côté et al., (2006) and MacDonald, King, Côté, and Abernethy (in press). As the average age of the players in the NFL was approximately 26 years, 1980 census and demographic data (i.e., distribution of males under the age of 14) were used to estimate city sizes and population distribution at the time the players were born (U.S. Census, 1981). Although there is the possibility that the athletes moved between cities of different sizes

throughout their development, Census statistics show minimal net migration changes between metropolitan and non-metropolitan areas in the United States (Schachter, Franklin, & Perry, 2003).

Data Analysis

To determine if relative age effects exist in the NFL and across city sizes, frequencies of birthdates in each calendar month were first tabulated across all players. With July 31 used as the cut-off date for youth age classifications, the frequencies of births in each of four quarters—August-October, November-January, February-April, and May-July—was then determined. July 31 was assumed as the cut-off date used most frequently in football leagues to determine age groupings although in American football this date is not uniform across all leagues and in some leagues junior player classification is done according to weight rather than age (Pop Warner, 2005). Players born in the first of these quarters (August-October) were considered relatively older and those born in the last of these quarters (May-July), relatively younger compared to their peers. A chi-square analysis was used to determine if there were any significant deviations from equal frequencies across the four quarters and in particular to ascertain if the relative frequencies of birthdates were greater in the first quarter than in the last.

As in the Côté et al. (2006) approach, effect sizes (Cohen's d) were calculated to evaluate the comparative magnitudes of any birthplace and relative age effects. For relative age, comparisons were made between the number of players born in the first six months (August–January) and the last six months (February–July) following the age cut-off date of July 31. For birthplace, comparisons were made between cities of less than and greater than a population of 500,000. In 1980 approximately 51.8% of the population of youth under the age of 14 resided in cities with population greater than 500,000. A comparison between players born in cities less than 500,000 and greater than 500,000 consequently provides a situation where the frequency of athletes from each set should be approximately equal if there is no place of birthplace bias in producing elite athletes.

The procedure used to examine the birthplace data was similar to the one used by Côté et al. (2006). Differences across all U.S. Census (1981) city size brackets and the birthplace distributions of the population of youth under the age of 14 and NFL players were assessed using Monte Carlo simulations, which were conducted based on methods discussed by Press, Flannery, Teukolsky, and Vetterling (1986). The Monte Carlo technique yielded estimates of the expected standard deviations for randomly unbiased samples using the same numbers of cases (i.e., players). These standard deviations were then used to determine the probability of the deviations of cases from the general population across all the different city sizes. Using the sampling distribution and standard deviations obtained from the Monte Carlo simulation, z-scores and probabilities were calculated for each city size. Alpha levels were adjusted using the Bonferonni method and set at $p < .001$.

Finally, odds-ratios were also calculated across the different city sizes and 95% confidence intervals (CI) were calculated around each odds-ratio. Ratios greater than 1 (with upper and lower limits above 1) were taken to imply that an individual born in the given city size was more likely to become a professional player in the NFL than if born in any other city size. Conversely, an odds-ratio less than 1 (with upper and lower limits less than 1) was taken to imply that an individual born in the given city size was less likely to become a professional player in the National Football League than if born in a city of different size. Odds-ratios that include the value 1 within their CI range were considered to be not statistically significant.

Table 1
Absolute and Relative (%) Frequencies of Birthdates of the 1,969 NFL Players Across Four Quarters of the Year

	Absolute Frequency	Relative Frequency (%)
August–October	509	25.9
November–January	503	25.5
February–April	477	24.2
May–July	480	24.4

RESULTS

Relative Age

There was no evidence of a systematic relative age effect in the NFL data. The absolute and relative frequencies of birthdates in each of the four quarters were similar (see Table 1), with the chi-square analysis showing no significant deviations across the four quarters ($X^2 = 1.58$, $p = .663$). The effect size for the comparison between the two halves of the year was also very small ($d = .06$), reinforcing the conclusion that birthdate is not a significant factor in predicting whether or not an athlete will make it to the NFL. The chi-square analyses that tested the relative age effect across cities were also non-significant with large (>500,000) and small (<500,000) cities yielding values of $p = .950$ and $p = .574$ respectively.

