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Original research

From entry to elite: The relative age effect in the Australian football talent pathway

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ABSTRACT

Objectives: This study aimed to assess the first instance and prevalence of the Relative Age Effect (RAE) in the male Australian Football (AF) talent development pathway through to the Australian Football League (AFL).
Design: Retrospective cross-sectional analysis.
Methods: Birthdate distribution was accessed from an U10–U12 AF academy trial (n = 514), U13–U19 AF academy players (n = 408), AFL state, national and international combines (n = 2989), AFL Rising Star nominees (n = 50) and the top ten AFL Brownlow vote recipients (n = 50) between 2013–2017.
Results: Chi-squared analysis showed significant overrepresentation to early born players in the selection year for both quartile and half-year compared to the previously known distribution at different stages of the talent pathway. Odds ratio demonstrated bias to players born in quartiles one and two of the selection year compared to players born in quartile four in every cohort examined.
Conclusions: RAEs appear between ages 10–12 in the male AF development pathway and continue to senior professional competition. RAEs are amplified as the competition for positions increases and at points where selection cut-offs occur. Interestingly, players receiving votes for the AFL's best and fairest award were 12.6 times more likely to be born in the first half of the year. This may suggest a latent effect, which has long term benefits for relatively older players. Nonetheless, the RAE affects career progression in a male AF talent pathway.

Practical implications

- Coaches, selectors and sport scientists should attempt to mitigate the relative age effect, especially when competition for selection occurs. For example, they could assist in capping the percentage of first half-year born players (i.e. limiting to 50% of the selected cohort).
- Specific emphasis needs to be placed on retaining relatively younger players in each age cohort, especially throughout the initial stages of a talent pathway. This will provide greater opportunity for relatively younger players long term development, and increase the quality of talent coming through development programmes.
- There may be potential long-term latent effects of the RAE, influencing physical, cognitive and psychological competencies through to adulthood sport.

1. Introduction

Age stratified youth sport competitions aim to provide equal opportunity for each player to develop the requisite physical, perceptual-cognitive, motor skill and psychological competencies to succeed. However, within-group differences in youth athletes' relative age (i.e. specific age at certain cut off points in the competition year) may provide greater opportunity to those born earlier in the selection year (i.e. Relative Age Effect [RAE]).[1,2,3] This includes exposure to high-level coaching, greater resources through talent development programmes and greater exposure to talent scouts and recruiters. The RAE has been established across skill levels (i.e. elite, sub-elite, amateur) and age cohorts in team sports such as ice hockey,[4] soccer,[5,6] basketball[7] and rugby league[8] among others. Generally, early born players (determined by birth and cut off dates) tend to be more biologically mature (determined by genes and the environment) compared to later born counterparts[9,6] and possess favourable sport-specific performance characteristics such as greater stature, body mass, speed, strength, aerobic endurance and power.[10,11,12] As such, relatively younger players who do not

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possess these performance characteristics are often deselected or drop out of talent development programs,[9,13] which limits relatively younger players' opportunities for career progression (i.e. progression through the pathway within AF).

Understanding and improving the career progression and development process remains a focus for sporting organisations because of the considerable resources invested into identifying and developing young talent.[14] Thus, optimising the talent development pathway from youth to professional adult sport is especially relevant to organisations with the perennial challenge of providing equitable opportunity to all athletes, whilst focusing on those with potential for professional careers. In Australian Football (AF) for example, 50.5% of the 911 drafted players between 2006–2012 seasons had participated in one stage of a talent pathway.[15] These results show the role a talent development pathway plays in developing and sustaining expert sport performance. Interestingly, relatively older athletes were more likely to be deselected as they progressed in the pathway. Therefore, the RAE may be more prominent in younger cohorts, where relative age differences may greatly confound physical characteristics and performance.

The confounding effect of age variations is likely stronger in younger than older age cohorts because the same absolute age difference represents a greater relative age difference for younger than for older athletes. For example, a 10-year-old born in the first three months of the year may be 5–10% older than a player born in the last three months of the year. In contrast, an 18-year-old player born in quartile one may be 3–4% older compared to quartile four born players. Nonetheless, only Under-16 (U16) and Under-18 (U18) state level and drafted players were considered in the previous study.[15] Thus, these samples do not represent the complete youth sport pathway to professional competition, and therefore lack the ability to gauge how the RAE affects career progression from first entry into AF until successful performance at senior level.

