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SPORTS PERFORMANCE

The influence of initial selection age, relative age effect and country long-term performance on the re-selection process in European basketball youth national teams

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ABSTRACT

The aims of the study were to: (a) analyse the re-selection patterns in European youth basketball national teams, and (b) investigate how the chance of re-selection is influenced by the initial selection age and relative age of the players, as well as the long-term performance of the country at the youth level. The sample consisted of 8362 basketball players (5038 men, 3324 women) born 1988–1997 who have participated in at least one U16, U18 or U20 European youth basketball championship between 2004 and 2017. The results from the survival analysis showed that around 75% of male and 80% of female players participating in a championship were re-selected the following year. Also, initial selection age, relative age effect, and the country long-term performance influenced the re-selection rates, with relationships being different between men and women. To conclude, the results of the present study show that the re-selection process by which players progress in European youth national basketball teams is complex and influenced by several different factors.

ARTICLE HISTORY
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KEYWORDS
Talent identification; talent development; selection; team sport; survival analysis

Introduction

Talent identification and development is of primary interest for clubs and federations in their pursuit to develop elite players and achieving success. National sporting organisations and federations are investing large amounts of money in creating programmes and pathways to develop talent. In the context of team sports, the federations main talent development programme is generally the youth national teams. For example, in basketball, more than 250 national teams and 3000 players participate each summer in the male and female U16, U18, and U20 European youth championships (FIBA, 2018). It has also generated significant interest from scholars, and considerable amount of research has been conducted within this field (Johnston et al., 2018).

Previous research on both individual and team sports have shown that the national team programmes are not characterised by an initial selection and then long-term nurturing of talented athletes, but rather of a dynamic process of selection, re-selection and de-selection (Barth et al., 2018; Güllich, 2013). For example, between 1992 and 1998 approximately half of the athletes in German Olympic sports national team programmes remained selected from one season to the next (Güllich & Emrich, 2012), while slightly more (59%) in the male soccer youth national teams (Güllich, 2013). Further, between half and two-thirds of the players competing in youth national teams in soccer, volleyball, and handball were re-selected for the subsequent age category (Barreiros et al., 2012; Wrang et al., 2018). In general, players seem to be initially selected into the youth national team programmes at varying ages, and either remain in the programme by being re-selected from one year to the next or drop out of the programme by being de-selected at some stage after the initial selection (for a detailed description of this process in basketball youth national teams, see Figure 1).

While there are several studies on the proportion of players that gets re-selected, there is, however, limited research on which factors might affect the probability of getting re-selected. In one of the few existing studies, Wrang et al. (2018) found that players in the Danish male U19 handball national team born later in the year, or a year later, had higher chances of being selected for the U21 team than their relatively older team-mates. This inverse relative age effect has also been found in the progression from youth to senior of initially selected players in other team sports (Gil et al., 2020; McCarthy et al., 2015). In basketball, Arrieta et al. (2016) showed that there exists a relative age effect in the European youth championship, where players born early in the year are over-represented. However, this effect was smaller in the older age categories, which suggest the possibility of an inverse relative age effect on the re-selection process.

Apart from the relative age effect, another factor that might influence the re-selection process is the age at which players are selected into the youth national teams for the first time, as a later initial selection has been shown to increase chances of reaching the senior national team (Schroepf & Lames, 2018). Earlier studies have also found that strategic and organisational factors influence talent development programmes, and sporting success (De Bosscher & De Rycke, 2017; De Bosscher et al.,

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Supplemental data for this article can be accessed on the here.

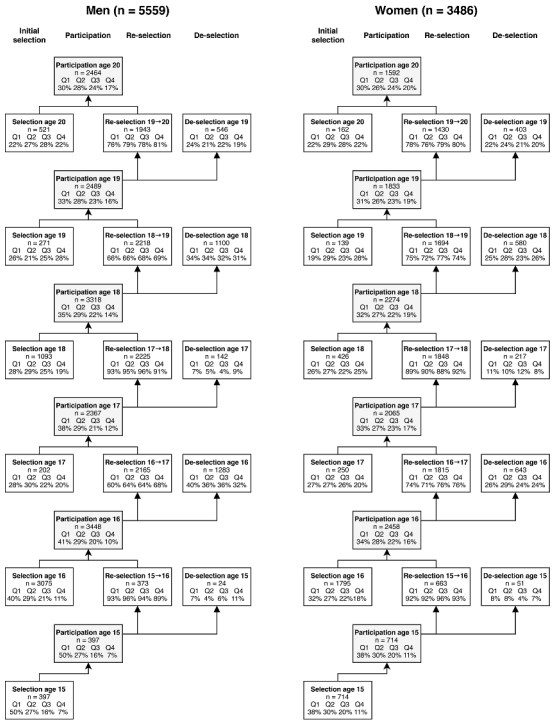

Figure 1. Flowchart of initial selection, participation, re-selection and de-selection in the European basketball youth championships. For initial selection and participation, percentage indicate distribution between birth quarters. For re-selection and de-selection, percentage indicate proportion of players within each birth quarter.

