Selected 15-year-old boy and girl football players’ continuation with football and competitive level in young adulthood: the impact of individual and contextual factors

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ABSTRACT
This study investigates players who have been selected to a district team in the Swedish Football Association U15 talent programme. Using register data on all selected 15-year-old boy and girl district team players (3943 boys and 4056 girls born between 1986 and 1996) from Sweden’s 24 football districts, we analysed the relationships between club affiliation at age 15, the player population of the district, date of birth, and continuation with football and competitive level as young adults. The results show that a higher percentage of boys than girls continued playing football into young adulthood and that continuation is related to district size. Belonging to an elite club at age 15 reduces the likelihood of girls playing football at age 21, but it has no effect on the likelihood of boys playing football at age 21. In addition, 15-year-old boys and girls from larger districts who played on an elite club at age 15 were more likely to play elite football at age 21. In sum, the study shows that football district size and club affiliation at age 15 affect whether boys and girls continue to play football and whether they play at an elite level as young adults.

ABBREVIATIONS: FA: Football Association; NHL: National Hockey League; OR: Odds Ratio; Q1, Q2, Q3, Q4: Birth quarter 1, 2, 3, 4; RAE: Relative age effect; TDP: Talent development program; U15/17/19: Under 15/17/19

KEYWORDS Relative age; talent development; population size; drop-out; elite athletes

Introduction

Sport participation and adult sports success can be advanced through talent development programmes sponsored by sports organisations. These programmes can be viewed as systematic structures with substantial financial and human resources used
to identify and develop talented young boys and girls. One such programme, which will be investigated in this study, is the Swedish Football Association’s (FA) district teams. Every year, each of the 24 football districts in Sweden selects 16 boys and 16 girls from their clubs to participate in a program for potential elite players and to serve as the recruiting base for the youth national teams. The district teams (i.e. regional teams) consist of 15-year-olds who play each other at an annual elite training camp. Using register data of selected boy and girl players born between 1986 and 1996, we investigated whether contextual factors (i.e. number of football players in the districts and elite club affiliation) correlate with continuation with playing football and participation at the elite level as young adults. The influence of contextual factors on athletes’ performance in adulthood and specifically gender-specific differences in these variables have had limited interest in previous talent development research (Johnston et al., 2018; Lidor et al., 2014; Smith et al., 2018).

**Previous research**

Over the last decades, research on sports success in adulthood shows that individual factors (e.g. sports debut and training), structural factors (e.g. date of birth), and contextual factors (e.g. pool of participants in a region and number of elite teams) help explain athletic development and sporting success in adulthood (e.g. Augste & Lames, 2011; Cobley et al., 2009; Côté et al., 2006; Hancock et al., 2013).

Although training is a key ingredient for developing individuals into elite athletes (Bailey & Pickard, 2010), the research on individual backgrounds reveals that achieving adult success is not a linear process (e.g. Gulbin et al., 2013; Johnson et al., 2008). For example, studies have shown that the amount of training during a career appears to be similar for more and less successful adult athletes (Gülich & Emrich, 2006; see also Moesch et al., 2013), and that success during adolescence does not automatically lead to long-term success in adulthood (Gülich & Emrich, 2006, 2012). Moreover, research has found that children who had higher levels of participation in peer-led football were more likely to be selected to participate in a male or female national youth initiative (Erikstad et al., 2018), to be selected to play on a woman’s senior national team (Gülich, 2019; Hendry et al., 2019), or to be selected to play professionally on a male Bundesliga team (Hornig et al., 2016).

Date of birth seems to influence the selection of children and youth to elite development programs as well as their future sporting careers (e.g. Augste & Lames, 2011; Nolan & Howell, 2010). Several researchers have hypothesised that older players (i.e. players born early in the selection year) have physical advantages that are sustained throughout their athletic career and skill development (e.g. better training opportunities), resulting in a greater likelihood they will experience success in their sport, a phenomenon called the relative age effect (RAE) (Baker et al., 2009; Hollings et al., 2014; Hancock et al., 2013). RAE is also evident in professional male football players (Sierra-Díaz et al., 2017) and female elite football players (Sedano et al., 2015). However, some studies have shown that RAE becomes weaker for both boys (Jimenez & Pain, 2008; van den Honert, 2012) and girls (Delorme et al., 2010a; Grossman & Lames, 2013) as they age. Studies of young football players in France have also shown that
being born later in the competitive year is associated with drop-outs for both girls and boys (Delorme et al., 2010a, 2010b). With respect to selected youths, the focus of this article, studies have found that RAE is more evident in youth academies of elite clubs than amateur clubs and that relatively younger male players from these clubs have a higher probability to make it to the Bundesliga (Grossman & Lames, 2013).

