Factors affecting the relative age effect in NHL athletes

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Background: The relative age effect (RAE) has been reported for a number of different activities. The RAE is the phenomena whereby players born in the first few months of a competition year are advantaged for selection to elite sports. Much of the literature has identified elite male athletics, such as the National Hockey League (NHL), as having consistently large RAEs. We propose that RAE may be lessened in the NHL since the last examination.

Methods: We examined demographic and selection factors to understand current NHL selection biases.

Results: We found that RAE was weak and was only evident when birth dates were broken into year halves. Players born in the first half of the year were relatively advantaged for entry into the NHL. We found that the RAE is smaller than reported in previous studies. Intraplayer comparisons for multiple factors, including place of birth, country of play, type of hockey played, height and weight, revealed no differences. Players who were not drafted (e.g., free agents) or who played university hockey in North America had no apparent RAE.

Conclusion: We found little evidence of an RAE in the current NHL player rosters. A larger study of all Canadian minor hockey intercity teams could help determine the existence of an RAE.

Contexte : L'effet de l'âge relatif (EAR) entre en ligne de compte dans plusieurs types d'activités. Dans le contexte des sports d'élite, par exemple, l'EAR est le phénomène qui fait que les joueurs nés au cours des premiers mois d'une année de compétition ont un avantage sur les autres au moment de la sélection. La littérature a abondamment fait mention de la persistance d'un EAR important dans les sports d'élite masculins, entre autres, au sein de la Ligue nationale de hockey (LNH). Selon notre hypothèse, l'EAR peut avoir diminué au sein de la LNH depuis la dernière étude.

Méthodes : Nous avons analysé les facteurs démographiques et les facteurs de sélection afin de comprendre les biais de sélection actuels au sein de la LNH.

Résultats : Nous avons observé que l'EAR était faible et qu'il ne se manifestait que lorsque les dates de naissance étaient scindées en demi-années. Les joueurs nés durant la première demie de l'année étaient relativement avantagés au moment de la sélection pour la LNH. Nous avons constaté que l'EAR était plus faible qu'on ne l'avait rapporté lors des études antérieures. Les comparaisons entre les joueurs selon différents facteurs, dont le lieu de naissance, le pays où le sport a été pratiqué, le type de hockey pratiqué, la taille et le poids, n'ont révélé aucune différence. Les joueurs qui étaient sans contrats (c.-à-d., agents libres) ou qui ont joué dans des ligues de hockey universitaires nord-américaines ne semblaient pas soumis à un quelconque EAR.

Conclusion : Nous avons trouvé peu de preuves d'un EAR dans les listes actuelles des joueurs de la LNH. Une étude de plus grande envergure sur les équipes de hockey mineures intercités au Canada permettrait de vérifier l'existence d'un EAR.

Many resources go into training and nurturing athletes to perform at elite levels. Emphasis on training techniques, hockey intelligence and parental attributes has often been seen as influencing the choice of hockey players on draft day. Over the last 2 decades there has been an ongoing debate of what other aspects,^{1,2} such as where and when players were born, are

the primary factors in determining success in sports. Are certain athletes, mainly on the basis of relative birthdates, unfairly using these resources intended for all athletes? This has been defined as the relative age effect (RAE),^{1,3-5} where players who are born in the first few months of the year are predominately selected over relatively younger players born in the later months of the year. Hockey and other sporting programs have been reviewed.⁶⁻¹⁴ Some authors have studied the potential bias in the past and have recommended wholesale changes in league age structure.¹⁰ Are these recommendations really warranted in today's environment? Certainly they would disrupt the established selection and training process already in place. Most of the relative age data in the literature are from hockey and soccer. A recent study of the soccer leagues in France¹⁵ showed there was little relative age discrepancy in the professional ranks. In response to the relative age phenomena, Hockey Canada has examined the restructuring of minor hockey to prevent the proposed weighted selection of early year birthdates in elite hockey leagues.¹⁰ The presence in some sports of an RAE can be explained and perhaps avoided. Reviewing the National Hockey League (NHL) player distribution may be indicated at this time, particularly with respect to the players' leagues of origin or pathways to professional hockey.