In AF, an established talent pathway exists where players can progress from development squads to state selection, then draft contention culminating at testing combines (i.e. a yearly 'showcase' of potential talent to clubs and recruiters, where players perform physical and technical tests) and potential Australian Football League (AFL; the professional competition) selection. Within this pathway, several AFL clubs have established youth academies. These programs aim to increase the talent pool for each club's specific region, facilitate and accelerate skill development and provide players with a progression into professional competition. Many AF academy programs recruit athletes from 11–13 years. Whilst the focus of these academy's is long term player development, the representative level of competition and inevitable continuous selection and deselection of aspiring athletes' forces organisations to realign resources to athletes who are perceived to have the greatest potential to succeed.[16]

In previous research on high-level youth AF players, coaches tended to favour the selection of early maturing players.[17] Recently, an assessment of policy changes on the RAE in national (age = 18.3 ± 0.8 years), state (age = 19.1 ± 1.7 years) and U16 (age = 15.9 ± 0.4) combines was observed, whilst concomitantly attempting to determine the origin of the RAE in an AF talent pathway.[18] Although RAEs were reported in each cohort, it is likely that the RAE occurs much earlier than the U16 level. For example, RAEs are evident in high-level U12 and U14 soccer teams,[5] and in U9–U16 English Premier League academies.[19] In rugby league, a RAE was reported in U7–U18 cohorts.[8] Clearly, ignoring younger age groups in determining the role of relative age in the career progression of youth AF players underestimates its confounding effect in the talent development process. Thus, there is a need to assess younger cohorts within the high-level pathway to accurately determine where and how the RAE presents in younger age groups.

While there is evidence of the RAE in AF,[20,15,18] no research has evaluated the presence and prevalence throughout a talent pathway from trialling for a place on an academy roster, participation in an academy, to draft selection and AFL competition. Therefore, this study retrospectively investigated the birthdate distributions from a high-level academy, athletes participating in AFL state, national and international combines, players nominated for a Rising Star Award and AFL Brownlow medal contenders to examine the prevalence and first appearance of the RAE in an AF talent pathway from first entry to the pinnacle of an AF career. It was hypothesised that the RAE would be present in every cohort. Additionally, it was expected that the highest RAEs would be present during adolescence and at selection points (i.e. where coaches select players for further development, whilst concomitantly deselecting others). Similar to previous research,[2] RAEs were then expected to progressively decrease at higher competition levels as physical profiles become homogenous, and absolute age differences represent smaller proportional age differences.

2. Methods

This study used a retrospective, cross-sectional analysis to assess the first instance and prevalence of the RAE in an AF talent pathway. Date of birth data was collected from U10–U12 high-level academy trials ($n = 514$, age: 10.9 ± 0.9 years), young academy players aged U13–U15 ($n = 277$, age: 13.6 ± 0.9 years), older academy players aged U16–U19 ($n = 131$, age: 16.4 ± 1.0 years), AFL state, national and international combines ($n = 2989$, age: 17.7 ± 2.8 years), Rising Star nominees ($n = 115$, age: 20.1 ± 0.3) and AFL Brownlow Medallist contenders (i.e. top 10 votes received) ($n = 50$, age: 26.2 ± 2.7 years). The project received ethical clearance from the University of Technology, Sydney (UTS) Human Research Ethics Committee.