Birthplace Effects

Table 2 shows the results of the analysis performed on the city size data. Cities with populations of below 500,000 all produced odds-ratios reliably higher than 1 whereas cities over 500,000 showed odds-ratios reliably lower than 1. A large effect size (Cohen, 1988) of 3.8 was observed for the comparison between the frequency of NFL athletes born in cities with populations below 500,000 and those over 500,000.

Table 2
Difference between U.S. Population and National Football League Players and Odds-Ratios (OR) Across City Sizes

	US Pop (%)	NFL %	Diff[a]	SD[b]	Z	O.R. (CI)
>5,000,000	9.9	0.1	−9.9	0.68	−14.5	.01(.38, −.37)
2,500,000–4,999,999	11.4	2.5	−8.9	0.70	−12.7	.20(.21, .19)
1,000,000–2,499,999	18.1	3.8	−14.3	0.87	−16.5	.18(.18, .17)
500,000–999,999	12.4	8.7	−3.7	0.73	−5.1	.67(.67, .67)
250,000–499,999	11.0	11.7	0.7	0.71	1.0	1.08(1.08, 1.07)
100,000–249,000	9.6	12.7	3.0	0.68	4.5	1.37(1.37, 1.37)
50,000–99,999	1.1	10.7	9.7	0.23	42.0	10.79(10.79, 10.79)
<50,000	26.4	49.8	23.4	0.98	23.9	2.77(2.77, 2.77)

[a]Difference between % of 1980 U.S. population and % of National Football League players in each city.
[b]Determined from Monte Carlo simulation.

DISCUSSION

Relative age did not emerge from this study as a prominent factor affecting achievement in American football, although this may in part be due to the varying age and weight criteria used for classification within different youth football leagues (Pop Warner, 2005). The usual explanation of the relative age effect is that individuals who are relatively older than their counterparts (and generally more physically mature) will enjoy a performance advantage (Musch & Grondin, 2001). However, if children of similar ages are placed in different categories or positions on a team based on weight, one can assume that any effects of relative age will be diluted by this secondary classification level. Creating equalities above and beyond date of birth in a sport as physical as American football is important to minimize injury rates, ensure enjoyment, and generally sustain participation. Against this background, it is probably not surprising that the relative age effect was found to be absent amongst professional NFL players as a whole. The elimination/minimization of relative age effects, presumably through the use of sub-classification systems, may help provide some important insights for other sports keen to eliminate relative age effects from their developmental pathways.

In contrast to the relative age effect, there was strong evidence of a birthplace effect amongst the NFL players. Consistent with Côté et al.'s (2006) data from other groups of male professional athletes in North America, the analysis conducted in this study showed an under-representation of NFL players originating from cities with populations over 500,000 and a corresponding over-representation of athletes from cities with populations less than 500,000. The effect size of 3.8 observed between large cities (>500,000) and small cities (<500,000) in this NFL sample was large (Cohen, 1988) and comparable in magnitude to that reported by Côté and colleagues for U.S. ice hockey, basketball, baseball, and golf. Collectively, the evidence from this study, and that of Côté et al., suggests that the opportunities large and smaller cities afford for the development of expertise and for the attainment of elite level playing standards are quite different.

