The relative age effect in Australian Football League players

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Abstract

Youth sports teams are usually grouped into yearly age groups based on fixed cut-off date (September 1st in the UK and January 1st in Australia). Children born just after this cut-off will be the oldest and most mature in their age group. This gives them an advantage in competitive sport, an advantage which has persisted into adulthood as shown by seasonal patterns in the dates of birth of professional ice hockey, football and basketball players. We were interested in whether a similar seasonal pattern exists in professional Australian Football League (AFL) players. We examined all AFL players in the 2009 season excluding foreign-born players. We compared the observed number of players' born in each month with the expected number based on national statistics. There was a marked and statistically significant seasonality in players' dates of birth. There were 33% more players than expected with dates of birth in January, and 25% fewer in December. Players who are relatively older in youth AFL teams have a better chance of turning professional.

Introduction

Children's sports teams are arranged into yearly age groups so that children compete against others of a similar size and maturity. However, even within annual age groups there can be significant variations in development [19], with the relatively oldest children likely to be the tallest, strongest and most mature. The difference has been shown to lead to substantive advantages in terms of academic and sporting achievement and is known as the "relative age effect" [16, 25]. Its effect on sporting achievement persists into adulthood as strong seasonal patterns have been found in the dates of birth of: ice hockey players in Canada [13, 5, 4]; football players in Australia [17], the UK [20], Spain [15] and Europe [14]; and basketball players in France [10]. In Canada more ice hockey players have dates of birth at the start of the year (January to March), and fewer players have dates of birth at the end of the year (October to December). Ice hockey is a physical game, and greater physical size gives players a distinct advantage [19]. The cut-off date for youth sports teams in Canada is January 1st, which explains the greater number of players with a date of birth early in the year. The UK cut-off is September 1st (for school and extracurricular sports teams), and so there are a greater number of professional football players born in September to December compared with June to August [20]. In countries where the cut-off date is in January, more football players are born at the start of the year [15].

If physical size is the only reason for the relative age effect then it should be less pronounced in less physical sports [24]. However, a recent surprisingly finding was a relative age effect in shooting sports, with relatively older boys being over-represented [9]. The same study did not find a relative age effect in women involved in shooting, and another study found no effect in gymnastics [6]. The finding of a seasonal imbalance in shooting sports suggests that relative mental, as well as physical maturity, is part of the

advantage.

The objective of this paper was to discover whether a relative age effect exists for Australian Football League (AFL) players. The Australian sporting cut-off is January 1st, so we expected to find more players with dates of birth earlier in the year. AFL is a fast and physical game and taller players have a distinct advantage, therefore we also expected the pattern to be quite strong.

Although many previous papers have investigated the effect of relative age [7], there has only been two previous studies using Australian data [17, 1]. Also, much of the previous analyses used crude tests of seasonality based on simple frequency tables by month or quarter of birth. In this paper we present a test that specifically tests for the type of seasonal pattern caused by a relative age effect.

Methods

The study sample comprised professional AFL players in the 2009 season excluding foreign born players because we were interested in the effect of growing up in Australia. Dates of birth were taken from the official AFL web site (`http://www.afl.com.au/`). National data on the total number of births by month was obtained from the Australian Bureau of Statistics [2].

We tested for a seasonal pattern in dates of birth using two tests. We used a chi-squared test that tests for any departure from a uniform spread of dates of birth, and we tested for a "sawtooth" seasonal pattern that tests for the sharp rise and subsequent steady fall that we would expect if there were a relative age effect (more details below). A chi-squared test has the advantage of making no assumption about the seasonal pattern, but has a low power to detect specific seasonal patterns [3]. It does have the advantage

of being familiar to most researchers, and is the test most often used in other studies in this area. A "sawtooth" pattern will have a greater power to detect a seasonal pattern compared with the chi-squared test, assuming that the seasonal pattern has a sharp rise followed by a steady fall (or vice versa). This is the seasonal pattern that we would expect if there were a relative age effect, as the chances of becoming a AFL player would increase dramatically between a date of birth of 31 December and 1 January. From 1 January to the end of the year we would expect a steady decline in the probability of becoming a player as the additional growth time declines.

Both tests examined the monthly frequencies of births compared with the expected number of births in each month based on national statistics. Using the expected number of births accounts for the unequal number of days in the month (e.g., 28 or 29 days in February compared with 31 in January) and any underlying seasonal pattern in the total number of births. We used national data on the total number of births for the years 1975 to 1991, as this covered the same period as the players' dates of birth.

For the "sawtooth" model the key unknown parameter is the month in which the numbers increase [3]. To find the optimal value we fitted 12 separate models assuming a change in the sawtooth pattern in each month (January to December) and then selected the month with the smallest Deviance Information Criterion (DIC) [22]. The DIC is an estimate of model fit that balances a close fit to the data and model complexity, it is the Bayesian version of the Akaike information criterion. The model was fitted using a Bayesian paradigm [11], using the WinBUGS software [23]. We used a burn-in of 10,000 Markov chain Monte Carlo iterations, followed by a sample of 10,000. The convergence of the model was assessed using the "coda" library in R [18].

As a graphical summary we plotted the observed and expected number of births in each month using a circular plot. Compared with a standard bar chart a circular plot has

the advantage that the results from December and January are side by side [3].

Results

We found birth dates for 617 Australian born AFL players from 16 professional clubs (median of 38.5 players per club). A circular plot of the number of players born in each month and the expected number is shown in Figure 1. The observed number of players was greater than expected in January to March. From April to July the observed and expected number of players were reasonably similar, but in August to December there were fewer players born than expected. The most number of players were born in March (73 players), and the fewest in December (37 players). The biggest change between neighbouring months was an increase of 29 from December (37 players) to January (66 players).