2015), which can reveal itself in a relationship between long-term success and re-selection strategies.

Although studied in other individual and team sports, the proportion of re-selected players has not been studied in basketball. Further, to our knowledge, only one previous study has analysed factors that might influence the re-selection process. Therefore, the aims of the study were to: (a) analyse the re-selection patterns in European youth basketball national teams, and (b) investigate how the chance of re-selection is influenced by the initial selection age and relative age of the players, as well as the long-term performance of the country at the youth level. We hypothesise that: (a) players initially selected at a later age will have a higher chance of re-selection, and (b) that amongst the selected players, players born later in the year will have a higher chance of re-selection. Due to the lack of previous research, we did not pose any hypothesis for the relationship between the county long-term performance and chance of re-selection.

Method

Sample

The total sample composed 9045 players (5559 men, 3486 women) born 1988–1997 that had been selected and participated in at least one U16, U18 or U20 European youth basketball championship between 2004 and 2017. The players represented in total 46 different countries, with male players from 46, and female from 37 different ones. Of these players, 683 were initially selected at age 20 and did therefore not participate in any youth national team re-selection process. They were therefore not included in the analysis.

Variables and procedure

For each player, information about youth championship participations, date of birth, and nationality, together with the ranking points of the country was gathered from the official data archive of the International Basketball Federation (archive.fiba.com) in January 2020. Player age was calculated by subtracting the players' year of birth from the year of the championship. To analyse the effect of relative age on the re-selection process, players born in January–March were categorised as quarter 1, April–June as quarter 2, July–September as quarter 3 and October–December as quarter 4. The players' first participation in a championship was recorded as their initial selection age. As a measure of country long-term performance, the ranking points of each country was used. The ranking points are given separately for men and women based on the performance of the youth national teams over the last eight seasons. The ranking points were standardised within each gender to range from zero to one.

Data analysis

For the analysis, we created one observation for each season a player had the chance to being re-selected, with a dichotomous variable indicating if the player was re-selected or not (re-selection = 1, de-selection = 0). For example, a player that was initially selected at age 16, participated at age 16 and 17, and de-selected at age 18, would have two observations; one at age 17 indicating re-selection and one at 18 indicating de-selection. As the ranking points were skewed, they were log-transform with base two and centred around its median within each gender. Birth quarter was treated as a continuous variable and centred.

The number of players that were initially selected, participated, were re-selected and were de-selected are presented for each player age. The percentage of initially selected and participating players that are born in each quarter, and the percentage of players within each quarter that were re-selected or de-selected was calculated. Further, the percentage of players that were re-selected, and the percentage of selected players who remained selected up until and including each player age was calculated.

The survival analysis was made by modelling the chance of re-selection using a Bayesian multilevel logistic regression (Austin, 2017), with separate intercepts and effects for men and women, ranking points and birth quarter as fixed effects nested within gender, and the combination of initial selection age and player age as random effect (named category). Four different models were fitted to test for the existence of interactions between variables: no interaction (Model 1), birth quarter × ranking points (Model 2), ranking points × category (Model 3), and birth quarter × category (Model 4). The models were compared using approximate leave-one-out cross-validation (LOO-IC), where lower values indicate better out-of-sample predictive performance.

Prior predictive simulations were used to choose non-informative priors that assigned roughly equal probability

on the outcome scale. Non-informative priors were chosen as not enough previous literature exist to justify more informed ones. The models were estimated using a Hamiltonian Monte Carlo algorithm with 5000 warm-up and 5000 sampling iterations.

The model intercepts represent the log odds for men and women to get re-selected. The model parameters for ranking points represent the log odds ratio between bottom and top-ranked countries and for birth quarter the log odds ratio between one quarter and the subsequent. And for category the standard deviation in log odds between the different categories.

