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When "where" is more important than "when": Birthplace and birthdate effects on the achievement of sporting expertise

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Abstract

In this study, we assessed whether contextual factors related to where or when an athlete is born influence their likelihood of playing professional sport. The birthplace and birth month of all American players in the National Hockey League, National Basketball Association, Major League Baseball, and Professional Golfer's Association, and all Canadian players in the National Hockey League were collected from official websites. Monte Carlo simulations were used to verify if the birthplace of these professional athletes deviated in any systematic way from the official census population distribution, and chi-square analyses were conducted to determine whether the players' birth months were evenly distributed throughout the year. Results showed a birthplace bias towards smaller cities, with professional athletes being over-represented in cities of less than 500,000 and under-represented in cities of 500,000 and over. A birth month/relative age effect (in the form of a distinct bias towards elite athletes being relatively older than their peers) was found for hockey and baseball but not for basketball and golf. Comparative analyses suggested that contextual factors associated with place of birth contribute more influentially to the achievement of an elite level of sport performance than does relative age and that these factors are essentially independent in their influences on expertise development.

Keywords: *Elite athletes, children in sport, city size, relative age, athlete development*

Introduction

Individual sport development can vary because of different learning opportunities and the psychosocial environment in which learning takes place (Côté, Baker, & Abernethy, 2003). Differences in unique environmental experiences during childhood could lead to disparities among elite and less elite athletes, in motivation to practise, and in the type of skills acquired, as well as in how and when exceptional abilities are developed (Bloom, 1985; Côté *et al.*, 2003). Retrospective studies of elite athletes show that critical incidents that promote a child investing in one sporting activity over others include positive experiences with a coach, encouragement from an older sibling, early success, and/or simple enjoyment of the activity (Carlson, 1988; Côté, 1999; Kalinowski, 1985; Monsaas, 1985). Kalinowski (1985) described the early years of 21 elite swimmers as critical for later achievement in swimming as follows: "Had there been no excitement during the early years, and no sense that the young swimmer was very successful, there would never have been a middle or later period" (p. 141). Furthermore, evidence suggests that the making of an expert athlete usually begins in an environment where children are exposed early and regularly to sporting activities (Baker, Côté, & Abernethy, 2003; Kalinowski, 1985; Monsaas, 1985; Soberlak & Côté, 2003). Accordingly, some children might benefit from situations that provide them with more opportunities to become involved in sports. The relative age effect (Musch & Grondin, 2001) and, to a lesser extent, the size of the city from which an athlete comes from (Curtis & Birch, 1987) are two variables that have been associated with increased early exposure to sport and the achievement of expertise.

The relative age effect shows that the older one is relative to one's peers in the same grouping or junior sport team (i.e. the greater one's "relative age"), the greater the probability of eventually becoming an elite athlete (Baxter-Jones & Helms, 1994, Dundink, 1994; Helsen, Hodges, Van Winckel, & Starkes, 2000).

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Studies examining birthdates of professional athletes in baseball (Thompson, Barnsley, & Steblelsky, 1991), ice hockey (Barnsley & Thompson, 1988; Boucher & Mutimer, 1994), soccer (Barnsley, Thompson, & Legault, 1992; Dundink, 1994), and basketball (Hoare, 2000) have shown a skewed birthdate distribution favouring players that were born in the first quarter of each sport-year. In an extensive review, Musch and Grondin (2001) proposed mechanisms that could be responsible for the relative age effect in sport. Competition, physical development, psychological factors, and experience were discussed as factors related to the relative age effect that would alter the environment in which young children practised sport. The most compelling hypothesis about the relative age effect suggests that older children within a group will be provided with environments that facilitate the improvement of their skills early in their development. For example, a coach could identify children as being more mature or physically larger and, accordingly, give them more practice or opportunities for learning, thereby facilitating their development.