We examined the NHL players from the 2011–12 season to determine if there was a selection bias for birth month, quarter or half-year. The purpose was to determine if there were inherent groupings of players within the NHL who exhibited an RAE. There are several pathways to the NHL at this time: junior hockey in North America, European professional hockey and college/university hockey. In addition, we examined other demographic factors, such as birthplace, junior hockey location, draft year, weight and height, as possible contributory factors. The primary outcome null hypothesis was that there would be no RAE for any NHL players on the 2011–12 rosters.

METHODS

The study cohort comprised all NHL players on the midyear team rosters. We gathered our data from nhl.com, and consulted individual NHL, American Hockey League (AHL) and other team sites to obtain missing information. The primary outcome measurement was relative age. We compared current NHL player data with a general population distribution to determine whether there was an RAE. The birth dates were categorized into either quarters or half-years (e.g., a birthdate in January–March was quarter 1, a birthdate in July–December was half 2). This coincides with the athletic year start for hockey and is the comparison used in the literature. We analyzed quarters as well as halves for all comparisons. Secondary outcome measurements were used to determine if the RAE, if any, was particular to individual factors, such as country of birth, where the players played junior or university hockey, and whether the players entered through

the university ranks or the professional system. These analyses were carried out as comparisons within the NHL population cohort to determine if there was any group within the NHL population that demonstrated an RAE.

Statistical analysis

Analysis was performed with commercially available software (SPSS Inc.). We carried out cross-tab and χ^2 analyses for categorical data. Continuous variables were analyzed with a *t* test to determine significance. We considered results to be significant at $p < 0.05$.

RESULTS

The NHL cohort was made up of 748 players. The average age was 27.49 ± 4.61 years. The players were on average 185.9 ± 5.1 cm tall and weighed 92.2 ± 7.1 kg, with no statistical difference across birth halves or quarters. There was no clinical difference between demographic characteristics for players born in Canada or for the pathway to the NHL (Table 1). The measurements were normal in distribution. The mean age at NHL debut was 20.6 ± 2.13 years, and players had spent an average of 6.89 ± 4.20 years in the league.

Primary outcome results showed that in comparison to the population at large there was no RAE in the NHL according to quarters ($p = 0.19$). The actual birth quarter numbers (and expected numbers) were 216 (205.9) for quarter 1, 208 (200.7) for quarter 2, 163 (171.4) for quarter 3 and 161 (170.1) for quarter 4. We found a significant difference when comparing birth halves ($p = 0.034$). The actual birth half numbers (and expected numbers) were 424 (406.6) for half 1 and 324 (341.4) for half 2 (Fig. 1).

Secondary outcome results were obtained to better understand the primary outcome scores. We compared players who came through the junior hockey system in Canada with those who took alternate routes to the NHL. There was no difference for birth quarters ($p = 0.19$) or halves ($p = 0.93$). Both groups seemed to show a similar pattern of fewer players born in the second half of the year (Fig. 2).

Examination of players born in Canada versus those born outside of Canada showed a significant difference for

Table 1. Descriptive statistics for NHL players

Characteristic	Group; mean			
	Players by birthplace		Players by pathway into NHL	
	Canada, <i>n</i> = 399	Other, <i>n</i> = 349	University, <i>n</i> = 203	Other, <i>n</i> = 545
Height, cm	186	186	185	186
Weight, kg	92	92	91.5	92.4
Age debut, yr	20.8	20	21.8	20
Years in NHL, no.	6.8	7.0	6.3	7.1
NHL = National Hockey League.				

quarters ($p = 0.023$) but not for halves ($p = 0.36$). The difference in quarters represents a variance in actual versus expected numbers in all quarters (Table 2). In particular, there were fewer players than expected born in the second quarter, and this difference is not necessarily explained by an RAE. For players born in North America versus those born outside of North America, there were no differences for quarters ($p = 0.23$) or for halves ($p = 0.23$). Country of birth did not show any difference for birth quarter ($p = 0.23$) or half ($p = 0.60$).

Fig. 1. Number of players in the National Hockey League according to birthdate, by half-year. Half 1 = January–June; half 2 = July–December.

Fig. 2. Distribution by birth quarter of players in the National Hockey League who played Canadian junior hockey or who played in other systems. Quarter 1 = January–March; quarter 2 = April–June; quarter 3 = July–September; quarter 4 = October–December.