Posterior predictive sampling was used for follow-up analysis of relative chance (relative risk) to be re-selected until age 20 for the different initial selection ages, ranking points and birth quarters. The chance of re-selection until age 20 was calculated by multiplying the chance of re-selection for each player age.

Compatibility intervals (CI) were calculated using the 95% highest-density intervals, representing the range in which the value lies with a 95% probability. The interpretation of the CI is that there is a 95% probability that the value falls in this range. All data preparation and statistical analysis were made in R 3.6.3 and STAN. The data and syntax are openly available in Open Science Framework at https://doi.org/10.17605/OSF.IO/DA7R9.

Results

The number of players who were initially selected, participated, were re-selected, and were de-selected at each age are presented in Figure 1, with the percentage of the selected and participating players born in each quarter, as well as the proportion of players born each quarter that was re-selected or de-selected. The proportion of players re-selected is presented in Table 1.

The ranking points × category interaction model (Model 3) showed the best out-of-sample predictive performance and was the only one that outperformed the no interaction model (Model 1). All the following results are therefore based on the ranking points × category interaction model. The model coefficients are presented in Table 2. For coefficients and out-of-sample performance of all models, see Supplementary Material 1.

The model coefficients and the interactions excluded suggest that the chance of re-selection varies between different initial selection ages and player ages. That there is a positive relationship between later birth quarter and higher chance of re-selection, with equal effect across initial selection age and player age. And that there is a positive relationship between higher ranking points and higher chance of re-selection for women, and possibly for men, with different effect for different initial selection age and player age.

When controlling for birth quarter, ranking point and category, it is unclear if there is a difference in re-selection chance between genders (intercept). The relationship between ranking points and re-selection chance is likely more substantial in women than men. The relationship between birth quarter and re-selection is similar for both genders.

Initial selection age

The relative chance of re-selection until age 20 between different initial selection ages is presented in Table 3. For men, the chance of re-selection until age 20 is lower for players initially selected at age 16 compared to all other ages. In general, there is a higher chance for players initially selected at age 15, 17 and 19 compared to age 16 and 18. For women, the chance for players initially selected at age 15 is higher compared to all other ages. The chance for players initially selected at age 17, 18 and 19 is similar to each other. The chance of remaining re-selected over the years for initial selection age is presented in Figure 2.

Relative age effect

The estimated marginal chance of re-selection until age 20 for players born in quarter 1 and quarter 4, together with the relative chance is presented in Table 4. Players born in quarter 4 have a higher chance of re-selection until age 20 than players born in quarter 1 in both genders and all initial selection ages. The chance of re-selection until age 20 over the years for quarters 1 and 4 can be seen in Supplementary material 2.

Country long-term performance

The estimated marginal chance of re-selection until age 20 in top and bottom-ranked countries, together with the relative chance is presented in Table 5. For men, players in top-ranked countries have a higher chance of re-selection until age 20 than players from bottom-ranked teams when initially selected at age 16 or

Table 1. Season-to-season and cumulative re-selection percentage by initial selection age and player age.

		Re-selection percentage						Cumulative percentage				
Initial selection	*n*	16	17	18	19	20	Mean	16	17	18	19	20
Men	5038											
Age 15	397	94.0	85.3	92.8	78.0	82.2	87.1	94.0	80.1	74.3	57.9	47.6
Age 16	3075		60.1	95.3	71.8	79.5	73.9		60.1	57.2	41.1	32.7
Age 17	202			84.2	77.1	80.9	80.9			84.2	64.9	52.5
Age 18	1093				54.3	82.0	64.1				54.3	44.6
Age 19	271					57.9	57.9					57.9
Mean		94.0	62.8	94.0	66.8	78.1	74.2	94.0	62.4	60.6	46.5	38.6
Women	3324											
Age 15	714	92.9	91.7	92.3	82.4	81.4	88.8	92.9	85.2	78.6	64.7	52.7
Age 16	1795		67.2	92.0	78.1	80.5	78.0		67.2	61.9	48.4	38.9
Age 17	250			70.4	79.5	80.0	75.6			70.4	56.0	44.8
Age 18	426				52.6	81.2	62.5				52.6	42.7
Age 19	139					43.9	43.9					43.9
Mean		92.9	73.8	89.5	74.5	78.0	79.7	92.9	72.3	67.0	53.2	43.0

Table 2. Coefficient of final model and difference between genders.