Another environmental variable that has received little attention in sport expertise research is the size of the city where elite athletes gain their formative experiences. This variable could have a significant influence on how athletes will first be exposed to sports, which, like the relative age effect, can limit or benefit performance. It is apparent that many children who live in smaller cities have access to facilities that introduce them to sport in different ways than children from urban centres. Children from a larger urban centre have potential access to a larger number of resources compared with their counterparts from smaller cities (e.g. arenas, specialized coaching). Urban athletes are also more likely to practise their sport in a structured setting such as a league, which is monitored by coaches with specific practice times and games, whereas individuals in smaller cities are more likely to engage in games without the structure of the urban setting. There might also be greater diversity in player size and ability in small cities, since all the children from the neighbourhood gather to play together independent of age and ability. Urban athletes, who live within a more densely populated and structured environment, usually find themselves playing opponents and having team-mates who are all relatively the same age, size, and ability. It has been suggested (Côté *et al.*, 2003; Soberlak & Côté, 2003) that more opportunities to play with older children and adults and experiment with different types of sport and physical activity, such as those found in rural settings, might facilitate the development of sport expertise.

Data on the "urban–rural" debate are limited. In one study of 10 Swedish elite tennis players, Carlson (1988) concluded that elite players predominantly came from rural areas, and that these areas provided the athletes unlimited opportunities to participate in sports. Carlson also suggested that coaches in rural areas were more likely to take great care in maintaining the player–coach relationship even if they did not have the technical tennis knowledge of the coaches in urban centres. In another study, Curtis and Birch (1987) examined the city size of the birthplace of Canadian and US Olympic hockey players and Canadian National Hockey League (NHL) players. They found that for Canadian players, regions with a population of less than 1000 inhabitants and those with a population greater than 500,000 inhabitants were under-represented in relation to the expected proportions of the population in the same age range. The remaining values in each of the census subdivisions of population yielded values that closely resembled the expected proportions. Based on these findings, Curtis and Birch (1987) suggested that "top players are more likely to come from communities large enough to build rinks, but not so large that the demand for ice time outweighs opportunities to skate" (p. 239). Unfortunately, the qualitative nature of Carlson's (1988) study and the focus of Curtis and Birch's (1987) study on ice hockey did not permit the identification of optimal city sizes for sport development across different sports and different sport systems.

The primary purpose of this study was to examine whether the size of the city in which an athlete is born (i.e. the birthplace effect) influences the likelihood of playing professional sport. A secondary purpose was to examine the relative age effects on the same sample of professional athletes and to compare the magnitude of any observed influences of birthplace with the well-documented birthdate (relative age) effects on the probability of becoming a professional athlete. To maximize generalizability and identify effects that may be sport specific, athletes from several professional sports were surveyed. Furthermore, a comparison for the same sport across two different countries was made to clarify whether any observed effects were due to the sport demands or to the variations in sport development systems of different countries.

Methods

Participants

A total of 2240 male athletes were evaluated. The birthplace and birthdate of American players in the National Hockey League (NHL, $n = 151$; 2003–2004 roster), National Basketball Association (NBA, $n = 436$; 2002–2003 roster), Major League Baseball (MLB, $n = 907$; 2002–2003 roster), Professional Golfer's Association (PGA, $n = 197$; 2003 – 2004 roster), and Canadian players in the NHL ($n = 549$; 2002 – 2003 roster) were collected from official websites (ice hockey: http://www.nhl.com; basketball: http://www.nba.com; baseball: http://www.mlb.com; golf: http://www.pgatour.com). The total number of athletes displayed on these websites was 2291; however, the birthplace city of 51 athletes could not be matched with official census data and, as a result, these athletes were dropped from further analyses.

