

# Factors underlying competitive success in youth football

## A study of the Swedish national U15 football talent system

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### Abstract

This study of Sweden's 24 football districts analyses whether contextual factors (number of players, number of elite teams, and number of elite players on each district team) influence the district teams' relative age effect (RAE) and the way in which contextual factors and RAE correlate with the U15 teams' competitive success. The analysis is based on register data on district players (4,516 girls and 4,501 boys, all 15 years old) who attended an annual elite football camp: birthdate, the total number of players aged 15, club membership, senior elite clubs, proportion of elite players on the district teams, and match outcomes. Based on the birthdates of the players born between 1986 and 1997, a relative age index was constructed for each district. The results showed a relative age effect (RAE) for the selected district players (boys and girls) compared to the general 15-year-old football population; however, birthdate only affected the competitive success of the boys' district teams. The analysis points out that contextual factors such as the number of football players and the presence of elite clubs are important to consider in order to understand how RAE is produced and its relationship to the success of winning matches for boys' district teams.

*Keywords:* talent identification, football, relative age, RAE, performance, gender, youth, elite

## Introduction

One variable that has been associated with sport participation, talent identification, and talent selection is the relative age effect, RAE (Côté, MacDonald, Baker, & Abernethy, 2006). In team sports such as football (soccer), research has shown that both professional league players and young players selected for talent groups are predominantly born early in the competitive year (e.g., Cobley, Baker, Wattie & McKenna, 2009; Gibbs, Jarvis & Dufur, 2012; Guiterrez Diaz Del Campo, Pastor Vicedo, Gonzales Villora & Contreras Jordan, 2010; Musch & Grondin, 2001; Romann & Fuchslocher, 2011; Schorer, Wattie & Baker, 2013; Sierra-Diaz, Gonzalez-Villora, Pastor-Vicedo & Sierra-Olivares, 2017). Because relatively older players have advantages that are sustained throughout their athletic career and skill development (e.g., better training opportunities and better educated/more experienced coaches), they are more likely to experience success in their sport (Baker, Schorer, Cobley, Schimmer & Wattie, 2009; Hollings, Hume & Hopkins, 2012, Hancock, Adler & Côté, 2013). The close relationship between RAE and talent identification in youth football could help explain the uneven birthdate distribution in senior professional football (Takacs & Romann, 2016). For example, a study in Argentina showed that RAE is associated with male players' chances of reaching the A-league (Gonzalez Bertomeu, 2016). However, several studies have shown that RAE becomes weaker as players become older (Helsen, Van Winckel & Williams, 2005), a trend that is true for both boys (Jimenez & Pain, 2008; van den Honert, 2012) and girls (Delorme, Boiché, & Raspaud, 2010a; Grossman & Lames, 2013).

RAE could be a consequence of the conditions in specific regions such as the pool of participants in relation to the available spots on a team (Musch & Grondin, 2001) or the opportunities associated with an elite environment (Guiterrez Diaz Del Campo et al., 2010). While acknowledging that this line of research has advanced our knowledge, we argue that some factors and contexts have been overlooked. Although research on RAE has been extensive, the research on RAE in girls' sports is limited (Smith, Weir, Till, Romann, & Cobley, S. 2018), especially in football (Sierra-Diaz et al., 2017). Therefore, many researchers have called for more RAE research that focuses on female athletes (e.g., Musch & Grondin, 2001; Smith et al., 2018). Although many studies acknowledge that the RAE exists in different sports and ages (e.g., Takacs & Romann, 2016), in school sport specialisation programmes (Saether,

Peterson & Matin, 2017), in achieving expertise (e.g., Côté et al., 2006), or in relation to physical advantages (e.g., Gil et al., 2014), few studies have investigated the link between RAE and sport performance – i.e., whether teams with higher RAE win more matches than teams with lower RAE. The few studies that have investigated a link between teams with higher RAE and increased competitive edge are rather inconclusive as they reveal relationships as well as non-relationships (e.g., Augste & Lames 2011; Grossman & Lames, 2013; Kirkendall, 2014). Similarly, few studies have explored how RAE covaries with regional contextual factors and affects a team's competitive performance either in winning matches or tournaments.

Drawing on data from a project that investigates the national U15 talent development program for girls and boys playing on district teams in Sweden, we examine: a) how contextual factors (i.e., number of players, number of elite teams, and number of elite players on each district team) influence RAE for girls and boys participating in the special talent programme that the Swedish Football Association carries out to both identify talent and enable player development in the 24 football districts in Sweden; and b) the way in which these contextual factors and RAE correlate with the U15 girls and boys team's success in winning matches.

## Literature review

Several analyses have been developed to help researchers understand how RAE is produced and how RAE affects the way coaches identify the most talented football players. In the following, we discuss four main areas where RAE operates.