Contextual factors that influence early development of players, which is of particular interest in this article, include the size of the pool of participants in a region, available spots on a team (Côté et al., 2006; Musch & Grondin, 2001), and the existence of elite teams in a region (Gutierrez Diaz Del Campo et al., 2010; Rossing et al., 2016). Studies that used population size or population density as a proxy for investigating the impact of an athlete’s early development show mixed results regarding the size and density of a city or community affecting the likelihood to attain a high level in a given sport. A study of volleyball players showed that a smaller district in Portugal was related to adult male and female success although living in a less densely populated district in a smaller district was an advantage for men but not women (Hancock et al., 2018). Studies on ice hockey found that male world junior ice hockey players were less likely to be from larger populated cities (Bruner et al., 2011) and that NHL draftees were underrepresented in regions with over 1,000,000 people, that is, the population of one’s birthplace impacted the likelihood of being selected in the NHL draft (Baker & Logan, 2007).

Rossing et al. (2016) found that population density of one’s community affected whether handball and football players became elite athletes. Elite football players came, compared to elite handball players, from communities of high density. However, Ishigami (2016) found that the climate of a player’s home district not the population of the player’s home district affects the likelihood of Japanese football players reaching an elite level. Research on females, which has been investigated to a much lesser extent than males, has shown that professional female soccer players and golfers were from smaller cities and towns (MacDonald et al., 2009), and such birthplace effects exist in Israeli basketball, handball, and volleyball, but not football (Lidor et al., 2014). van Nieuwstadt et al. (2021) problematise the understanding of population density in their study of male elite football players from the Netherlands. They found that, although living in urban municipalities is related to the probability of male youth club players playing at an elite level, a demographic composition such as median income and migration background act as mediators of population density and explains this effect.

Other studies focussing on contextual factors found a relation between proximity to elite clubs or talent programmes and the likelihood of playing at an elite level. Danish studies suggest, for example, that maintaining an elite club requires having access to many youth players in the region (Larsen et al., 2013; Rossing et al., 2018). A study on youth football players (U17 and U19) highlights that the location of elite clubs influences the likelihood of youth developing into elite players (Rossing et al., 2018). Rossing et al. (2016) conclude that it is likely that becoming an elite player in Denmark increases if elite and talent clubs in the player’s place of early development are present. Similarly, a study of elite youth Irish footballers 14–17 years old found that the footballers from a county with an elite training centre were more likely to be selected for a regional talent centre (Finnegan et al., 2017). However, van Nieuwstadt
et al. (2021) found that the presence of elite clubs in municipalities did not influence the likelihood of youth developing into elite football players. They explain the result as a consequence of the fact that the Netherlands is a small country with excellent infrastructure, which makes athlete development resources easily accessible. Studies have also shown that football population size and the presence of elite clubs in a region affect the competitive performance of 15-year-old boys but not girls (Söderström et al., 2019).

Although previous research has advanced our knowledge, some factors and contexts have been overlooked. Studies that focus on contextual variables to capture the place of early development mainly examine how birthplace affects whether a youth athlete plays at an elite level as an adult. Few studies have considered birthplace effects on talented youth’s continuation with sport participation overall, their competitive level, and whether birthplace affects boys and girls differently. To address these gaps in knowledge, this study analyses register data for all boy and girl players born between 1986 and 1996 selected for district teams to determine whether the number of players in a district, the number of senior elite clubs in a district, the players’ elite club affiliation at age 15, and players’ date of birth were associated with playing football at the non-elite level and playing football at the elite level as young adults.

**Method**

This study uses registered data provided by the Swedish Football Association. The data, collected from Sweden’s 24 football districts, include information about all boys and girls who played organized football between 2001 and 2011 (i.e. all players born between 1986 and 1996) and players born between 1986 and 1996 selected for district teams.