Procedure

The distributions of athletes' birthplaces across various city sizes were compared with the distribution of similar aged individuals in the general population using census statistics. Because our examination involved the birthplace of the professional athletes, census statistics from the 1976 census for Canada (Statistics Canada, 1979) and the 1980 census for the United States (US Bureau of the Census, 1981) were used, since these years more accurately represented the Canadian and American statistics during the players' birth year. The census statistics provided the number of males under the age of 14 who lived in each of the population subdivisions. The birthplace of athletes provides a proxy for the location in which children spent their developmental years. It is important to recognize that the place of birth does not always coincide with the place of development. For example, athletes born in large urban centres might have moved to smaller communities during their development or, conversely, athletes born in small towns might have moved to larger cities. Although migration of some individuals between small towns and larger urban centres is probable within our sample, the net movements between the two are likely to be essentially equal and opposite.

To test the relative age effect, birthdates for all players were collected from the same websites. Birth month of each player was compiled into quarters (Q), which reflected the calendar year of each sport at the time that these athletes were involved in youth sport. The calendar year of US and Canadian hockey is from 1 January to 31 December (Q1 = January, February, March; Q2 = April, May, June; Q3 = July, August, September; Q4 = October, November, December). The calendar year of US baseball is from 1 August to 31 July (Q1 = August, September, October; Q2 = November, December, January; Q3 = February, March, April; Q4 = May, June, July). The calendar year of US basketball is from 1 September to 31 August (Q1 = September, October, November; Q2 = December, January, February; Q3 = March, April, May; Q4 = June, July, August). Although US golf does not adhere to a strict calendar year and age-restricted categories in the way other sports do, players are classified as junior if they are under 18 years at the time of the national junior championship. This championship is usually held during the last two weeks of July. To calculate the calendar year for golf, we used the same categorization as baseball (i.e. from 1 August to 31 July).

Statistical analyses

To assess differences between population and league distributions, Monte Carlo simulations were conducted based on methods discussed by Press, Flannery, Teukolsky and Vetterling (1986). Monte Carlo simulation is a bootstrapping technique that involves drawing samples from a well-defined population (i.e. the census distribution; Hoyle, 1999; Mooney & Duval, 1993). The simulations yielded estimates of the expected standard deviations for randomly and unbiased samples using the same numbers of cases (i.e. athletes) represented in each sport. These standard deviations were then used to determine the probability of the deviations of cases in each sport from the general population across the different city sizes. For example, using MLB players, we randomly selected 907 cases (the same number of athletes in the MLB portion) to create one sample, and then determined how this sample corresponded to the actual population. By repeating this re-sampling process 10,000 times, we obtained a sampling distribution to use as the basis for comparisons to the sport under examination (in this case baseball). From our data, we were able to compare the sport distribution to the sampling distribution obtained from the 10,000 re-samples and determine the likelihood that the sport distributions were due to chance. Using the sampling distribution and standard deviations obtained from the Monte Carlo simulation, z-scores and probabilities were calculated for each sport and city size. Alpha levels were adjusted using the Bonferroni method and set at $P < 0.001$.

Odds ratios were also calculated across the different city sizes for the US and Canadian data. The odds ratios were calculated by dividing the odds of becoming a professional athlete in each sport by the odds of being born in a city of a specific size. A 95% confidence interval (CI) was calculated. An odds ratio greater than 1 (with upper and lower limits higher than 1) implies that an athlete born in a city of a given size is more likely to become a professional athlete than if born in a city of any other size. An odds ratio less than 1 (with upper and lower limits less than 1) implies that an athlete born in a city of a given size is less likely to become a professional athlete than if born in a city of any other size.

Any odds ratios with a CI range that contains the null value of 1 are considered not to be statistically significant.

Chi-square tests were conducted on the birthdates of each player according to the four quarters of their sport calendar year to determine the significance of deviations for the expected number of births in each quarter. Similar to other studies on relative age (e.g. Barnsley & Thompson, 1988), the expected values were calculated based on the assumption of an even distribution of birth throughout each quarter of the year.