First, many researchers suggest that coaches identify individuals born early in the competitive year as potentially elite performers because these players are more physically and mentally mature than individuals born later in the competitive year (e.g., Smith, Weir, Till, Romann & Cogley, 2018). That is, these studies posit that individuals born early in the competitive year have acquired maturational advantages, resulting in a greater chance of being selected for talent groups or similar elite development systems than those born later in the year (e.g., Augste & Lames, 2011; Guitierrez Diaz Del Campo, Pastor Vicedo, Gonzales Villora & Contreras Jordan, 2010; Helsen, van Winckel & Williams, 2005; Helsen et al., 2005; Hollings, Hume & Hopkins, 2014). Although

there seems to be strong evidence of a link between RAE (i.e., physical advantages) and how talent is selected for a team, existing research shows both weak and strong associations. Depending on the sample used (e.g., younger or older players or selected talent or team players), studies have shown that relatively younger football players in an age cohort perform worse on physiological tests (Gil et al., 2014; Votteler & Höner, 2014) and that more mature U15 players had higher match running performance (Buchheit & Mendez-Villanueva, 2014). Frago, Massuca, and Fererira (2015) found that physical fitness in U15 male football players correlates to biological maturation. On the other hand, studies have also found that there are no differences regarding physical components (Carling, le Gall, Reilly & Williams, 2009; Deprez, Vaeyens, Coutts, Lenoir & Phillipaerts, 2012) or anaerobic performance based on date of birth (Deprez et al., 2013; Skorski, Skorski, Faude & Hammes, 2016). One possible explanation for these results is that those relatively younger might have been selected due to early maturation (see Skorski et al., 2016). Similarly, the few studies that have investigated whether teams with higher RAE win more matches than teams with lower RAE have found both weak and strong associations. Kirkendall's study (2014) of girl and boy U11-U16 football players, which focused on match outcome and the players' birth month, found no relationship between RAE and match outcomes. On the other hand, a study of 41 German U17 first league player squads found that the final league rank of the U17 teams (i.e., their success of winning matches) was related to RAE (Augste & Lames 2011; Grossman & Lames, 2013). Clearly, this issue has not been settled.

Second, when comparing football players with the general population, research has found a significant RAE effect (e.g., Grossman & Lames, 2013; Sedano, Vaeyens & Redondo, 2015). A study of first-, second-, and third-division female Spanish players, comparing them to the general Spanish population, showed that the players in the first and second divisions, but not the third, were overrepresented by players born in the first quarter of the year (Sedano, Vaeyens & Redondo, 2015). However, the use of general population as a comparison in these studies may have introduced measurement errors due to deviations from the actual football population (Sierra-Diaz et al., 2017). Delorme, Boiché, and Raspaud (2010a), however, found that the total female football population (players from 8 to 17 years old) in France had an overrepresentation of players born in the first and second quarters of the year compared with

the national birth statistics. The study further showed that the dropout of players (10, 14, and 17 years old) is related to RAE. Similarly, a study of all male French football players showed that for all ages there was an overrepresentation in the first and second quarters of the year compared to national birth statistics (Delorme, Boiché & Raspaud, 2010b; 2010c).

Third, research has also found that RAE is a consequence of contextual conditions in a region such as the pool of participants (Musch & Grondin, 2001), available spots on a team (Schorer et al., 2015), and the existence of elite teams in a region (Guterrez Diaz Del Campo et al., 2010). Musch and Grondin (2001) showed that a larger pool of players, because of competition, results in stronger RAE on a team (cf. view on environmental constraints by Wattie, Schorer & Baker, 2015). Similarly, Finnegan, Richardson, Littlewood and McArdle's (2017), in a study of how the Irish national football association's elite development programme selects players, found that RAE was stronger for players (aged 14-17) living in more densely populated areas. Other researchers have come to similar conclusions concerning successful talent development (Larsen, Alfermann, Henriksen & Christensen, 2013) and the effects of total population on sporting success in a country (De Bosscher, De Knop, Van Bottenburg & Shibli, 2006). Another contextual condition that is important for understanding RAE is the impact of an elite environment. Findings from comparisons between non-elite and elite youth teams showed that the elite samples had higher RAE (e.g., Guterrez Diaz Del Campo et al., 2010; Musch & Grondin, 2001; Sedano et al., 2015; Grossman & Lames, 2013). Studies have also found that the relationship between RAE and teams' final rankings disappears if elite and amateur clubs are analysed separately (Grossman & Lames, 2013). In their study of football in Denmark, Rossing, Nielsen, Elbe and Karbing (2016) found that the location of elite clubs likely influences the probability of youths developing into elite players. Similarly, De Bosscher et al. (2006) highlight that on a national level elite sport culture – e.g., an emphasis on high-performance sport as well as high levels of training and training opportunities – influences sport success in a country.

Fourth, although studies have revealed that RAE is apparent in youth football in many parts of the world, research on RAE in girls' sports is limited (Smith et al., 2018), especially in football (Sierra-Diaz et al., 2017). Results from research carried out on girls' RAE is not as unanimous as for boys' RAE (e.g., Guterrez Diaz del Campo et al., 2010; Helsen et al., 2005; Romann & Fuchslocher 2011, Schorer et al., 2015; Sierra-Diaz

et al, 2017). For example, a study of female players from U15 and U17 in Australia (van den Honert, 2012) and U17 in the US (Vincent & Glamser, 2006) showed that there was no RAE. Moreover, a study showed that RAE did not exist at the U17 World Championships for girls from Asia, Oceania, and South America (Romann & Fuchslocher, 2013). The lack of RAE effects in these studies could be explained by the fact that in these countries female football players have less competition for places compared to their male counterparts (Romann & Fuchslocher, 2013; van den Honert, 2012) or by the fact that girls physically mature earlier than boys, a circumstance that reduces age performance differences (Vincent & Glamser, 2006). On the other hand, a study of Swedish players participating in the Football Association's competitions for the U15 district team found that it is four times as likely for girl and boy players born during the first quarter to be selected for Sweden's U16 national team compared to those born in the last quarter (Peterson, 2011).