The environmental circumstances for developing young athletes are complex, yet it appears that small cities provide environments that are more supportive of the development of expert performance than large cities. The critical follow-up issue is to identify what it is about smaller cities that facilitates the development of sporting expertise and, conversely, what it is about larger urban environments that inhibits such development. Learning to play football obviously requires space and it is probable that smaller cities may generally provide more access to such space for children. In larger urban centers, a child may not have easy access to facilities for playing or practicing football and may have to compete with existing leagues and teams to utilize key infrastructure (Curtis & Birch, 1987). Smaller cities provide more access not only to physical facilities but also to opportunities to regularly experience the kind of play and practice conditions that are known to be associated with the development of expert performance in team ball sports. For example, opportunities for deliberate play, for broad exposure to a range of different sports, and for early play against adults (Côté et al., 2003, 2007) are likely to be more abundant within the physical environment of smaller cities. This is supported by Carlson (1988) who demonstrated that young elite tennis players in smaller cities sampled a variety of sports until approximately the age of 14. Carlson also showed that smaller cities provided young athletes with greater accessibility to infrastructure and more opportunities for spontaneous play. Past research by Côté and colleagues has established that deliberate play and exposure to multiple sports during childhood favors the development of expertise in several sports (Baker, Côté, & Abernethy, 2003; Soberlak & Côté, 2003). The transfer of skills across sports and the opportunity to learn from older athletes during deliberate play activities

in smaller cities represent specific opportunities to develop the skills necessary to excel in a sport (Côté et al., 2007).

In 2002 the National Research Council and Institute of Medicine (NRCIM, 2002) identified eight environmental features that are reliably associated with positive youth development. Three of these relate to the physical environment, viz., 1) a safe environment in which youth develop, 2) an appropriate structure in which children experience a stable environment, and 3) the availability of opportunities for skill building. Kyttä (2002) demonstrated that smaller cities provided youth with a safer environment and more spaces for participation in unorganized physical activity (i.e., cycling, skating). The results of this study were based on towns and neighborhoods with the urban centers being within a city of 500,000 or more inhabitants. The smaller cities and towns were areas where 45,000 individuals lived. Although the qualitative nature of the study resulted in only a few cities being studied, the results nonetheless suggest that open spaces combined with a safe environment and adequate opportunities to develop skills, of the type provided to children in smaller cities, are beneficial to the development of sport participation (Kyttä, 2002). More opportunities to participate will increase a child's likelihood of developing sport skills and psychological skills such as goal setting and decision-making; skills known to contribute to overall sport proficiency (Abbott & Collins, 2004; Martindale, Collins, & Daubney, 2005).

The NRCIM (2002) suggested four psychosocial setting features of positive youth development - 1) supportive relationships, 2) opportunities to belong, 3) positive social norms, and 4) support for efficacy. Research has demonstrated that youth in smaller cities typically have better social support, increased self-efficacy, and face less conflict when compared to individuals in larger cities (Elgar, Arlett, & Groves, 2003). Elgar and colleagues reported that youth in rural settings have fewer opportunities to select peer groups, providing them with stronger bonds and better support groups. These results exemplify the differences between large and small cities with respect to the development of supportive relationships; an important component for the nurturing of talent in sport (Côté et al., 2003).

Another psychosocial factor to consider as a possible contributor to athletic development in smaller cities is social comparison. Individuals who view themselves as more talented than others may develop higher levels of self-efficacy. In smaller cities, where the number of competitors is smaller, athletes have more opportunities to be perceived as "talented" and receive more attention from coaches and parents. This idea of "big fish little pond" was first developed by Marsh (1987) within the academic domain. As a test of this effect in sport, Chanal, Marsh, Sarrazin, and Bois (2005) investigated how individuals in gymnastics performed based on the perception of their skills and their class's skill level. By using hierarchical linear modeling to tease out individual and contextual effects, they identified that at an individual level, athletes with high perceptions of personal abilities performed better than athletes with lower perceptions of personal abilities. They also found that the athlete's perception of their class's skill level influenced performance, showing that individual perceptions of high skills within their class negatively predicted athletic performance (Chanal et al., 2005). When compared to smaller cities, bigger cities sports systems tend to place athletes with high skills together into selective sport programs at a younger age (Carlson, 1988). Since much time is devoted to competing for resources in large cities (Curtis & Birch, 1987) athletes with similar skills levels are often grouped together to provide youth with similar opportunities to participate. According to Chanal et al. (2005), such environments can negatively affect the self-concepts of individual athletes. Future research investigating the "big fish little pond" effect across city sizes would be useful in validating the effect and providing important information about how youth are socialized into sport.