Sport-specific and overall effect sizes (Cohen's *d*) were calculated to evaluate the magnitude of the relative age effect and the birthplace effect. For the relative age effect, Cohen's *d* was calculated as the difference between the number of players that were born in the first 6 months of a given sport-year and the number of players that were born in the last 6 months divided by the standard deviation of the sample. For birthplace, Cohen's *d* was calculated as the difference between the number of players that were born in large cities (500,000 and more) and the number of players born in small cities (less than 500,000) divided by the standard deviation of the sample. [This effectively created a "top half/bottom half" comparison similar to that undertaken for birthdate, as in 1980 some 51.8% of the US population resided in cities with a population in excess of 500,000, with the balance (~48.2%) in smaller cities.] For the Canadian data, residents in areas of less than 1000 were not included in the "small cities" bracket for the calculation of the effect size. The 1976 Canadian census classified areas of less than 1000 as "rural" and as lacking any type of infrastructure that is common to a city.

Finally, some analyses were conducted to determine if the relative age effect and the birthplace were independent from each other in predicting elite performance in sport. First, Pearson correlations were calculated between the players' birth month (according to their sport's calendar year) and city size of birthplace. Second, chi-square analyses were conducted to examine the relationship between the ratios of the players born in small cities (less than 500,000) and large cities (500,000 and more) in each of the sport-year's quarters to determine if place of birth in any way moderated any relative age effect.

Results

Birthplace

Table I contains data from the 1980 US census (i.e. the census that most closely reflects the birth year of the professional athletes) on the percentage of boys under the age of 14 that lived in cities of different

Table I. Representation of the US population, professional athletes, and odds ratios across cities of different sizes.

		US professional athletes[b]							
		NHL		NBA		MLB		PGA	
City size	US population (%)[a]	%	OR (CI)	%	OR (CI)	%	OR (CI)	%	OR (CI)
>5,000,000	9.9	0.7	0.06 (0.16, −0.04)	3.9	0.37 (0.38, 0.36)	1.8	.17 (.18, .15)	0.5	0.04 (0.16, −0.08)
2,500,000–4,999,999	11.4	2.6	0.21 (0.24, 0.19)	6.7	0.55 (0.56, 0.55)	2.8	.22 (.23, .21)	1.0	0.08 (0.14, 0.01)
1,000,000–2,499,999	18.1	3.3	0.15 (0.18, 0.13)	6.9	0.33 (0.34, 0.33)	2.9	.14 (.15, .12)	0.5	0.02 (0.18, −0.13)
500,000–999,999	12.4	6.6	0.50 (0.51, 0.49)	11.9	0.96 (0.96, 0.95)	7.1	.54 (.54, .54)	11.1	0.88 (0.88, 0.87)
250,000–499,999	11.0	12.6	1.16 (1.17, 1.16)	15.6	1.50 (1.50, 1.49)	13.3	1.24 (1.24, 1.24)	16.8	1.64 (1.64, 1.63)
100,000–249,999	9.6	17.9	2.05 (2.05, 2.05)	16.1	1.80 (1.80, 1.80)	17.8	2.04 (2.04, 2.04)	13.5	1.46 (1.47, 1.46)
50,000–99,999	1.1	17.2	18.70 (18.70, 18.70)	10.8	10.86 (10.86, 10.86)	16.8	20.82 (20.82, 20.82)	11.1	11.18 (11.18, 11.18)
<50,000	26.4	39.1	1.79 (1.79, 1.79)	28.2	1.10 (1.10, 1.09)	37.7	1.69 (1.69, 1.69)	45.7	2.34 (2.35, 2.34)

[a]Percentage of males under the age of 14 in each of the subdivisions of the 1980 US census.
[b]Percentage of professional athletes in 2002–2004 born in each of the subdivisions of the 1980 US census.
Abbreviations: OR = odds ratio, CI = confidence interval.

sizes (i.e. expected values) and the percentage of players in 2002–2004 from the NHL, NBA, MLB, and PGA that were born in these different areas (i.e. observed values). Table I also contains the odds ratios of becoming a professional athlete when born in cities of different sizes in the USA. Table II presents mean differences between expected and observed values for US hockey, baseball, basketball, and golf together with the corresponding z-scores. Odds ratios (Table I) and Monte Carlo simulation (Table II) show that cities over 500,000 are consistently under-represented in terms of producing professional athletes, while cities under 500,000 are of expected proportions or over-represented. Cities with populations between 50,000 and 100,000 present the best odds of producing elite athletes in hockey, basketball, baseball, and golf.