**The Swedish FA’s district activities**

Sweden has 24 FA districts divided according to geographical region. To form a district squad, the districts use a successive selection process that starts when the players are 13 years old and includes regular training camps that are generally open to anyone who wants to participate. These camps (1–3 days) are conducted a couple of times each year. All districts have a base structure that includes a district coach responsible for the team and local talent developers/instructors responsible for the training sessions. The local instructors and district coaches choose the 14-year-old players they believe to have developed the most. From this group, the pool of players is reduced to the 16 players who will form a U15 district team and who will participate in the national annual elite training camp the summer they are 15 years old. The players on the district teams serve as the recruiting base for the national U15–19 teams (Peterson, 2011). Of the 384 boys and 384 girls district players that participate each year in the elite camp, about 60 boys and 40 girls are selected to a national U15 training camp, which ultimately results in a U15 national team squad. After the annual elite training camp, a new selection process starts in the districts to select a district team that at the age of 16–17 will play in a national district tournament.
Participants and procedure

This study has been approved by the regional ethics review board (2018/68-31). Between 2001 and 2011, 4224 boys and 4224 girls born between 1986 and 1996 participated in the elite training camp (384 boys and 384 girls each year divided into 24 districts). Due to incorrect registration by the districts and that some players started to play in clubs abroad at an early age, not all the players who participated on the district teams were possible to follow up as young adults. Therefore, this study includes 3943 boys and 4056 girls distributed over the 24 football districts. The data set, provided by the Swedish Football Association (retrieved 2017), includes district player squads (16 players) between 2001 to 2011 (boys and girls born between 1986 and 1996; 11 cohorts). In addition, the data set includes the date of birth of each player, their club affiliation the year they played in the annual elite training camp (age 15), and their club affiliation the year when the players were 21 years old. The data set also includes district conditions such as the total number of football players at the age of 15 and the number of elite senior teams in a district.

Access to elite environments helps explain competitive performance in football (e.g. Larsen et al., 2013; Rossing et al., 2018). Therefore, based on data on senior elite teams in the two highest divisions in Sweden for 2001–2011, the players’ club affiliations were categorised as belonging to an elite club if at age of 15 and 21 they were registered on and played matches in a team of a club competing 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).

Table 1. District conditions in 2001–2011 for girls and boys (the spread for the structural conditions and $M = \text{median}$).

| Categories      | No. of districts$^a$ | Elite team index$^b$ | Elite players in the district team$^c$ | Football population$^d$ |
|-----------------|----------------------|----------------------|--------------------------------------|-------------------------|
| **Small districts** |                      |                      |                                      |                         |
| Girls           | 8                    | 0−0.73               | 0−19.4                               | 47–135                  |
|                 |                      | $M = 0.24$           | $M = 3.8$                            | $M = 100$               |
| Boys            | 8                    | 0−1                  | 0−41                                 | 85–214                  |
|                 |                      | $M = 0.39$           | $M = 10.8$                           | $M = 168$               |
| **Medium districts** |                    |                      |                                      |                         |
| Girls           | 7                    | 0.18−2               | 1.3−19.4                             | 171–269                 |
|                 |                      | $M = 1.04$           | $M = 11.3$                           | $M = 229$               |
| Boys            | 5                    | 0.27−1.09            | 1.2−20.0                             | 273–370                 |
|                 |                      | $M = 0.62$           | $M = 7.8$                            | $M = 323$               |
| **Large districts** |                    |                      |                                      |                         |
| Girls           | 5                    | 1−3.27               | 5.1−24.7                             | 300–373                 |
|                 |                      | $M = 1.96$           | $M = 12.8$                           | $M = 348$               |
| Boys            | 6                    | 0.25−2.45            | 5.8−42.3                             | 462–693                 |
|                 |                      | $M = 1.33$           | $M = 20.1$                           | $M = 575$               |
| **Extra-large districts** |            |                      |                                      |                         |
| Girls           | 4                    | 1.73−6.25            | 2.5−36.3                             | 673–776                 |
|                 |                      | $M = 3.96$           | $M = 21.2$                           | $M = 718$               |
| Boys            | 5                    | 1.18−5.45            | 25.5−87.3                            | 867–1850                |
|                 |                      | $M = 3.87$           | $M = 52.1$                           | $M = 1400$              |