The final setting discussed by the NRCIM (2002) is integration of family, school, and community efforts. An athlete who has positive influences from family, school, and the community may perform better than an athlete who has negative integration of the three (Gould, Dieffenbach, & Moffett, 2002). Siblings, grandparents, spouses/significant others, and parents may all help athletes keep perspective on things such as goals and commitments. Schooling may have a role through teachers providing specific expectations throughout development and by teaching athletes skills they could apply to the sport domain. Finally, being part of an active community may contribute to athletes' motivation to be involved and active themselves. In the current context it is conceivable that the desirable integration of family, school, and community may be more easily achieved in smaller communities than in larger ones. Research within the academic setting has shown that students with positive support from family, school, and the community perform better in school (Eccles & Harold, 1996).

Differences between large and small cities are also known to exist with respect to sporting culture. Bale (2003) reported that residents of smaller cities identify themselves more with local sport teams and local high-level athletes than do residents of larger cities. The opportunities to interact with local teams or high-level athletes may provide youth in smaller cities with more visible and effective role models throughout their development and may provide a source of motivation to help excel in sport that is not as powerful for children growing up in larger cities (Martindale et al., 2005).

The consideration of both physical and psychosocial factors is necessary to fully understand the processes through which the birthplace effect occurs and to subsequently help extract useful, practical applications to assist in the provision of optimally supportive developmental environments for *all* athletes. The physical and psychosocial environments of smaller cities are consistent with the principles of positive youth development and the eight setting features identified by the NRCIM (2002): 1) physical and psychological safety, 2) appropriate structures, 3) opportunities for skill building, 4) supportive relationships, 5) opportunities to belong, 6) positive social norms, 7) support for efficacy, and 8) integration of family, school and community. Sport psychology practitioners across all city sizes should consider these eight setting features when working with young athletes. For example, practitioners should ensure that activities are age-appropriate and centered on enhancing physical and social development. Creating and maintaining a sense of security through appropriate physical environments is integral to young athletes' growth in sport. Given that small cities provide safer participation settings and greater opportunities for play (Kyttä, 2002), large centers could attempt to re-create these conditions within their communities. Practitioners should also reinforce supportive relationships (i.e., athlete-athlete; coach-athlete) that foster emotional and moral development. Supportive relationships will lead to the development of psychosocial skills (i.e., communication) that enhance success and sport performance. Finally, athletes should be given ample opportunities to succeed within the sport setting at all ages. Early success in sport will increase intrinsic motivation and desire to participate (Vallerand, 2007). Taken together, the implementation of the eight setting features with young athletes will help lay the foundations for youth sport programs designed to promote performance and participation in sport.

Although the results of the present study offer insight into contributing factors related to the development of expertise, limitations do exist. The main limitation of the present study is the inability to draw causal links between birthplace and the attainment of professional status in the NFL. A second limitation, which lies in the data, is the inability to be certain that birthplace is the actual location where these athletes were introduced to sport. Although past research suggests that migration effects across large and small settings are negligible (Schatcher et al., 2003), future research validating this proposition would be a useful addition to the current results. Although certain youth football programs use the secondary classification of weight

(Pop Warner, 2005), no information is available to quantify what percentage of leagues use these different classification schemes. Hence, investigations of how different leagues across the United States operate would be useful to understanding the variability in experiences presented to young football players. More research is now needed to further understand the mechanisms that underpin the birthplace effects in sports development and performance.

References

Abbott, A., & Collins, D. (2004). Eliminating the dichotomy between theory and practice in talent identification and development: considering the role of psychology. *Journal of Sports Sciences*, *22*, 395–408.

Abernethy, B., & Farrow, D. (2005). Contextual factors influencing the development of expertise in Australian athletes. In *Proceedings of the ISSP 11th World Congress of Sport Psychology* [CD]. Sydney: International Society of Sport Psychology.

Baker, J., Côté, J., & Abernethy, B. (2003). Sport specific training, deliberate practice and the development of expertise in team ball sports. *Journal of Applied Sport Psychology*, *15*, 12–25.