Table III contains data from the 1976 Canadian census on the percentage of boys under the age of 14 that lived in cities of different sizes, the percentage of players in 2002–2003 from the NHL that were born in these different areas, and the mean differences between expected and observed values. Table III also contains the odds ratios of becoming a professional hockey player when born in cities of different sizes in Canada. The Canadian data show that cities with populations larger than 500,000 produced significantly less ice hockey players than expected. The Canadian data also suggest that rural areas with populations of less than 1000 produced significantly less professional players than expected.

Relative age effect

Table IV illustrates the frequency and percentage distributions of the players' birth months and the results of the chi-square analysis. These results show a relative age effect for professional ice hockey players from both Canada and the USA, and US baseball players. Generally, players born in the first quarter of the sport-year were over-represented compared with players born in the fourth quarter. No relative age effects were found for US golf and basketball.

Table II. Difference between US population and US NHL, NBA, MLB, and PGA players across cities of different sizes.

	NHL			NBA			MLB			PGA		
City size	Diff.[a]	s[b]	z	Diff.[a]	s[b]	z	Diff.[a]	s[b]	z	Diff.[a]	s[b]	z
>5,000,000	−9.3	2.4	−3.9*	−6.0	1.4	−4.2*	−7.9	1.0	−7.9*	−9.5	2.1	−4.6*
2,500,000–4,999,999	−8.4	2.5	−3.3*	−4.8	1.5	−3.1	−8.4	1.0	−8.2*	−10.0	2.2	−4.6*
1,000,000–2,499,999	−14.7	3.2	−4.6*	−11.8	1.9	−6.0*	−15.1	1.3	−11.9*	−17.5	2.7	−6.6*
500,000–999,999	−5.4	2.7	−2.0	−0.5	1.6	−0.3	−5.4	1.1	−5.0*	−0.9	2.2	−0.4
250,000–499,999	1.6	2.6	0.6	4.5	1.5	3.0	2.0	1.1	1.9	5.8	2.2	2.7
100,000–249,999	7.9	2.4	3.2*	6.4	1.4	4.5*	8.4	1.0	8.4*	3.5	2.1	1.7
50,000–99,999	16.2	0.8	20.0*	9.7	0.5	19.9*	15.9	0.3	48.3*	10.1	0.7	14.8*
<50,000	13.1	3.5	3.7*	1.8	2.1	0.8	11.6	1.5	7.9*	19.7	3.1	6.4*

[a]Difference between percent of US population and percent of professional athletes in each city size (from Table 1).
[b]Standard deviations determined by Monte Carlo simulations.
*z-score significant at $P < 0.001$.

Table III. Canadian population, Canadian NHL players, and odd ratios across different city sizes.

City size	Canadian population[a] (%)	% NHL[b]	Diff.	s[c]	z	OR (CI)
>500,000	33.2	15.7	−17.5	2.0	−8.7*	0.37 (0.38, 0.37)
100,000–499,999	13.3	33.2	19.9	1.5	13.6*	3.24 (3.24, 3.24)
30,000–99,999	7.6	15.8	8.2	1.1	7.3*	2.28 (2.28, 2.28)
10,000–29,999	7.3	10.4	3.1	1.1	2.8	1.47 (1.48, 1.47)
5000–9999	3.4	7.7	4.3	0.8	5.6*	2.37 (2.37, 2.37)
2500–4999	3.4	6.0	2.6	0.8	3.4*	1.81 (1.82, 1.81)
1000–2499	3.3	6.2	2.9	0.8	3.8*	1.94 (1.94, 1.93)
<1000	28.5	5.1	−23.4	1.9	−12.2*	0.13 (0.15, 0.12)

[a]Percentage of males under the age of 14 in each of the subdivisions of the 1976 Canadian census.
[b]Percentage of players in 2002–2003 born in each of the subdivisions of the Canadian census.
[c]Standard deviations determined by Monte Carlo simulation.
*z-score significant at $P < 0.001$.
Abbreviations: OR = odds ratio, CI = confidence interval.