The 'U12 $\text{Academy}_{\text{Trial}}$' group consisted of young boys trialling for the high-level academy. The 'U12 $\text{Academy}_{\text{Selected}}$' group consisted of the boys selected into the academy from the trial group. Both groups consisted of boys aged U10–U12. The 'U15 Academy' had players aged U13–U15 who were training within the academy. The 'U15 $\text{Academy}_{\text{Selected}}$' group were players selected to progress within the academy (i.e. from the U15 age group into the U16 program). The 'U19 Academy' consisted of players aged U16–U19 training within the academy. The '$\text{Combines}_{\text{Trialled}}$' and '$\text{Combines}_{\text{Drafted}}$' groups consist of players who participated in AFL-organised state, national and international combines. Birthdate data from 2015, 2016 and 2017 was analysed. The '$\text{AFL}_{\text{RisingStarNominees}}$' cohort consists of young players from 2013–2017 who were deemed to have performed well by a panel of AF experts. To be eligible for the award, a player must be younger than 21 years at the 1 st of January of the award year and played less than 10 senior matches before the beginning of the season. One player that meets these criteria is nominated per round by a panel of AF experts. The '$\text{AFL}_{\text{BrownlowVotes}}$' cohort consists of the top ten players from the 2013–2017 seasons who received the most votes from the officiating field umpires of each game of the home and away season in that year. This award is considered the highest honour of the game and is awarded to the 'Best and Fairest' player.

Players were classified into their respective birth quartiles (Q1: January – March, Q2: April – June, Q3: July – September, Q4: October – December) and birth halves (H1: January – June, H2: July – December) based on their birthdate. For each subsample of the academy dataset, corresponding birth quarter and birth-half distributions were obtained from the Australian Bureau of Statistics for all monthly live births between 1998 and 2007.[21] As the birthdates for the combines, Rising Star nominees and Brownlow

Medallists contenders ranged considerably, no general population comparison was attained.

Chi-square ($\chi 2$) analyses assessed the birth distributions for each cohort compared to expected birth quartile and birth-half distributions. For each cohort excluding the U12 $Academy_{Trial}$, the distributions were compared and analysed to the previous group (i.e. the distribution of the sample from which the observed sample originated) in relation to the chi-square analysis. For example, U12 $Academy_{Selected}$ group distributions were analysed and compared to the U12 $Academy_{Trial}$ group. The distributions were compared to the previous level to gauge how the RAE developed in comparison to where the group originated from. Odds Ratios (OR) and associated 95% Confidence Intervals (CI) were calculated to represent the odds of being born in Q1, Q2 and Q3 compared to Q4, and in H2 versus H1 for each cohort. When comparing birth distributions, the relatively youngest members (i.e. Q4 & H2) were the reference group for the OR analyses.[2] All statistical analyses were conducted using Microsoft Excel (Microsoft, Redmond, WA, USA).

3. Results

Table 1 demonstrates the quartile and half-year distributions and chi-square analyses for all cohorts, along with the 10–12, 13–15 and 16–19-year-old Australian population distributions. Chi-square analyses revealed significant birth quartile and half year differences at different stages of the talent pathway. The initial trial cohort significantly differed to the Australian population (U12 $Academy_{Trial}$, $\chi 2 = 10.00$, $p < 0.05$). The older cohorts demonstrated significant birth quartile differences between the cohort and the sample from where the cohort originated (U19 Academy, $\chi 2 = 11.29$, $p < 0.05$; $Combines_{Trialled}$, $\chi 2 = 152.42$, $p < 0.001$; $AFL_{BrownlowVotes}$, $\chi 2 = 18.18$, $p < 0.001$).

Table 2 shows the OR and their 95% CI for the odds of belonging to a particular quartile and half-year subgroup. The OR analyses revealed greater odds of being born in Q1 vs Q4, Q2 vs Q4 and HI vs H2 at every level of the talent pathway. The ORs revealed that players selected for either entrance into the academy (i.e. U12 Academy) or continual transition in the academy program (i.e. U15 $Academy_{Selected}$ and U19 Academy) were more likely to have been born in the first two quartiles of the selection year compared to the fourth quartile. Fig. 1 shows the quartile distributions of an AF talent pathway.