The literature review shows that research on birthdate and maturational advantages is contradictory. There is relatively strong evidence that contextual factors such as the pool of participants in a specific district, access to elite environments, and the number of elite players in a region are related to increased RAE effects. Furthermore, the connection between RAE and different contextual factors and performance (winning matches) is still largely unexplored, especially in comparative studies of girls and boys who participate in a national talent development system. In light of this literature review, our study of boys and girls U15 district teams (players born 1986–1997) will contribute to the discussion on contextual factors that influence how talent is identified and whether this selection process influences the competitive success of district teams.

## Method

This study uses register data provided by the Swedish Football Association. The data, collected from Sweden's 24 football districts, includes information about all boys and girls who played organized football between 2001 and 2012 (i.e., all players born between 1986 and 1997).<sup>1</sup> These 24 districts are divided according to geographical region.

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1 Given that changes in the talent development system (a new national player development programme) were introduced by the Swedish Football Association in 2013, we refer to the situation during the period 2001–2012.

Because the most populated areas in Sweden are in the south, there are more football players in districts located in southern areas. Every year each of the 24 districts identifies 16 boys and 16 girls from local clubs in the region with the potential to develop into elite football players. These district teams (i.e., regional teams), which consist of 15-year-olds, play against each other at an annual elite training camp. The players on the district teams serve as the recruiting base for building not only the national U15 teams (Peterson, 2011) but also future senior elite teams.

The districts use a successive selection process, which starts when the player is 13 years old and includes training and education camps that are generally open to anyone who wants to participate. These camps (about 1-3 days) are carried out a couple of times each year. All districts have a base structure that includes a district captain responsible for the team. In most of the districts, there is also a goalkeeper captain. In addition, there are zone instructors or local talent developers who are responsible for the training sessions and have a role in the player selection process. When the players are 14 years old, the zone instructors and district association managers choose the players they believe to be the most talented. From these 14-year-old boys and girls (30-40 from small districts to over 100 from large districts), players are selected and invited by the district to future training camps. From this selected group, the pool of players is ultimately reduced to the 16 players who will form the U15 district team and participate in the national annual elite training camp the summer they will be 15 years old.

### *Participants and procedure*

The study was based on girls and boys who attended the elite camp at age 15 and was approved by the regional ethics review board (2018/68-31). Between 2001 and 2012, 4,608 boys and 4,608 girls played on district teams (384 girls and boys each year). The data set included birth, district, and club of each player. Due to incorrect registration by the districts, not all players' birthdates and club participation were classified. Birthdate data for each player were found for 4,516 girls (92 missing) and 4,501 boys (107 missing), and club data for each player were found for 4,556 girls (52 missing) and 4,486 boys (122 missing).

The districts were, in relation to number of players at age 15, divided into four categories: small (girls  $n < 145$  and boys  $n < 222$ ), medium (girls  $n = 184-280$  and boys  $n = 282-370$ ), large, (girls  $n = 314-377$  and boys  $n = 459-$

469) and extra-large (girls  $n = >682$  and boys  $n >883$ ) (Table 1). However, the number of players in each category differs between girls and boys in relation to average number of players (the football population); that is, a large district for girls is not necessarily a large district for boys.

#### The districts' birthdate distribution

Based on birthdate distribution for players born between 1986 and 1997, a RAE index was calculated for each district. The index was calculated based on the number of players born in each quarter in relation to the total (16) players on the team (Calculation =  $(([Q1]*4) + ([Q2]*3) + ([Q3]*2) + ([Q4]*1)) / [Total]$ ). The indexes for all years were added and divided by 12 (years), resulting in a RAE index for each district between 2001 and 2012: 4 reflects the fact that all 16 players on the team (100% of the players) were born in the first quarter (January-March) while 1 reflects the fact that 100% of the players were born in the last quarter (October-December).

#### District performance

The elite camp included matches between district teams, and the results (3 points for a win, 1 for a draw, and 0 for a loss) of these matches served as a proxy for district performance. Between 2001 and 2012, 33 matches for boys and 36 matches for girls were registered for each district (the boys played only two matches between 2003 and 2005 instead of three), which gave a total score for each district.

#### Elite environment in the districts

To capture the influence of the senior elite team in a district, an elite team district index for women and men was calculated based on the sum of the number of elite teams in the two highest divisions for each year between 2001 and 2012 divided by 12 (years). Data on senior elite teams in the two highest division were provided by the Swedish Football Association. The players were categorized as belonging to an elite club if at the age of 15 they played on a club in one of the two highest divisions. However, for girls, the second division consisted of two series, a north and south division (in 2013 the organisation was changed to two national series).