Table 1 shows the observed and expected number of players in each month. There were 66 players born in January, when we would have expected 51 if there were no seasonal pattern. In December there were only 37, when we would have expected 50. A chi-squared test comparing the observed and expected number of births showed that births were not equally spread over the year ($X^2 = 24.63$, p-value = 0.01).

For the sawtooth seasonal model the lowest DIC was 75.6 in January, which was 12.6 lower than the next best DIC in August. A difference in DIC of 10 or more is considered substantial [21], therefore we can be confident that a change in the sawtooth pattern in January gives the best model. The estimated percentage excess assuming a sawtooth model with a change in January is shown in Table 1. January had the largest positive

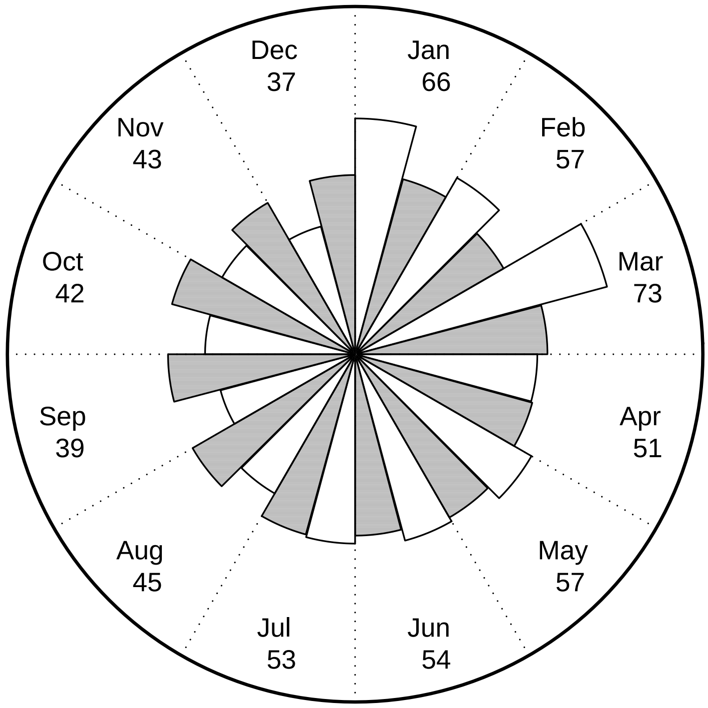

Figure 1: **Circular plot of the observed and expected number of AFL players' births.** The observed values are shown in white segments and the expected value in grey. The numbers around the outside of the plot are the observed number of births in each month. The expected number of births are based on national data.

excess, with 33% more players born in January than would be expected if there was no seasonal pattern in players' dates of birth (95% credible interval 17%, 50%). December had the biggest shortfall with 25% fewer players born in December than expected (95% credible interval −34%, −15%).

Discussion

There is a strong seasonal pattern to the dates of birth of AFL players, with more players born early in the year and a gradual decline to a low in December. This pattern was

Table 1: **Observed and expected number of AFL players born in each month and the estimated percentage excess based on a sawtooth seasonal model**

Month	Observed	Expected	Percentage Excess (95% CI)
January	66	51	33 (17, 50)
February	57	48	26 (14, 40)
March	73	54	20 (11, 30)
April	51	51	14 (7, 20)
May	57	53	8 (4, 12)
June	54	51	3 (1, 4)
July	53	52	−3 (−4, −1)
August	45	53	−7 (−11, −4)
September	39	52	−12 (−17, −7)
October	42	53	−17 (−23, −10)
November	43	49	−21 (−28, −12)
December	37	50	−25 (−34, −15)
Total	617	617	

AFL = Australian Football League

statistically significant, both using a chi-squared test (p-value = 0.01), and using a "sawtooth" test specifically designed to model the seasonal pattern caused by the difference in relative age. We tested for a change in the number of players using all 12 months, and a change in January gave by far the best fit. Also, Figure 1 shows that the biggest increase in numbers was between December and January. If relative age is the cause of the seasonal pattern then January is the month that we would expect the change to occur as enrollment into school and extracurricular sports teams is based on January 1st. Boys born at the start of the year will have up to a year of extra growth (both physical and mental) compared with boys born at the end of the year. When playing in youth teams the larger boys are more likely to do well, and the larger boys are more likely to be born earlier in the year.

The results of our study confirm a previous Australian study that found a relative age effect in AFL and also Rugby league [1]. In that study the odds of a player being born in January to March were 1.44 times the odds for October to November [7].

One possible explanation for the relative age effect is that smaller children are more likely to be discouraged from taking part in sport and are more likely to quit [8]. This has broader implications for Australia, where the rates of childhood obesity are growing [12]. Discovering whether smaller children are under represented in Australian sports could be achieved by measuring the heights of children involved in sporting activity and comparing them with their inactive classmates. Alternatively a study could examine the dates of birth of adolescent children in extracurricular sporting teams to see whether the relative age bias is present. If smaller children are missing out on sporting activity then this has potentially serious consequences for their health in adulthood. Interventions designed to increase levels of physical activity in children may need to consider specific encouragement for relatively small children.

Ways to avoid the relative age effect have been suggested [16], including: creating teams based on biological age rather than chronological age, using a chronological age banding in sporting leagues that is less than a year (e.g., creating teams based on the first and second half of the year), varying the entry dates for sports (e.g., using the 1st of June for rugby and the first of January for football), and making coaches and talent scouts aware of the problem so that they are less likely to select players based purely on size. We hope this paper brings the problem to the attention of sports teams and sports governing bodies in Australia.

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