				Women – Men		
		95% CI			95% CI	
	Est	LL	UL	Diff	LL	UL
Fixed effects						
Men: Intercept	1.32	0.87	1.75			
Women: Intercept	1.26	0.82	1.68	−0.06	−0.68	0.53
Men: Birth Quarter	0.11	0.07	0.16			
Women: Birth Quarter	0.09	0.04	0.14	−0.02	−0.09	0.04
Men: Ranking Points	0.25	−0.06	0.58			
Women: Ranking Points	0.70	0.35	1.07	0.45	−0.04	0.94
Random effects						
Category	0.79	0.42	1.26			
Category × Ranking Points	0.26	0.02	0.57			

Note. Coef = Model coefficient; CI = Confidence interval; LL = Lower Limit; UL = Upper Limit; Diff = Difference between coefficient for men and women.

Table 3. Relative chance of re-selection until age 20 between different initial selection ages.

	Men			Women		
		95% CI			95% CI	
Initial selection	RC	LL	UL	RC	LL	UL
Age 15 / Age 16	1.54	1.36	1.73	1.39	1.25	1.53
Age 15 / Age 17	0.95	0.78	1.13	1.17	0.99	1.37
Age 15 / Age 18	1.08	0.94	1.23	1.27	1.09	1.46
Age 15 / Age 19	0.92	0.78	1.09	1.21	0.97	1.50
Age 16 / Age 17	0.61	0.52	0.72	0.85	0.71	0.99
Age 16 / Age 18	0.70	0.63	0.77	0.92	0.79	1.06
Age 16 / Age 19	0.60	0.52	0.69	0.88	0.71	1.08
Age 17 / Age 18	1.15	0.96	1.34	1.09	0.90	1.32
Age 17 / Age 19	0.98	0.78	1.16	1.04	0.80	1.31
Age 18 / Age 19	0.85	0.73	0.99	0.96	0.73	1.19

Note. RC = Relative chance of re-selection until age 20 between initial selection ages; CI = Confidence interval; LL = Lower Limit; UL = Upper Limit.

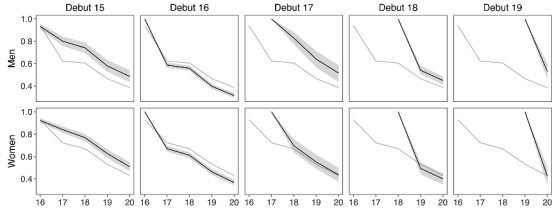

Figure 2. Chance of re-selection until age 20 by age at first selection, with 95% compatibility interval. Grey lines indicate chance of remaining re-selected for all players.

19. For women, the players in top-ranked countries have a higher chance of re-selection until age 20 than players from bottom-ranked teams regardless of initial selection age. The chance of re-selection until age 20 over the years in top and bottom-ranked countries can be seen in Supplementary material 2.

Discussion

This study aimed to analyse what factors influence the re-selection process in European youth basketball national teams. We found that overall, around 74% of male and 80% of female players participating in a European championship were re-selected the following season, and around 40% of the players were continuously re-selected until the last year of youth championships. The re-selection probability was influenced by the initial selection age, the ranking of the country and an inverse relative age effect.

Table 4. Relative chance of re-selection until age 20 between players born in quarter 4 and quarter 1.

	Quarter 4			Quarter 1			Q4 / Q1		
		95% CI			95% CI			95% CI	
Initial selection	Est	LL	UL	Est	LL	UL	RC	LL	UL
Men									
Age 15	0.54	0.48	0.59	0.43	0.38	0.49	1.25	1.14	1.36
Age 16	0.37	0.33	0.40	0.27	0.24	0.29	1.38	1.22	1.55
Age 17	0.57	0.49	0.64	0.46	0.39	0.54	1.22	1.13	1.33
Age 18	0.50	0.46	0.54	0.40	0.36	0.44	1.24	1.13	1.33
Age 19	0.57	0.50	0.64	0.49	0.42	0.56	1.17	1.09	1.25
Women									
Age 15	0.55	0.50	0.60	0.47	0.42	0.51	1.18	1.07	1.29
Age 16	0.41	0.37	0.45	0.33	0.29	0.36	1.26	1.09	1.42
Age 17	0.48	0.41	0.54	0.40	0.33	0.46	1.21	1.07	1.35
Age 18	0.44	0.39	0.49	0.36	0.31	0.42	1.20	1.07	1.33
Age 19	0.46	0.37	0.54	0.39	0.31	0.48	1.17	1.06	1.27

Note. Est = Estimated chance of re-selection until age 20; RC = Relative chance of re-selection until age 20 between birth quarters; CI = Confidence interval; LL = Lower Limit; UL = Upper Limit.