#### Birthdate distribution of the football and Swedish population

The study included data for the total football population in each district – i.e., birthdates for all 15-year-old football players (162,185 boys and

87,086 girls born between 1986 and 1997) in Sweden from 2001 to 2012. These birthdates for all 15-year-old football players were provided by the Swedish Football Association. A RAE index for the football population was calculated each year for each district based on the same calculation as for the district teams. Further, the study also included national birth statistics for 675,080 boys and 640,326 girls born between 1986 and 1997 provided by Statistics Sweden (SCB).

### *Statistical analysis*

Chi-square tests were used to compare groups (girls and boys) with respect to date of birth quarter (observed and expected distributions, degrees of freedom = 3 for comparisons of birth quarters). Spearman's rank correlation coefficient (two-tailed) was, for girls and boys, used to measure statistical dependence between the RAE index in the football population and the district teams year 2001-2012, and between district variables (i.e., match outcome, RAE, football population, senior elite clubs and proportion of elite players in the teams). Values for strength of correlations were, strong  $>0.7$ , moderate  $0.4 - 0.6$  and weak  $0.1 - 0.3$  (see Akoglu, 2018). The level of significance taken into account was  $p < 0.05$ . The football population (licensed football players) was excluded from the national birth statistics, and the district team population was excluded from the football population to avoid distribution measurement errors (cf. Delorme, 2010b; Sierra-Diaz et al., 2017). All statistical analyses were performed using IBM SPSS Statistics version 24.0.

## Results

We present the results in three steps. In the first step, we describe some background information on the RAE in Swedish football and how this effect increases when coaches select players for the district teams. In the second step, we describe RAE indexes and the contextual factors in the 24 district teams. In the final step, we analyse whether contextual factors in the district and the RAE index for the boys' and girls' teams affect the match results at the elite camp at age 15.

### *Relative age effects in Swedish football*

The analysis of birthdate distributions shows that 57% of the boys and 56.9 of the girls in the football population compared to 52% of the boys and 52.6 of the girls in the national population were born in the first two quarters of the year (Figures 1 and 2). The birthdate distribution of the boys' and girls football population is significantly different from the national population (boys  $\chi^2 \approx 1601.1$ ;  $p < 0.01$ ; girls  $\chi^2 \approx 759.4$ ;  $p < 0.01$ ).

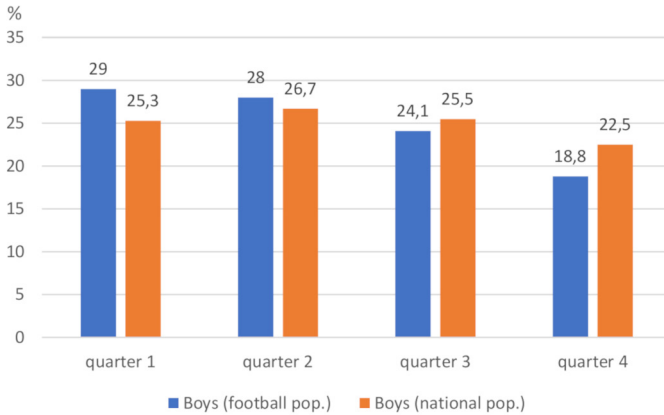


FIGURE 1. *Birthdate distribution (%) for boys football population and national population, 1986-1997.*

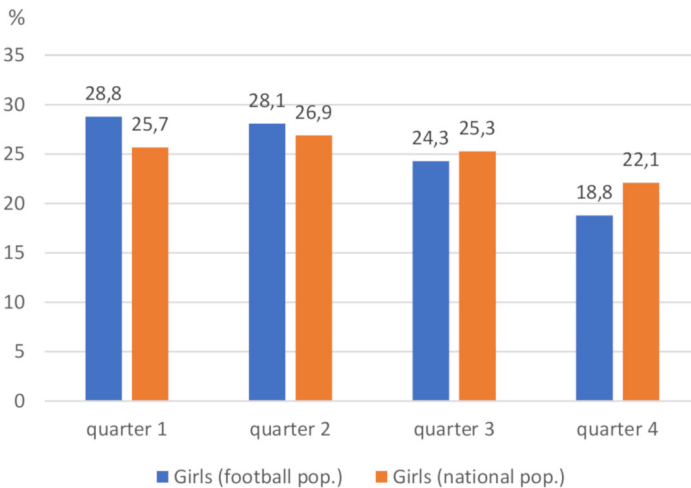


FIGURE 2. *Birthdate distribution (%) for girls football population and national population, 1986-1997.*

In other words, at the age of 15, football players (regardless of level) are more likely to have been born early in the year and this pattern increases when district coaches select district players for elite camps (Figures 3 and 4).