Baker, J., & Logan, A. J. (2007). Developmental contexts in sporting success: birth date and birthplace effects in national hockey league draftees 2000–2005. *British Journal of Sports Medicine*, *41*, 515–517.

Bale, J. (2003). *Sport geography* (2nd ed.). New York: Routledge.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*, 191–215.

Barnsley, R. H., & Thompson, A. H. (1988). Birthdate and success in minor hockey: The key to the NHL. *Canadian Journal of Behavioral Science*, *20*, 167–176.

Barnsley, R. H., Thompson, A. H., & Legault, P. (1992). Family planning: football style—The relative age effect in football. *International Review for the Sociology of Sport*, *27*(1), 77–88.

Baxter-Jones, A. D. G. (1995). Growth and development of young athletes: Should competition levels be age related? *Sports Medicine*, *20*, 59–64.

Baxter-Jones, A. D. G., & Helms, P. (1996). Effects of training at a young age: A review of the training of young athletes (TOYA) study. *Pediatric Exercise Science*, *8*, 310–327.

Bell, J., & Daniels, S. (1990). Are summer-born children disadvantaged? The birthdate effect in education. *Oxford Review of Education*, *16*(1), 67–80.

Carlson, R. C. (1988). The socialization of elite tennis players in Sweden: An analysis of the players' backgrounds and development. *Sociology of Sport Journal*, *5*, 241–256.

Chanal, J. P., Marsh, H. W., Sarrazin, P. G., & Bois, J. E. (2005). Big-Fish-Little-Pond effects on gymnastics self-concept: Social comparison processes in a physical setting. *Journal of Sport and Exercise Psychology*, *27*, 53–70.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Côté, J., Baker, J., & Abernethy, B. (2003). From play to practice: A developmental framework for the acquisition of expertise in team sport. In J. Starkes, & K.A. Ericsson (Eds.), *Expert performance in sports: Advances in research on sport expertise* (pp. 89–110). Champaign, IL: Human Kinetics.

Côté, J., Baker, J., & Abernethy, B. (2007). Practice and play in the development of sport expertise. In G. Tenenbaum, & R. C. Eklund (Eds.), *Handbook of sport psychology* (3rd ed.) (pp.184–202). Hoboken, NJ: Wiley.

Côté, J., MacDonald, D. J., Baker, J., & Abernethy, B. (2006). When "where" is more important than "when": Birthplace and birthdate effects on the achievement of sporting expertise. *Journal of Sports Sciences*, *24*, 1065–1073.

Curtis, J. E., & Birch, J. S. (1987). Size of community of origin and recruitment to professional and Olympic hockey in North America. *Sociology of Sport Journal*, *4*, 229–244.

Daniel, T. E., & Janssen, C. T. L. (1987). More on the relative age effect. *Canadian Association for Health, Physical Education, and Recreation Journal*, *53*, 21–24.

Dudink, A. (1994). Birthdate and sporting success. *Nature*, *368*, 592.

Eccles, J., & Harold, R. (1996). Family involvement in children's and adolescent's schooling. In A. Booth, & J. Dunn (Eds), *Family-school links: How do they affect educational outcomes* (pp. 3–34). Hillsdale, NJ: Lawrence Erlbaum Associates.

Edwards, S. (1994). Born too late to win? *Nature*, *370*, 186.

Elgar, F. J., Arlett, C., & Groves, R. (2003). Stress, coping, and behavioural problems among rural and urban adolescents. *Journal of Adolescence*, *26*, 574–585.

Gould, D., Dieffenbach, K., & Moffett, A. (2002). Psychological characteristics and their development in Olympic champions. *Journal of Applied Sport Psychology*, *14*, 172–204.

Grondin, S., & Koren, S. (2000). The relative age effect in professional baseball: A look at the history of Major League Baseball and at current status in Japan. *Avante*, *6*, 64–74.