Birthplace	Q1	Q2	Q3	Q4
Canada				
Count	116	88	65	80
Expected count	100.8	97	76.1	75.1
Other				
Count	100	120	98	81
Expected count	115.2	111	86.9	85.9

Q = quarter; Q1 = January–March; Q2 = April–June; Q3 = July–September; Q4 = October–December.

Players who came through the university system did not differ from other NHL players by quarter ($p = 0.36$) or half ($p = 0.18$). The breakdown of these players by halves is 107 players in half 1 and 96 in half 2; the breakdown by quarters is 52 players in quarter 1, 55 in quarter 2, 44 in quarter 3 and 52 in quarter 4. Graphically the distribution seems quite even (Fig. 3).

There was a difference in RAE between players who were not drafted (e.g., free agents) and those who were drafted. The breakdown of players who were not drafted is 47 players in half 1 and 48 in half 2; the breakdown by quarters is 25 players in quarter 1, 22 in quarter 2, 24 in quarter 3 and 24 in quarter 4. This group seems to have an even distribution (Fig. 4).

DISCUSSION

Many previous studies have reported variable results for an RAE. Inconsistent results are not surprising in population-based studies with many confounding variables. Also, authors of previous studies may have overlooked potentially confounding factors in their analyses of RAE.¹⁶ Hockey, however, has been one of the most examined sports. Results from minor hockey to the NHL have shown varying RAEs. The NHL-related results^{17,18} have shown a small to medium RAE with what seems to be a variable but consistent increase in the number of players born early in the year. Our results (424 players in half 1 and 324 in half 2) show a

Fig. 3. Players in the National Hockey League who played in university system or other systems, by birth date. Half 1 = January–June; half 2 = July–December.

Fig. 4. Comparison of players drafted to the National Hockey League and those who were not drafted, by birth date. Half 1 = January–June; half 2 = July–December.

relative ratio of 1.31 (424 of 324), which is less than the ratio reported in other published studies.¹⁰ The birth dates by quarter were not significantly different ($p = 0.19$).

Despite what seems like a rather logical reasoning for the RAE — more mature players in the same age group will likely be considered better players — other systems around the world may not have the same age-related onus on success dictated by draft year. The present study, as a snapshot for 1 year, found evidence of an RAE. The RAE was virtually identical for non-Canadian and non-North American players as it was for Canadian-born or trained players. The RAE should be re-examined if Hockey Canada follows through with plans to change the training system¹⁰ to elucidate the effect of changes in policy.

Musch and Grondin¹⁹ reported that the increasing findings of an RAE suggested that a mixture of physical, cognitive, emotional and motivational causes work together to produce the effect. In fact, RAE may be just a mass effect of selection to elite ranks occurring at a young age. The RAE is then perpetuated because the selected players are exposed to better coaching and increased ice time as part of an elite team. Other authors have shown that RAE is generally not present in lesser calibre competition.³ It is also not present in most female sports in which fewer players are vying for a limited number of positions.²⁰ The RAE should be present in all endeavours where there is a large inception cohort that is streamed through a fairly extreme selection process at an early age. It is at an early age where there may be a significant difference in outcome measurement in the population.^{7,10} This outcome may be marks in school or athletic ability.¹⁹ The hockey system in Canada, 20 years ago, may have been an example of this type of selection bias. A large number of candidates from minor hockey were coming through a fairly small channel of eligibility — major junior hockey. The junior ranks from Canada were seen as the only viable pathway to the NHL. College hockey players were not really seen as NHL players in the making. The senior hockey leagues were established but were seen as fighting leagues. This has changed. Presently, college hockey is a viable pathway to the NHL. In fact, in the present study, an RAE was not evident among NHL players who played university hockey (Fig. 3). Presumably, these players have a few more years to mature in university, thereby eliminating the RAE because all birth date players are more developed at draft eligibility. Other routes to the NHL may be viable options as well. The senior professional league teams in the AHL and the ECHL, to a large extent, are now affiliated with NHL teams and are seen as feeder organizations. Therefore there are now options for the players who do not get into Midget AAA and major junior leagues because they are late developers. The NHL players who were not drafted showed no RAE (Fig. 4), much like the university players. It is possible that the narrow corridor of entry to the NHL has been made larger for older players or those who were not subjected to the age restrictions of the classic selection

process. This may be the reason that we did not find a high relative score for birth halves in 2011. Notably, the university entry portal is going to change owing to new eligibility rules. The admission of seasoned major junior players into the university programs is relatively new and will result in older players, who have already been selected to junior hockey teams with an RAE, taking away university positions from younger players. This will make the road to elite hockey and presumably the NHL harder for players who were not selected for a junior team and may re-establish a marked RAE in the NHL in future years.