4. Discussion

The purpose of this investigation was to examine the prevalence and first instance of the RAE throughout an AF talent pathway utilising birthdate data from an AF academy, AFL state, national and international combines and the AFL. The findings suggest a clear and substantial bias towards Q1 and Q2 born players throughout the entire pathway, appearing in the U10–U12 cohorts. The chi-square analysis demonstrated evidence of the RAE at different stages throughout the talent pathway when compared against the cohort's previous group of origin. Additionally, OR analyses revealed players born in Q1 and Q2 were more likely to be involved in a high-level AF development program compared to players born in Q4. These odds peak in the U19 Academy cohort, with players 5.7 times more likely to be born in Q1 compared to Q4. Most notably, as competition for a smaller number of selection positions occurs, RAEs are amplified. Specifically, in the U12 $Academy_{Selected}$ cohort, 61.8% were born in the first half of the year. These results are similar to the U15 $Academy_{Selected}$ cohort (61%) and the U19 Academy, $Combine_{Trialled}$ and $Combine_{Drafted}$ cohorts (65.4, 60 and 59.1%, respectively).

In youth male sports, player progression is facilitated through talent development pathways characterised by continuous selection and deselection processes.[22,23,9] The current findings are consistent with an assessment of the RAE in the United Kingdom's rugby league development pathway.[8] In cohorts where selection for a smaller number of positions occurred, RAEs were amplified. They report players selected for an U15 national camp were 7.2 times more likely to be born in Q1 compared to Q4. Consistent with these selection biases to early born players, players in the present study selected to transition into the U16 development program were two times more likely to be born in Q1 compared to Q4. Although there is disparity in the size of the odds (potentially due to the different sports observed), Q1 born players are still provided a clear and significant advantage over relatively younger peers. However, these odds decrease to 2.1 times in the $Combines_{Drafted}$ cohort, with the $AFL_{RisingStarNominees}$ reducing further to 1.8 times for first half-year born players compared to second half-year born players. The reduction in odds demonstrates a decrease in the chances of being born in the first half of the year compared to the second as the pathway progresses. These findings are consistent with research in high-level junior AF players, highlighting that relatively older players are actively deselected or drop out as they progress into higher-level AF.[15]

In contrast, players in the top ten recipients for the AFLs best and fairest award are 12.6 times more likely to be born in the first half of the year. Although it is difficult to determine the reasons for the large bias, and the lack of longitudinal analyses makes it impossible to establish causation, it may be explained by greater exposure throughout a talent pathway providing relatively older players with greater chance to develop sporting expertise. Moreover, relatively older players are more frequently exposed to leadership roles throughout their development and schooling,[24] resulting in well-developed leadership skills throughout adulthood. Regardless, these findings indicate that the effect of relative age on career progression in AF may be latent where relatively older athletes may be advantaged well into their AF careers. Future research is required to examine this concept.

Previously, youth players born late in the selection year have shown higher dropout rates in soccer[13,9] and ice hockey.[1,25] As such, sport programs may systematically exclude later born players because of their lack of physical development compared to early born players.[9] A potential solution to mitigate the systematic exclusion of players based on relative age may be to eliminate the deselection process during adolescence. In support, the U15 Academy cohort in this study showed the smallest overrepresentation of Q1 and Q2 born players compared to Q4 born players, respectively (27.8%, 25.3% & 24.2%). During this period in the academy, no active deselection occurred until the conclusion of the season for the U15 age group only. Prior to this, the players develop through the U13 and U14 seasons without the chance of being deselected. As such, this evidence suggests that eliminating active deselection may be a potential method to reduce the RAE, allowing players to develop and have continual exposure to higher-level coaching and resources. However, evidence from soccer suggests that repeated incidences of selection and deselection throughout youth development, rather than long-term continuous presence in an academy, may be more beneficial to reaching professional playing status.[22] Future research should aim to address whether the avoidance of a deselection process during high-level development is beneficial for playing professional AF.

This study analysed the RAE in a 'typical' pathway from initial entry into an academy through to senior elite competition. Despite its clear strengths, some limitations need to be considered. The data collected was only from one high-level youth academy, so may not be representative of an entire AF pathway. Furthermore, there was missing date of birth data in the combines dataset. As

Table 1
Distribution of birth date data for academy players, AFL Combines, Rising Star Nominees and top 10 Brownlow Votes recipients.