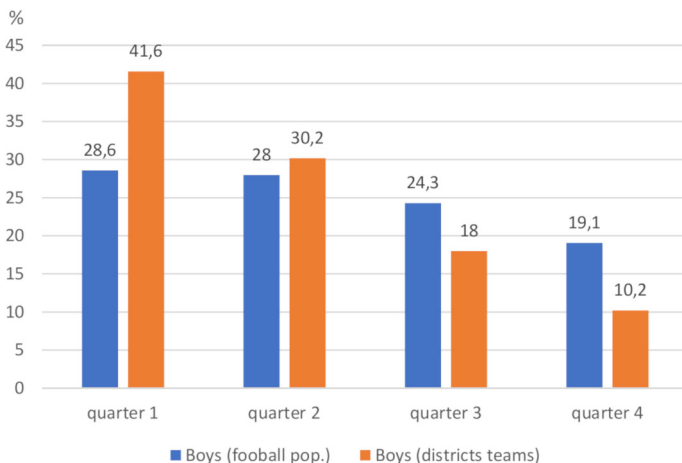


FIGURE 3. *Birthdate distribution (%) for the boys football population and district team population, 1986-1997.*

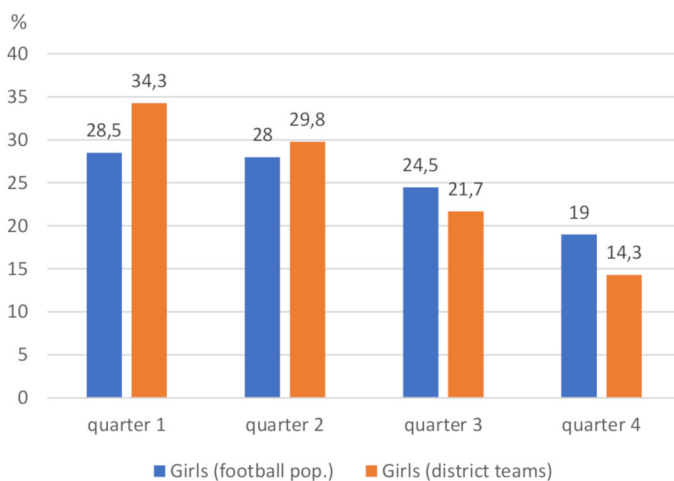


FIGURE 4. *Birthdate distribution (%) for the girls football population and district team population, 1986-1997.*

When the district team players are compared with the total football population of 15-year-old players, the results show differences in birthdate distributions (Figures 3 and 4). Of the district players who participated in the elite camps between 2001 and 2012, a majority of both boys (71.8%) and girls (64.1%) were born during the first two quarters of the year. The birthdate distribution of those district players participating in the elite camps is statistically different from the total football population (boys,  $\chi^2 \approx 516.6$ ;  $p < 0.01$  and girls,  $\chi^2 \approx 117.7$ ;  $p < 0.01$ ).

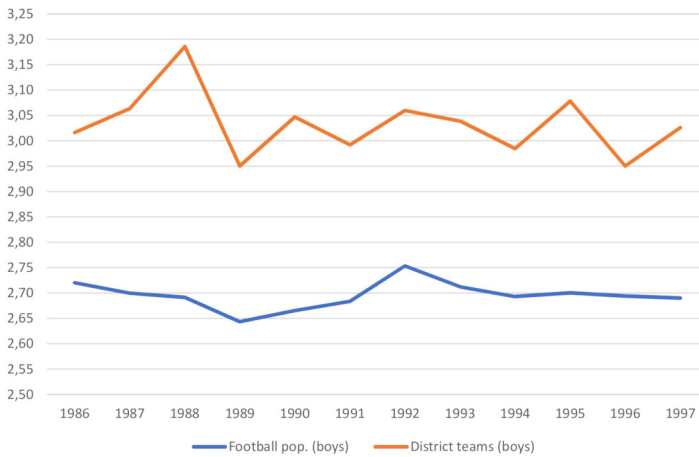


FIGURE 5. RAE Index football population and district teams 2001-2012 (boys).

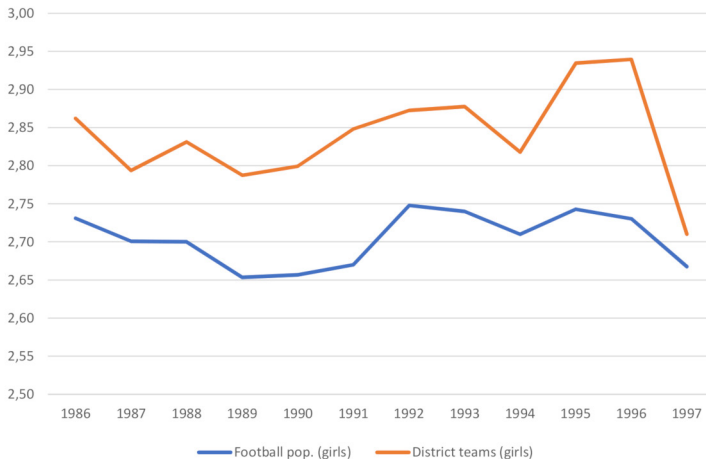


FIGURE 6. RAE Index football population and district teams 2001-2012 (girls).

An analysis of the RAE index for the district and the football population born between 1986 (2001) and 1997 (2012) shows that the differences between the RAE indexes for each year is wider for the boys (variation between 0.26 to 0.49) than for the girls (variation between 0.04 to 0.21) (Figures 5 and 6).

An analysis of the relationship between the RAE index for the district and the total football populations show a statistical correlation for the girls, but not the boys (girls,  $r_s = .788$   $p < 0.05$ ; boys,  $r_s = .426$   $p > 0.05$ ).