Table 5. Relative chance of re-selection until age 20 between top and bottom-ranked countries.

	Top ranked			Bottom ranked			Top/Bottom		
		95% CI			95% CI			95% CI	
Initial selection	Est	LL	UL	Est	LL	UL	RC	LL	UL
Men									
Age 15	0.53	0.42	0.63	0.48	0.43	0.54	1.09	0.83	1.33
Age 16	0.41	0.38	0.45	0.31	0.29	0.33	1.32	1.16	1.48
Age 17	0.57	0.44	0.69	0.51	0.44	0.59	1.12	0.84	1.38
Age 18	0.45	0.39	0.52	0.45	0.41	0.49	1.01	0.83	1.18
Age 19	0.75	0.64	0.86	0.53	0.46	0.59	1.43	1.14	1.75
Women									
Age 15	0.71	0.62	0.80	0.49	0.44	0.53	1.45	1.20	1.70
Age 16	0.52	0.46	0.58	0.35	0.33	0.38	1.47	1.23	1.72
Age 17	0.59	0.44	0.73	0.42	0.36	0.49	1.39	0.99	1.81
Age 18	0.57	0.46	0.68	0.39	0.34	0.44	1.49	1.11	1.89
Age 19	0.63	0.45	0.80	0.41	0.32	0.50	1.56	1.01	2.15

Note. Est = Estimated chance of re-selection until age 20; RC = Relative chance of re-selection until age 20 between top and bottom ranked countries; CI = Confidence interval; LL = Lower Limit; UL = Upper Limit.

The observed re-selection of around 74–80% is substantially higher than the 40–55% reported in German and Portuguese male football, as well as female volleyball national teams (Barreiros & Fonseca, 2012; Güllich, 2013). However, it is rather close to the reported value in Danish male handball national teams, where around 65% were re-selected over two seasons (Wrang et al., 2018). As there is still a high probability that players included in the sample can still make their senior national team debut, it was not considered in this study. However, looking at the roughly 40% of players who were re-selection until age 20, it is very similar to the junior-to-senior re-selection seen in various sports, including basketball (Barreiros & Fonseca, 2012; López de Subijana & Lorenzo, 2018; Wrang et al., 2018).

Initial selection age

As for the influence of age at initial selection, the results did not support our hypothesis that older selection age relates to higher re-selection chance. Female players initially selected at

age 15 had a higher chance of being re-selection until age 20 compared to all later initial selection ages. It is also noteworthy that over 20% of the female players had been initially selected at age 15, while less than 8% of the males had. This is in line with previously found earlier initial selection age and a higher number of youth championships for female national team athletes compared to their male counterparts (Barreiros & Fonseca, 2012; Kalén et al., 2017). Further, there were substantially fewer females than males selected at any time in the included sample. These results suggest that talented female basketball players are identified and selected earlier and are re-selected to a higher degree.

Male players had a higher chance of being re-selected until age 20 if they were initially selected at age 15, 17 or 19. As the European championships are played in U16, U18 and U20 categories, these are the years in which a player is underaged and will play against players one year older. Similarly, Wrang et al. (2018) found that Danish handball players playing in the U19 European championship at age 18 were more likely to be re-selected for the U21, and in U21 at age 20 more likely to reach the senior national team. In basketball, Steingröver et al. (2017) found underrepresentation of underage players in the German U16, but not U19 league, in line with our results. This constituent year effect is the between-years equivalence to the within-year relative age effect (Steingröver et al., 2017).

Relative age effect

We observed, in line with the relative age effect seen in earlier studies on youth national team players, a higher proportion of participating players born in the first two quarters of the year (Arrieta et al., 2016). The analysis of re-selection, however, showed that players born in the last quarter were 20–25% more likely to be re-selected until age 20, compared to players born in the first quarter. This is in line with our hypothesis of an inverse relative-age effect in the re-selection process. It also supports the suggestion that the reduction of relative age effect in older age groups (Arrieta et al., 2016) is, at least partly, driven by selected relatively younger players getting re-selected at a higher rate than their relatively older counterparts. The same higher re-selection rate of relatively younger players has also been shown in national team handball (Wrang et al., 2018). Moreover, studies in cricket, rugby and soccer revealed that, while relatively older players have a higher chance of initially getting selected, the relatively younger players who do manage to get selected have a higher chance at reaching senior professional level than their relatively older selected peers (Gil et al., 2020; McCarthy et al., 2015).