	Birth quartile							Half-year		
	N	Age	Q1 (n, %)	Q2 (n, %)	Q3 (n, %)	Q4 (n, %)	χ2	H1 (n, %)	H2 (n, %)	χ2
Australian population 10–12 years	831 514		203 063 (24.4%)	206 222 (24.8%)	215 141 (25.9%)	207 088 (24.9%)		409 285 (49.2%)	422 229 (50.8%)	
U12 $Academy_{Trial}$	514	10.9 ± 0.9	136 (26.5%)	150 (29.2%)	124 (24.1%)	104 (20.2%)	10.00*	286 (55.6%)	228 (44.4%)	8.54*
U12 $Academy_{Selected}$	89	10.7 ± 0.9	27 (30.3%)	28 (31.5%)	15 (16.9%)	19 (21.3%)	2.67	55 (61.8%)	34 (38.2%)	1.37
Australian population 13–15 years	756 405		188 118 (24.9%)	186 700 (24.7%)	194 759 (25.7%)	186 828 (24.7%)		374 818 (49.6%)	381 587 (50.4%)	
U15 Academy	277	13.6 ± 0.9	77 (27.8%)	70 (25.3%)	63 (22.7%)	67 (24.2%)	10.71*	147 (53.1%)	130 (46.9%)	8.94*
U15 $Academy_{Selected}$	41	14.9 ± 0.3	12 (29.3%)	13 (31.7%)	9 (22%)	7 (17%)	1.57	25 (61%)	16 (39%)	1.03
Australian population 16–19 years	1 012 346		252 553 (24.9%)	252 706 (25%)	259 612 (25.6%)	247 475 (24.5%)		505 259 (49.9%)	507 087 (50.1%)	
U19 Academy	131	16.4 ± 1.0	53 (40.5%)	32 (24.4%)	32 (24.4%)	14 (10.7%)	11.29*	85 (64.9%)	46 (35.1%)	0.84
$Combines_{Trialled}$	2989	17.7 ± 2.8	982 (32.9%)	809 (27.1%)	698 (23.3%)	500 (16.7%)	152.42**	1791 (59.9%)	1198 (40.1%)	32.24**
$Combines_{Drafted}$	181	18.4 ± 1.2	61 (33.7%)	46 (25.4%)	39 (21.5%)	35 (19.4%)	1.25	107 (59.1%)	74 (40.9%)	0.04
$AFL_{RisingStarNominees}$	115	20.1 ± 0.8	42 (36.5%)	24 (20.9%)	32 (27.8%)	17 (14.8%)	4.54	66 (57.4%)	49 (42.6%)	0.14
$AFL_{BrownlowVotes}$	50	26.2 ± 2.7	17 (34%)	22 (44%)	6 (12%)	5 (10%)	18.18**	39 (78%)	11 (22%)	8.69**

Notes: χ2, Chi-square.
* $p < 0.05$.
** $p < 0.001$.

Table 2
Odds Ratios (and 95% confidence intervals) for distribution of birth dates in academy players, AFL combines, Rising Star nominees and top 10 Brownlow votes recipients. These odds are calculated in reference to quartile four, and the second half of the year

	Birth quartile				Half-Year
	N	Q1v Q4	Q2v Q4	Q3v Q4	H1v H2
U12 $Academy_{Trial}$	514	1.4 (1.06–1.89)	1.6 (1.21–2.16)	1.3 (0.93–1.68)	1.6 (1.23–2.01)
U12 $Academy_{Selected}$	89	1.6 (0.81–3.16)	1.7 (0.86–3.32)	0.7 (0.35–1.58)	2.6 (1.42–4.79)
U15 Academy	277	1.2 (0.82–1.76)	1.1 (0.72–1.55)	0.9 (0.62–1.36)	1.3 (0.91–1.78)
U15 $Academy_{Selected}$	41	2.0 (0.69–5.77)	2.3 (0.79–6.41)	1.4 (0.45–4.10)	2.4 (1.00–5.92)
U19 Academy	131	5.7 (2.94–10.93)	2.7 (1.36–5.34)	2.7 (1.36–5.34)	3.4 (2.05–5.67)
$Combines_{Trialled}$	2989	2.4 (2.16–2.76)	1.9 (1.63–2.10)	1.5 (1.34–1.73)	2.2 (2.01–2.47)
$Combines_{Drafted}$	181	2.1 (1.31–3.42)	1.4 (0.86–2.33)	1.1 (0.68–1.91)	2.1 (1.37–3.17)
$AFL_{RisingStarNominees}$	115	3.3 (1.75–6.29)	1.5 (0.77–3.01)	2.2 (1.15–4.29)	1.8 (1.08–3.06)
$AFL_{BrownlowVotes}$	50	4.6 (1.55–13.84)	7.1 (2.40–20.81)	1.2 (0.34–4.31)	12.6 (4.87–32.38)