Grondin, S., Deshaies, P., & Nault, L. P. (1984). Trimestres de naissance et participation au hockey et au volleyball. [Birth-quarters and participation in hockey and volleyball]. *La Revue Québecoise de l'Activité Physique*, *2*, 97–103.

Helsen, W. F., Hodges, N. J., Van Winckel, J., & Starkes, J. L. (2000). The roles of talent, physical precocity and practice in the development of soccer expertise. *Journal of Sports Sciences*, *18*, 727–736.

Helsen, W. F., Starkes, J. L., & Van Winckel, J. (1998). The influence of the relative age on success and dropout in male soccer players. *American Journal of Human Biology*, *10*, 791–798.

Kyttä, M. (2002). Affordances of children's environments in the context of cities, small towns, suburbs, and rural villages in Finland and Belarus. *Journal of Environmental Psychology*, *22*, 109–123.

MacDonald, D. J., King, J., Côté, J., & Abernethy, B. (in press). Birthplace effects on the development of female athletic talent. *Journal of Science and Medicine in Sport*, doi: 10.1016./j.jsams.2007.05.015.

Marsh, H. W. (1987). The big fish, little pond effect on academic self-concept. *Journal of Educational Psychology*, *79*, 280–295.

Martindale, R. J. J., Collins, D., & Daubney, J. (2005). Talent identification: A guide for practice and research within sport. *Quest*, *57*, 353–375.

Musch, J., & Grondin, S. (2001). Unequal competition as an impediment to personal development: A review of the relative age effect. *Developmental Review*, *21*, 147–167.

Musch, J., & Hay, R. (1999). The relative age effect in soccer: Cross-cultural evidence for a systematic discrimination against children born late in the competition year. *Sociology of Sport Journal*, *16*, 54–64.

National Research Council and Institute of Medicine. (2002). *Community programs to promote community development*. Washington, DC: National Academy Press.

Pop Warner. (2005). *Ages and Weights*. Retrieved June 24, 2005, from http://www.popwarner.com/football/footballstructure.asp?lable=structure.

Pop Warner. (2006). *Pop Warner Football*. Retrieved November 23, 2006, from http://www.popwarner.com/football/pop.asp.

Press, W. H., Flannery, B. P., Teukolsky, S. A., & Vetterling, W. T. (1986). *Numerical recipes*. New York: Cambridge University Press.

Schachter, J. P., Franklin, R. S. & Perry, M. J. (2003). *Migration and geographic mobility in metropolitan and nonmetropolitan America: 1995–2000.* (Census 2000 special reports). Washington, D.C.: U.S. Department of Commerce.

Sherar, L. B., Bruner, M. W., Munroe-Chandler, K. J., & Baxter-Jones, A. D. G. (2007). Relative age and fast tracking of elite major junior ice hockey players. *Perceptual and Motor Skills*, *104*, 702–706.

Soberlak, P., & Côté, J. (2003). The developmental activities of professional ice hockey players. *Journal of Applied Sport Psychology*, *15*, 41–49.

Stanaway, K. B., & Hines, T. M. (1995). Lack of a season of birth effect among American athletes. *Perceptual and Motor Skills*, *81*, 952–954.

Starkes, J. (2000). The road to expertise: Is practice the only determinant? *International Journal of Sport Psychology*, *31*, 431–451.

Thompson, A. H., Barnsley, R. H., & Stebelsky, G. (1991). "Born to play ball" The relative age effect and Major League Baseball. *Sociology of Sport Journal*, *8*, 146–151.

U.S. Census. (1981). *Base data source, Tables 1 and 10: Census of Population and Housing, 1980: Summary Tape File 1C [machine-readable data file]*. Washington, DC: The Bureau.

Vallerand, R. J. (2007). Intrinsic and extrinsic motivation in sport and physical activity. In G. Tenenbaum, & R.C. Eklund (Eds.), *Handbook of sport psychology* (3rd ed.) (pp. 59–83). Hoboken, NJ: Wiley.

Verhulst, J. (1992). Seasonal birth distribution of west European soccer players: A possible explanation. *Medical Hypotheses*, *38*, 346–348.