Limitations

There are some limitations to this type of study. We examined a single point in midseason for 1 year. Multiple selection points over many years may have yielded different results. The midseason point was used to eliminate any early prospects who were being evaluated and could then have been sent back to junior hockey or another professional league. Late season rosters also include many players called up for evaluation when a team is eliminated from playoff contention. We considered the midseason point to be more representative of a team's true roster choice. Evaluating the RAE soon after the 2007 review by Nolan and Howell¹¹ was not seen as examining the same cohort. Over the last 7 years new players accounted for approximately 19% per year of the NHL, leading to rapid cycling of the team rosters. In addition, the study by Nolan and Howell, although it looked at major junior and NHL players, did not take into account the different feeder systems to the NHL, which is what we set out to review in the present study. Also, there are new concepts in RAE.²¹ Ice hockey participation in Canada implies both annual age grouping policies (relative age) and 2-year age league periods (constituent year) that may affect how players are selected early on in youth hockey. There may not be a large constituent effect in hockey because of the number of eligible players per league or because of conscious decision by coaches to take the best players in the first year of a league (constituent year). This may accentuate RAE if only the biggest players — and presumably the oldest players — are chosen for underage tryouts in their first year of eligibility for each league play.

In the end, the number of variables may be such that the true effect on NHL players is uncertain. Other sports that have been studied,^{8,10,15,21} such as gymnastics, basketball and American football, showed no difference in RAE. Gymnastics should have a profound RAE, as the sport depends on strength and body coordination, with a narrow acceptance channel to the highest levels. Perhaps the RAE is not present because the cohort is small — relatively few kids participate in gymnastics compared with larger team sports. Another factor is that physical size is not important; larger children generally do not make good gymnasts. This may

also lead to a decrease in RAE. National Basketball Association (NBA) teams have a small roster, such that only the best will be selected, and all of the best shooters may not be born in the first months of the year. Also, fewer secondary players are selected in basketball, and they may be overwhelmingly selected on parental genetics, rewarding height over performance. Also, the main entry draft for the NBA, as in the National Football League (NFL), is after college. This means that most football and basketball players are 4 years older than hockey players when selected. The NBA and NFL drafts are also inception drafts from hundreds of colleges and universities over multiple divisions and levels. The extensive scouting system allows consideration of all the teams. All these factors may minimize the RAE in football and basketball compared with that in hockey. These examples also show what can be changed to minimize the RAE in hockey or other sports. Later selection to elite leagues at all levels (minor to professional) will minimize the RAE. This realistically could only be addressed at the minor hockey level. If the pool of young players exposed to increased ice time and expert coaching was expanded and the selection process to elite hockey occurred later in life, the RAE might be minimized. Increasing the number of single letter programs and eliminating the double letter programs in the entry-level minor hockey leagues could accomplish this. If there were no super-regional teams until a later age, there would be less pressure to select according to RAE. Rules to prevent junior hockey players from entering university hockey while at the same time expanding the senior teams may allow more entry portals to professional play and it would certainly expand the ability of adolescents to continue playing hockey longer in life.

CONCLUSION

The previous system in Canada in which a limited number of junior teams (made up of players selected with an RAE at an early age) provided the bulk of players to the NHL is no longer intact. Other venues of entrance to the NHL — particularly of older players — have changed the weighting of relative age importance for selection to the NHL. It is impossible from this study to determine whether an RAE exists at the minor hockey levels, and it probably still does. The RAE based on birth halves observed in this study presumably was present because of this group of NHL players. A larger study of all Canadian minor hockey intercity teams could elucidate this question. Despite this, there is little evidence of an RAE in the current NHL player rosters.

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