### *Contextual factors and the districts' RAE*

The collected data reveal that the structural conditions differ between districts in terms of average number of players, number of elite players, and number of senior elite football clubs. Table 1 illustrates the conditions for girls and boys in small, medium, large, and extra-large districts.

Table 1. District conditions, 2001-2012 for girls and boys (the spread for the structural conditions and M=median value for each of them)

Table 1 shows that there are different patterns between girls and boys and between extra-large and small districts. The extra-large boy districts win more matches (M=59) than smaller districts (M=36), but this pattern is not as evident for girls (extra-large, M=51 vs. small M=45.5). The boys also have an increase in the RAE index between small and extra-large district teams (boys small districts M=2.92 vs. extra-large districts M=3.19); however, this is not the case for the girls (small districts M=2.79 vs. extra-large districts M=2.82). The RAE index is also higher for boys than for girls in 21 of 24 districts. For the boys, the districts' RAE index varies between 2.82 and 3.27 (M=3.04; spread 0.45). For the girls, the districts' RAE index is lower compared to boys and varies between 2.60 and 2.99 (M=2.84; spread 0.38).

Both boys and girls have, however, a decrease in the RAE index in the football population, from small (boys M=2.74 and girls M=2.75) to extra-large districts (boys M=2.68 and girls M=2.68). The data also show that the gap between the median RAE index value in the football population and the district teams is wider for boys (small 0.18, medium 0.29, large 0.37 and extra-large 0.51) than for girls (small 0.04, medium 0.12, large 0.18 and extra-large 0.14). For both girls and boys extra-large districts have more senior elite teams (boys M=4.25 and girls M=3.88) than small districts (boys M=0.04 and girls M=0.17), but the proportion of players from elite clubs in the extra-large district teams differs between girls and boys (boys M= 54.3% and girls M=21.1%).

TABLE I. *District conditions, 2001-2012 for girls and boys (the spread for the structural conditions and M=median value for each of them)*

Categories	a) No. of districts	b) Elite index	c) Elite players	d) Football population	e) Match outcome	f) RAE population	g) RAE districts
<b>Small districts</b>							
Girls	8	0 – 0.75 M=0.17	0 – 18.8 M=1.65	63 – 145 M=122.5	25 – 59 M=45.5	2.72–2.92 M=2.75	2.60–2.93 M=2.79
Boys	8	0 – 1 M=0.04	0 – 40.3 M=0.85	98 – 222 M=194.5	29 – 53 M=36	2.59 – 2.79 M=2.74	2.85 – 3.04 M=2.92
<b>Medium districts</b>							
Girls	7	0.17 – 2 M=1.08	2.1 – 16.7 M=14.6	184 – 280 M=250	43 – 59 M=52	2.69 – 2.76 M=2.73	2.78 – 2.98 M=2.85
Boys	5	0.25 – 1.08 M=0.58	1.0 – 24.5 M=8.5	282 – 378 M=340	36 – 64 M=49	2.70 – 2.75 M=2.74	2.95 – 3.13 M=3.03
<b>Large districts</b>							
Girls	5	1 – 3.25 M=1.75	7. – 11.6 M=10.4	314 – 377 M=368	42 – 63 M=54	2.67 – 2.76 M=2.71	2.78 – 2.97 M=2.89
Boys	6	0.25 – 2.42 M=1.42	5.8 – 40.1 M=15.4	459 – 696 M=592.5	36 – 60 M=45.5	2.69 – 2.75 M=2.69	2.82 – 3.12 M=3.06
<b>Extra-Large districts</b>							
Girls	4	3.17 – 6.25 M=3.88	12.9 – 36.5 M=21.1	682 – 787 M=716	46 – 64 M=51	2.67 – 2.70 M=2.68	2.76–2.84 M=2.82
Boys	5	1.17 – 5.42 M=4.25	26.6 – 87.5 M=54.3	883 – 1862 M=1266	56 – 60 M=59	2.67 – 2.69 M=2.68	3.06 – 3.27 M=3.19

- Number of districts
- Elite index = Senior elite club index in the district. Values = the sum of the number of elite teams in the two highest divisions for each year between 2001 and 2012 divided by 12 (years).
- elite players = Proportion of elite players in the district teams (%).
- Football population = Number of 15 year old players in the district.
- Match outcome = total points at the annual elite camp (3 points for a win, 1 for a draw, and 0 for a loss. In total 33 matches for boys and 36 matches for girls)
- RAE population = RAE index for the districts football population
- RAE districts = RAE index for the district teams

Taken together, Table 1 illustrates that there are differences between the districts regarding the recruitment base for the district teams and that this base also differs between boys and girls within each district.

*Contextual factors, RAE and performance*

In this final section, we analyse associations between contextual factors and RAE and in what way the number of senior elite clubs in each district, the proportion of elite players on the district teams, and RAE correlate with match outcome. For boys, there are statistically, both stronger and more moderate, significant correlations between a district's RAE index and the number of 15-year-old players in the district ( $r_s = .670$   $p < 0.01$ ), between the RAE index and senior elite clubs in the district ( $r_s = .416$   $p < 0.05$ ), and between the RAE index and match outcome ( $r_s = .423$   $p < 0.05$ ) (Table 2).