Table IV. Chi-square values and related probabilities between observed frequencies and expected frequencies.

	Number and % of players per quarter						
	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	Total	χ^2	*P*
US hockey	52 (34.4)	33 (21.9)	37 (24.5)	29 (19.2)	151	8.02	0.045*
US basketball	118 (27.7)	102 (23.4)	119 (27.3)	97 (22.2)	436	3.43	0.330
US baseball	276 (30.4)	231 (25.5)	200 (22.1)	200 (22.1)	907	17.09	0.001*
US golf	55 (27.9)	45 (22.8)	48 (24.4)	49 (24.9)	197	1.07	0.784
Canadian hockey	162 (29.5)	164 (29.9)	118 (21.5)	105 (19.1)	549	19.95	0.000*

Effect size

Effect sizes (Cohen's *d*) of the relative age effect and the birthplace effect are presented in Table V. The birthplace effect sizes varied between 1.98 for Canadian hockey to 4.22 for US hockey. The relative age effect sizes for Canadian hockey and US hockey were the largest at 0.90 and 0.74, respectively. The relative age effect sizes for US baseball, golf, and basketball were all under 0.5.

Table V. Cohen's *d* effect sizes for birthplace effect and relative age effect across all sports.

	Effect size (*d*)	
	Birthplace	Relative age
US hockey	4.22	0.74
US basketball	4.16	0.04
US baseball	3.94	0.44
US golf	3.27	0.09
Canadian hockey	1.98	0.90
Means (all sports)	3.51	0.44

Interaction between birthplace and relative age

Results of the correlation between the players' birth months (according to their specific sport's calendar year) and the players' birth city size show low and non-significant correlations for basketball ($r = -0.02$), baseball ($r = 0.04$), US hockey ($r = 0.02$), Canadian hockey ($r = 0.04$), and golf ($r = -0.01$). Chi-square results for the ratios of the players born in small cities (less than 500,000) and big cities (500,000 or more) for each of the sport-year's quarters showed no significant values for any of the sports calculated. Overall, these results show that the effect of birthdates and birthplace are independent of each other.

Discussion

The results of this study provide strong support for the view that smaller cities provide early opportunities for talent development in sport that are not matched by larger cities. This study also provides additional evidence for relative age as a factor that can affect elite performance in ice hockey and baseball, although no support was provided for a relative age effect in PGA golfers and NBA basketball players.

The US data indicate that children born in communities of 500,000 or more are significantly disadvantaged in terms of their likelihood of becoming an elite athlete compared with children from communities of less than 500,000. While nearly 52% of the US population reside in cities with populations over 500,000, such cities produce approximately 13% of the players in the NHL, 29% of the players in the NBA, 15% of the players in MLB, and 13% of players in the PGA. The Canadian ice hockey data corroborate the US data, showing that cities with populations larger than 500,000 are under-represented in terms of players in the NHL. The Canadian data suggest that there is also a critical value for minimum community size (i.e. >1000). The smallest rural areas (<1000) produced significantly fewer professional players than expected. The 1976 Canadian census characterizes populated areas of less than 1000 as lacking the infrastructures that are usually common to a city, which may result in fewer opportunities to invest in physical activities and sports. The lack of facilities and playing partners, typical in small rural areas, appears to be detrimental to the early development of sport skills (Curtis & Birch, 1987). This minimum populated areas effect was not seen in the US data and may be due to the 1980 US census not providing the number of people living in rural areas in the USA. Therefore, based on the collective Canadian and US data, it appears that the optimal community size for the early development of professional athletes is greater than 1000 but less than 500,000. Furthermore, the US census subdivision allows us to show that the odds ratio of becoming a professional athlete increase linearly as the population decreased, indicating better odds in cities that have a population smaller than 250,000.