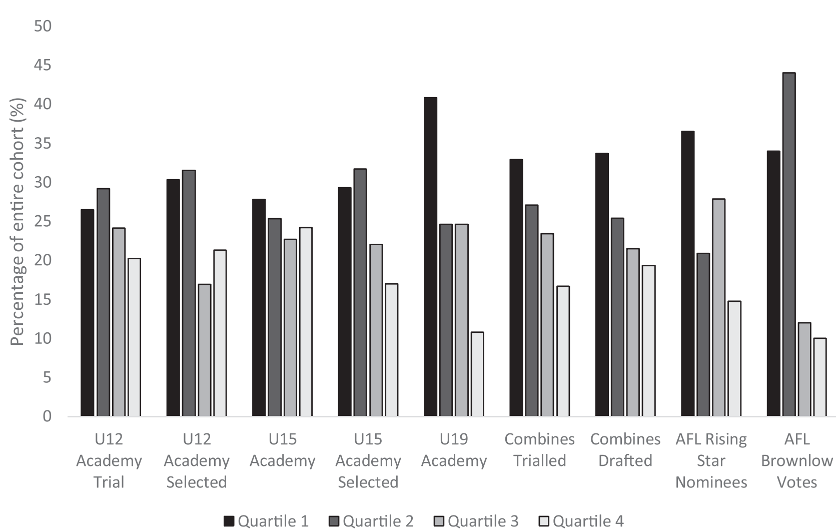

Fig. 1. Quartile distributions (%) of AF players in a talent pathway.

such, these missing values were not included in the analyses. However, the observation of specific selection points throughout an AF talent pathway enhances the understanding of the RAE and how it develops. Whilst it also must be considered that the study is cohort cross-sectional, and therefore no causation can be established. Nonetheless, the extensive dataset allowed comparison to the Australian population and to a reference cohort from which the observed sample originated. Future research should aim to analyse the birthdate data from numerous AF academies, rather than just one, and use longitudinal follow up to assess whether being relatively older throughout a development pathway is advantageous for career progression.

5. Conclusion

This study examined the birth quartile and birth-half distributions through an AF talent pathway. The substantial RAE evident highlights important findings not previously reported in younger cohorts and confirms the outcomes from research involving older, high-level AF players. There was a strong bias towards players born in Q1 and the first half of the year for all cohorts observed. Specifically, the RAE was evident in athletes aged U10–U12 and was amplified at points where competition for selection occurred. This is the first study to show that RAEs may affect career progression before being selected into a high-level AF development pathway at U16. Although the RAE was present in all cohorts and an overrepresentation of players born in Q1 was apparent, the RAE was not as substantial in the U15 Academy cohort. Nonetheless, this study highlights the RAE exists in AF athletes as young as 10 years and highlights its prevalence throughout a talent pathway, with peaks occurring when players are actively selected or deselected. Further, the presence of a RAE in professional adult AF counters recent evidence arguing the 'evening out' of the RAE in adulthood. The prevailing RAE in adulthood indicates that stronger strategies must be implemented to have a stronger mitigation effect on the RAE. Despite increased awareness of the RAE, coaches and practitioners should be assisted with evidence-based strategies to prevent an overrepresentation of relatively older players throughout the developmental pathway in AF.