TABLE 2. *Spearman's correlation coefficient for districts (Boy districts  $n = 24$ )*

	Match outcome	Football population	Senior elite clubs	Proportion elite players	RAE index
Match outcome	1.000	0.700**	0.632**	0.557**	0.423*
Football population		1.000	0.811**	0.728**	0.670**
Senior elite clubs			1.000	0.943**	0.416*
Proportion elite players				1.000	0.293
RAE index					1.000

\*\* =  $p < 0.01$  (two-tailed)

\* =  $p < 0.05$  (two-tailed)

The girls, however, show a very different pattern (Table 3). There is no statistically significant correlation between the measured contextual factors and the district teams' RAE index. In other words, our analyses show that RAE in the girl's district teams cannot be explained by the total football population, number of senior elite clubs, or the proportion of elite players. In addition, the RAE index cannot explain the match performance of the girl's district teams.

TABLE 3. *Spearman's correlation coefficient for districts (Girl districts  $n = 24$ )*

	Match outcome	Football population	Senior elite clubs	Proportion elite players	RAE index
Match outcome	1.000	0.394	0.296	0.178	-0.103
Football population		1.000	0.924**	0.657**	0.154
Senior elite clubs			1.000	0.774**	0.143
Proportion elite players				1.000	-0.007
RAE index					1.000

\*\* =  $p < 0.01$  (two-tailed)

\* =  $p < 0.05$  (two-tailed)

In summary, match outcomes for the boys are influenced by nearly all the variables we tested, but we did not find a corresponding outcome for the girls, a finding discussed in the next section.

## Discussion

The findings suggest that the talent development system used by the Swedish Football Association favours boys and girls born early in the competitive year; however, birthdate seems to affect only the competitive success of the boys' district teams. Our data point out that contextual factors such as the number of football players (cf. Musch & Grondin, 2001; Finnegan et al., 2017) and the presence of elite clubs (cf. Larsen et al., 2013; Rossing et al., 2017) in a district appear to be the fundamental variables to consider when trying to understand how the RAE influences the competitive performance of boys' district teams (cf. analysis on a country level by De Bosscher et al., 2006). Larger districts have more senior elite teams; as Danish studies show, a large number of youth players in the region is essential for recruiting talent and maintaining an elite club (Larsen et al., 2013; Rossing, Stentoft, Flattum, Cote & Karbing, 2017). As a consequence, players from elite clubs are overrepresented in the boys' district teams (Table 1). The RAE profile in districts with many elite clubs is, most likely, an effect of elite clubs recruitment of children in early ages 7-9 years, which favours children born early in the competitive year, which contributes to significant correlations to match outcome (Table 2). One important explanation for why this study contradicts Kirkendall's (2014) finding that RAE has no relationship with performance is that the two studies have different methodological focuses (e.g., youth league players vs. region players, a single region vs. all regions, one season vs. several seasons). Our interpretation is that this study's broader focus captures how contextual factors (e.g., pool of potential players and proximity to elite clubs) affect RAE and competitive performance.

In addition to larger proportions of elite players on district teams which also have a higher RAE index, the number of senior elite teams in a district may affect the amount and quality of training among all clubs in a district. Rossing et al.'s (2017) study of Danish football showed that communities located near an elite club had higher proportions of elite youth league football players and national youth players. It is therefore more likely that players from districts with a high number of elite teams

have gained more training experience in general (cf. Musch and Grondin, 2001); they may also have had more extensive training, better coaching, and more training opportunities than players from a district with fewer senior elite teams (i.e., smaller districts) (cf. De Bosscher et al., 2006, regarding influences of an elite environment on success).

### *Differences between girls and boys*

On the other hand, the very same contextual factors cannot explain the major reasons behind the birthdate effect on the girls' district teams. In addition, our variables do not correlate with the competitiveness of girls' teams. The different outcomes for girls and boys are an effect of both contextual factors and the specific age of the players when talent is identified and selected. Why the RAE advantage does not occur for the girls' district team's competitive performance is due to both the football population and the selection age. Compared to the boys, the pool of girl players in every district is much less competitive (Table 1), which means that there are generally fewer girl players competing for spots on a team (cf. Sierra-Diaz et al., 2017; van den Hornet, 2012). In turn, this produces a lower RAE. For girls in general, but also for boys in smaller districts, the birthdate distributions among the selected district players are more sensitive to the birthdate distribution in the football population (Figure 6 and Table 1). That is, smaller districts compared to larger districts have fewer differences between the RAE index in the football population and in the districts team for girls as well as for boys.