Two main hypotheses have been proposed to explain the higher success rate of relatively younger players (when comparing selected players), both regarding relative and constituent year effect. The first one is the underdog hypothesis, in which it is thought that for selected relatively younger players to be able to compete against the more mature ones, they need to have or develop superior psychological skills to be able to cope with playing against relatively older and more mature players (Cumming et al., 2018). However, there is currently weak support for this hypothesis, as relative age has not been shown to relate to self-regulation, nor physiological maturation (Cumming et al., 2018).

An alternative hypothesis is that the relatively younger players who manage to get selected perform as well as their relatively older peers since their superior skills compensate for the maturity disadvantage. As the players grow older, the maturity difference gets smaller and eventually disappears, and the relatively older players who relied on the maturity advantage do not perform as well (Fumarco et al., 2017; Gil et al., 2020). In other words, relatively younger players are to a higher degree initially selected based on factors relevant to the performance at the senior level; the talent identification and selection process work better on relatively younger players. This hypothesis is partly supported by the lack of correlation between performance and birth month in women's European youth basketball championships (Arrieta et al., 2016). However, in the same study, small but significant correlations were found for men, providing some evidence against it.

Country long-term performance

Comparing top to bottom-ranked countries, we found that male players initially selected at age 16 and 19 were 30% and 45% more likely to be continuously re-selected until age 20 if they come from top compared to bottom-ranked countries. This effect is even more evident for women, where the re-selection chance was 40–55% higher in top-ranked countries for all initial selection ages. It is worth to note that as ranking points are based on their results in the European youth championships over the last eight years, higher rank indicates that the country consistently performs better at the youth level. It has been shown that, at the senior level, a higher amount of experience from previous championships is related to higher performance in the European basketball championships (Kalén et al., 2017). There may exist a similar relationship at the youth level, which could mean that a higher re-selection of players results in better performance over time. However, it is also possible that if a team performs well, it is more likely that these players will be selected the following year.

Another potential explanation is that the re-selection proportion and long-term performance are both influenced by underlying factors, such as the structure and strategy of the national team programmes. Earlier studies have shown that there are differences in talent development programmes between countries (De Bosscher & De Rycke, 2017), and that better organisation and structure is related to higher sporting success (De Bosscher et al., 2015). We could, therefore, suspect that better organised national team programmes with a long-term strategy could both perform better over time and have a higher re-selection rate. For example, if the programme keeps the same base of coaches for several years, they might gain valuable experience on how to make the teams perform well. And the coaches' preference for certain players can increase the amount of re-selected players. Programmes that have a clearer idea of their goals, style of play and what type of players they are selecting can possibly both achieve greater performance, and select players perceived to be able to remain longer in the programme. The fact that the country's ranking affects the re-

selection chance more in women could support this explanation. As there are generally fewer resources invested in women's player development outside the national teams, the impact of a well-organised programme should be higher than for men.

Limitations and future studies

One limitation in the present study is that it did not measure the percentage of players who were selected for the senior national teams. The connection between the player development process and the final senior success is of high interest. However, this study focused on the factors influencing the dynamics of the re-selection process during the talent development phase. Another limitation is that the player's performance in the championships was not considered as a factor in the re-selection process in this study. Our results suggest that re-selection process is complex and, although we found initial selection age, relative age, and country long-term performance to influence it, there are probably more factors affecting the process. For example, future studies should analyse the role of the player's performance in the chance of getting re-selected. Another potential line of research is to study how the country's selection strategies in the youth national team programmes affect at the senior level.

Conclusions

The results of the present study show that the re-selection process by which players progress in European youth national basketball teams is complex and influenced by initial selection age, inverse relative age effect, and the country long-term performance, with some differences between men and women. Overall, around 75% of male and 80% of female players participating in a championship were re-selected the following year, which is higher than previously found in other team sports. We found an inverse relative age effect where players born in quarter 4 more likely to be continuously re-selected until the last year of youth championship than players in quarter 1, regardless of initial selection age or gender. Similarly, we found an inverse constituent year effect for men, where players initially selected as underaged (age 15, 17 and 19 in U16, U18 and U20, respectively) were more likely to be continuously re-selected until age 20. Further, the higher re-selection in top compared to bottom-ranked countries, especially in women, suggest that there might be underlying organisational and strategical factors influencing both selection strategies and long-term performance of the youth national teams.

Disclosure statement

No potential conflict of interest was reported by the authors.

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