On theoretical grounds, we can posit that the physical environment and psychosocial climate of big urban centers and smaller cities (excluding rural areas of less than 1000) are different and accordingly provide children with different sport experiences at an early age. From a physical environment perspective, smaller communities provide children with more space for physical activities such as cycling, running, skating, and playing sports with peers (Kytta, 2002). Moreover, Kytta showed that smaller communities provide a natural environment that is safer for children to move around independently, without adults' supervision. On the other hand, physical activity for young children in larger communities is more structured, taking place largely within the school system and organized leagues (Kristjansdottir & Vilhjalmsson, 2001). Such organized sport programmes require a lot of human resources, such as parental involvement, adult supervision, and coaching, that could limit the time children spend playing sports. Smaller cities' less structured, more natural, more spacious, and safer physical environment might facilitate various types of sport involvement and longer hours of involvement in sports at a young age, a characteristic that has been associated with later investment in sport (Baker *et al.*, 2003; Soberlak & Côté, 2003).

When discussing the geographical nature of modern sport, Bale (2003) argues that many small American towns use their sport success to proclaim their pride. This is often reflected on the welcoming signs of US towns and cities highlighting local sporting heroes (Bale, 2003). Although bigger cities offer more alternatives for children to engage in organized sports (Curtis & McPherson, 1987) and other structured leisure activities such as arts and music, a study of leisure-time use in adolescents demonstrated that urban adolescents reported decreased amounts of satisfaction with their leisure-time use compared with their rural counterparts (Gordon & Caltabiano, 1996). Therefore, the reduced number of leisure activities and the psychosocial environment of smaller cities could be important factors for future investment in sports.

Sport participation studies suggest that organized sport programmes have often been unsuccessful in retaining children because of the psychosocial environment in which sport is practised (De Knop, Engström, & Skirstad, 1996; Kristjansdottir & Vilhjalmsson, 2001). Individuals from smaller communities receive more social support, have higher self-efficacy, and experience less conflict with others than those from larger cities (Elgar, Arlett, & Groves, 2003). These psychosocial characteristics have been associated with sustained involvement in sport (Pelletier, Fortier, Vallerand, & Brière, 2001; Robinson & Carron, 1982). It is probable that the more intimate and informal environment of smaller cities is more conducive to experiencing early success, which, in turn, intrinsically drives propensity for more training. As a result, during the early years of a child's involvement in sport, smaller cities may facilitate the achievement of elite sport performance by providing a more supportive and facilitative psychosocial environment for early development.

The results of this study support the relative age effect in ice hockey in both Canada and the USA as well as US baseball; however, no relative age effect was found in golf and basketball. The results from hockey and baseball replicate past studies that have also noted a relative age effect with NHL and MLB players (Boucher & Mutimer, 1994; Thompson *et al.*, 1991). As noted by Musch and Grondin (2001) in their review of studies of the relative age effect in sport, it is likely that the causes of the relative age effect in sports such as hockey and baseball are multiple, including physical, cognitive, and social elements. The findings for basketball are consistent with the results of Daniel and Janssen (1987), who also found no relative age effect with NBA players for the 1984–85 season. On the other hand, Hoare (2000) reported a relative age effect with professional male basketball players in Australia. The fact that the high school developmental system for basketball in the USA has a "grade fail exemption" could partially explain the absence of a relative age effect in US basketball. The "grade fail exemption" allows three players per team to play with players of the same grade if they fail a grade. This exemption allows older players to play with younger players and could eventually eliminate the relative age effect in professional basketball. Studies of relative age with primary school elite basketball players could shed light on the function that the "grade fail exemption" rule plays in reducing the magnitude of the relative age effect in US basketball. No evidence of a relative age effect in golf was found for the US PGA players. Golf is a sport where age-related factors such as size and body mass might be less likely to influence performance. In addition, the structure of youth golf in the USA does not have as strict age groupings as other organized youth sports, including ice hockey and baseball. Finally, the beginning of organized play in golf is also likely to occur at an older age, which would limit the amount of time that golfers can benefit from a possible relative age advantage.