For the girls, however, this smaller difference between the largest and smallest districts might be due to the fact that girls tend to mature physically and mentally earlier than boys, reducing the effects that larger population sizes have on RAE in relation to being selected for a district team. That is, compared to boys, more girls have similar physical and mental characteristics when they compete for district teams (cf. Romann & Fuchloser, 2011). In addition, the results show a higher RAE index and higher gap between high and low RAE index between districts for boys. The wider gap for the boys reflects greater maturation differences compared with the girls. Individual variability arrives earlier for girls and birthdate effects might have diminished before age 15, whereas birthdate effects for boys diminish after age 15 (Deprez et al., 2013, van den Hornet, 2012). Similarly, Smith et al. (2018) found in their review of RAE in female sport contexts that greater RAE magnitude was related to pre-

adolescent years (before 11 years old) and adolescent years (12-14 years of age). Based on this interpretation of our results, the effect of maturity on sports performance occurs at different ages for girls and boys. In accordance with Schorer et al.'s (2015, p.139) view that the effect of depth of competition is related to the interaction of different factors at a given time, we suggest that how depth of competition operates depends on maturity.

Our results also suggest that proximity to an elite club means different things for girls and boys. Compared to boys, there are fewer girl players from elite clubs on the district teams (Table 1) even when there are female elite clubs in the district. This finding may reflect society's general attitude that girls' sports are not valued on the same level as boys' sports (cf. Connell, 2008). That is, for girls, proximity to an elite club does not produce the same effects as for boys. Compared to boys, there are fewer resources (e.g., elite teams, coaching, and training opportunities) and less public engagement for girls' sports. As women's elite clubs have little effect on the amount and quality of training among all clubs in a district, the presence of women's elite clubs has no real influence on the development of girl football players at the district level.

A second interpretation of these results is that we have repeated a methodological bias found in previous research. From this perspective, several research designs have long relied on incorrect indicators of both the development of RAE and its impact on girls' sports. This is a very discouraging finding that points out a general lack of interest in understanding female football – not only in terms of the unequal levels of professionalization and commercialization in female and male football, but also in terms of the lack of interest expressed by researchers. Sport science researchers lack knowledge about how different contextual factors relate to successful girl athletic environments (cf. Henriksen, 2010); this gap in knowledge is something future researchers should address by including other variables as well as qualitative studies. As the national talent system in football works differently for males and females, future research should incorporate a gender perspective and develop research designs that can avoid gender-neutral forms of understanding how talent is identified and developed (cf. Leite & Sampaio, 2012).

This study shows how RAE is produced within a system of talent identification and talent development and the factors underlying competitive success for girls and boys. RAE affects the competitive performance for boys but not girls as a consequence of three factors: 1)

boys make up a larger football population in relation to available spots on a district team than girls; 2) boys in larger districts are more influenced by senior elite teams than girls in larger districts; and 3) boys mature later than girls, creating larger performance advantages for boys than for girls at earlier ages. On the other hand, the differences that exist between boy districts also let us understand that it is reasonable to believe that the way different variables interplay is highly contextual.

However, by aggregating the data to a district level, we are aware that our analysis does not fully capture the complexity of the interaction between RAE, competitive performance, and contextual factors. To further understand the football talent system, future studies need to conduct more fine-grained analyses by, for example, considering how different factors interact in districts over time (cf. Schorer et al., 2015).

## Concluding remarks

From a general point of view, selection favours players who are more mature; this advantage needs to be changed (e.g., Helsen et al., 2005; Peterson, 2011). Researchers often posit that this problem can be solved by educating coaches about the influence of maturation and birthdate, creating an awareness that can lead to change (e.g., Augste & Lames, 2011, Kirkendall, 2014; Musch & Grondin, 2001). However, education about the role of birthdate and maturation does not seem to reduce RAE in the selection of children and adolescents for sports teams (e.g., Furley & Memmert, 2016; Hill & Sotiriadou, 2016). Concerning the district teams in Sweden, results from an interview study with coaches in four districts (player data are included in this study) showed that coaches are aware of what effect RAE and physical development has on their identification of talent and they try to find strategies to overcome this bias by, for example, considering the attitude of short players who exhibit good movement and play intelligence (Lund & Söderström, 2017). As the birthdate distribution data in this study show, irrespective of whether coaches are aware of RAE or whether they in practice try to overcome RAE effects, players born early in the year are more likely to be selected. Other studies suggest that the pressure on youth team coaches to be successful maintains the RAE (Jimenez & Pain, 2008; Schorer et al., 2015). However, Lund and Söderström (2017) show that coaches seek players that best fulfil the game played at the elite level, and as an effect those

who are most mature are selected. In addition, as this study shows, the most mature teams win the most games. In this sense, there is an equivalence between the districts as the selection takes place within an organizational framework and is based on similar assessments (cf. Peterson, 2011).

In order for a change of the Swedish talent system to occur, professionals at different levels within the system must not only understand the present limitations but also must find changes to be meaningful. Overall, coaches in the 24 districts fulfil the aim of finding potential players for the U15 national youth team. That is, the coaches have developed practices that produce what the identification system requires. The problem with changing a historically rooted practice such as the Swedish talent development system is that such changes force a change of an established practice, which will always have counteracting forces; furthermore, these counteracting forces are embedded in the system on the central, district, and club level (cf. Engeström, 2001). For change to happen, new questions need to be asked about whether players with the greatest potential to develop and improve Swedish football actually are identified and selected and if the present system best facilitates the players' learning and development potentials (cf. Peterson, 2011). These questions need to be asked at all levels – by the Swedish Football Association, by district administrators, by coaches, and by the leaders in the system that produces and reproduces the football practice.

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