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References

1. Barnsley RH, Thompson AH, Barnsley PE. Hockey success and birthdate: the relative age effect Can Assoc Health. *Phys Educ Rec* 1985; 51:23–28.
2. Cobley S, Baker J, Wattie N et al. Annual age-grouping and athlete development: a meta-analytical review of relative age effects in sport. *Sports Med* 2009; 39(3):235–256.
3. Smith KL, Weir PL, Till K et al. Relative age effects across and within female sport contexts: a systematic review and meta-analysis. *Sports Med* 2018; 48(6):1451–1478.
4. Barnsley R, Thompson G. Birthdate and success in minor hockey: the key to the NHL. *Can J Behav Sci* 1988; 20(2):167–176.
5. Helsen WF, Winckel JV, Williams AM. The relative age effect in youth soccer across Europe. *J Sports Sci* 2005; 23(6):629–636.
6. Carling C, le Gall F, Reilly T et al. Do anthropometric and fitness characteristics vary according to birth date distribution in elite youth academy soccer players? *Scand J Med Sci Sports* 2009; 19(1):3–9.
7. Delorme N, Chalabaev A, Raspaud M. Relative age is associated with sport dropout: evidence from youth categories of French basketball. *Scand J Med Sci Sports* 2011; 21(1):120–128.
8. Till K, Cobley S, Wattie N et al. The prevalence: influential factors and mechanisms of relative age effects in UK rugby league. *Scand J Med Sci Sports* 2010; 20(2):320–329.
9. Figueiredo AJ, Gonçalves CE, Coelho E et al. Characteristics of youth soccer players who drop out, persist or move up. *J Sports Sci* 2009; 27(9):883–891.
10. Till K, Cobley S, O'Hara J et al. Considering maturation status and relative age in the longitudinal evaluation of junior rugby league players. *Scand J Med Sci Sports* 2014; 24(3):569–576.
11. Malina RM, Eisenmann JC, Cumming SP et al. Maturity-associated variation in the growth and functional capacities of youth football (soccer) players aged 13–15 years. *Eur J Appl Physiol* 2004; 91(5–6):555–562.
12. Malina RM, Rogol AD, Cumming SP et al. Biological maturation of youth athletes: assessment and implications. *Br J Sports Med* 2015; 49(13):852–859.
13. Helsen WF, Starkes JL, Van Winckel JV. The influence of relative age on success and drop out in male soccer players. *Am J Hum Biol* 1998; 10(6):791–798.
14. Williams AM, Reilly T. Talent identification and development in soccer. *J Sports Sci* 2000; 18(9):657–667.
15. Cripps AJ, Hopper LS, Joyce C et al. Pathway efficiency and relative age in the Australian football league talent pathway. *Talent Dev Excellence* 2015; 7(1):3–11.
16. Vaeyens R, Lenoir M, Williams AM et al. Talent identification and development programmes in sport: current models and future directions. *Sports Med* 2008; 38(9):703–714.
17. Tribolet R, Bennett KJM, Watsford ML et al. A multidimensional approach to talent identification and selection in high-level youth Australian football players. *J Sports Sci* 2018; 36(22):2537–2543.
18. Haycraft JAZ, Kovalchik S, Pyne DB et al. The influence of age-policy chances on the relative age effect across the Australian rules talent pathway. *J Sci Med Sport* 2018; 21(10). http://dx.doi.org/10.1016/j.jsams.2018.03.008.
19. Johnson A, Farooq A, Whiteley R. Skeletal maturation status is more strongly associated with academy selection than birth quarter. *Sci Med Football* 2017; 1(2):157–163.
20. Coutts AJ, Kempton T, Vaeyens R. Relative age effects in Australian football league national draftees. *J Sports Sci* 2014; 32(7):623–628.
21. Australian Bureau of Statistics. Births, by year and month. Retrieved from http://stat.data.abs.gov.au/Index.aspx?DataSetCode=BIRTHS_MONTH_OCCURRENCE. Accessed 12 July 2017.
22. Güllich A. Selection: deselection and progression in German football talent promotion. *Eur J Sport Sci* 2014; 14(6):530–537.
23. Sherar LB, Baxter-Jones ADG, Faulkner RA et al. Do physical maturity and birthdate predict talent in male youth ice hockey players? *J Sports Sci* 2007; 25(8):879–886.
24. Dhuey E, Lipscomb S. What makes a leader? Relative age and high school leadership. *Econ Educ Rev* 2008; 27(2):173–183.
25. Lemez S, Baker J, Horton S et al. Examining the relationship between relative age: competition level, and dropout rates in male youth ice hockey players. *Scand J Med Sci Sports* 2013; 24(6):935–942.