Table V displays the Cohen's *d* effect sizes for birthplace and relative age across all sports. It is noteworthy that the birthplace effect, which has to date received little attention, is considerably and consistently stronger than the well-documented relative age effect. The birthplace effect shows effect sizes that are consistent across sports and that are well above the 0.80 value that Cohen (1988) suggested as constituting a "large" effect. On the other hand, the effect sizes for the relative age effect are not consistent across sports, with large effects for

Canadian hockey, medium effects for US hockey and baseball, and small effects for US basketball and golf. Despite these varying effect sizes across sports, it is generally considered that the relative age effect has a strong influence on talent development in sport (e.g. Helsen, *et al.*, 2000; Musch & Grondin, 2001). Based on the results of this study, birthplace has a considerably stronger influence on talent development than relative age in major US and Canadian sports. However, the birthplace effect requires examination in other countries and other sports to establish how generalizable this effect is.

The possible interactive relationship between birthdate (relative age) and birthplace of the athletes was examined in our sample using Pearson correlations and chi-squares analyses. These analyses were conducted to determine if birthdate and birthplace were associated. Correlations between a sport-year's birth months and birthplace were uniformly low for every sport analysed. To further examine the possible relationship between birthdate and birthplace, we assessed whether the ratios of players born in small cities and big cities were evenly distributed between the different quarters of a sport-year. Results of this analysis show a symmetrical distribution of players from small cities and big cities born in the different quarters of their sport-year. Overall, these analyses show that birthplace has an effect on athletes' development that is independent of the relative age effect, and presumably therefore has different origins of causation.

Conclusion

Our results show that children who live in smaller cities have more opportunities for the development of sport expertise. Drawing on the existing evidence about factors known to be important to expert development in sports, we can propose possible factors and mechanisms that contribute to the birthplace effect (Ericsson *et al.*, 1993; Côté *et al.*, 2003). The effect could be mainly due to skill acquisition factors related to the quality and quantity of play and practice afforded by the physical environment of smaller cities. The quality of play and practice could be a key factor because the physical environment of smaller cities is more conducive to unstructured play activities between children and adults of different ages and to experimentation with various forms of sporting activities. The quantity of play and practice in smaller cities could also be a factor because smaller cities present fewer safety concerns, better access to open spaces, and less competing sources of leisure-time use by children. Another factor that could contribute to the birthplace effect is the more intimate and, possibly, less competitive psychosocial environment of smaller cities. The smaller cities could offer increased opportunities to experience early success in sport, which in turn would increase self-efficacy and the motivational drive to play and practise more. In other words, smaller cities might present more opportunities for the type of developmental experiences and practice known to be associated with expert performance.

The birthplace effect found in this study is strikingly consistent across sports (baseball, basketball, ice hockey, golf), countries (Canada and USA), and sport development systems. On the other hand, although a relative age effect was found for hockey and baseball, the same effect was not observed across all sports. This study showed that birthplace is a much stronger and consistent factor than relative age in determining elite performance. Our data are limited by possible discrepancies between registered place of birth and the location where athletes spent the bulk of their developing years. However, US census data show a relative stability in population growth between cities of different sizes (Schachter, Franklin, & Perry, 2003), supporting the use of "birthplace" as a reliable indicator of where athletes spend their early years in sport. The birthplace effect found in this study reinforces the conclusion that contextual factors play a significant role in determining who achieves the highest level of sporting skill.

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