$^a$Number of districts in the category.
$^b$Elite team index = Senior elite club index in the district.
$^c$Elite players in the district teams = Percent (%) of elite players on the district teams.
$^d$Football population = Total number of 15-year-old players in the district.
Most previous studies examining birthplace effects have defined birthplace according to population size and used the category community size or city size (e.g. Ishigami, 2016; Lidor et al., 2014). In this study, we use the pool of 15-year-old football participants in the districts as it reflects the depth of football competition in a district. However, we do not know whether they lived in rural or urban areas within their district which has been key variables in birthplace studies. The districts, in relation to average number of players between 2001 and 2011 in each of the 24 districts, were divided into four categories: small (girls < 135 and boys < 214); medium (girls = 171–269 and boys = 273–370); large (girls = 300–373 and boys = 462–693); and extra-large (girls > 673 and boys > 867) (Table 1). The districts with similar average football populations formed categories and the categories were clearly separated from each other. The number of players in each category differs between girls and boys in relation to the average number of players (the football population); that is, a large district for girls is not necessarily a large district for boys.

To illustrate the elite environment in the districts, which has been found to be related to sport success (De Bosscher et al., 2006; Rossing et al., 2016), an elite team district index for women and men was calculated based on the number of elite teams in the two highest divisions for each year between 2001 and 2011 divided by 11 (years). Data on senior elite teams in the two highest divisions were provided by the Swedish FA.

Outcome variables

Data on the players’ most recent match competition, which were provided by the Swedish Football Association, served as a proxy to determine the age the players were active at a competitive level (ages 17, 19, and 21). Players who did not play a match the year before the age of 17, 19, and 21 were coded as football drop-outs, and players registered with a squad and who had participated in a match at age 17, 19, or 21 were coded as still playing football. The competitive level at age 21, the players’ club affiliation when they participated in a match, was classified based on data for senior elite teams in the two highest divisions (2001–2011) and on the transition to professional football abroad. The classification of the competitive level at age 21 followed the Swedish Football Association’s definition of elite football. Nearly all of the players played in Sweden at age 21, but 40 boys and 12 girls were affiliated with a professional elite club abroad at age 21.

Statistical analysis

Fisher’s exact test was used to compare the frequencies of two dichotomous variables. Chi-square tests were used to compare groups with respect to the different variables (birth quarter, district size, playing at age 21, and playing on the elite level at age 21. Phi coefficient ($\phi$) and Cramer’s $V$ were used to assess effect size. To investigate factors that potentially influenced activity and competitive level in young adulthood, we used logistic regression because the response variables were categorical. The regression models presented are tested for improvement of the baseline model (Omnibus Test; $p < 0.05$) and for a good fit to the data (Hosmer and Lemeshow Test; $p > 0.05$).
The level of significance was $p < 0.05$. All statistical analyses were performed using IBM SPSS Statistics version 26.0.

**Results**

First, we provide some background information on the football districts and the players. Then, we analyse how district conditions, participation in an elite or non-elite club at age 15, and date of birth correlate to continuation in football and elite-level participation in young adulthood.

**The districts’ recruiting base**

The collected data show variations between the districts and between boys and girls. Table 1 illustrates the average number of total football players (football population), number of elite players on the district team, and number of senior elite football clubs in small, medium, large, and extra-large districts (cf. Söderström et al., 2019, p. 152).

Table 1 shows that there are different patterns regarding the recruitment base for the district teams between boys and girls and between extra-large and small districts. There are more elite teams in extra-large boy and girl districts and therefore a higher proportion of elite players on the district teams compared to smaller districts. In boy districts with several elite clubs (extra-large and large districts), the percent of players from elite clubs (extra-large districts 52.1%, large 20.1%, medium 7.8%, and small 10.8%) is much higher than in the girl districts with several elite clubs (extra-large districts 21.2%, large 12.8%, medium 11.3%, and small 3.8%). Overall, statistically significantly more boys than girls on district teams came from elite clubs (21.3% vs. 10.8%) ($\chi^2 \approx 164.08; p < 0.05, \Phi = 0.144$) and for both boys and girls a statistically significantly higher proportion of players in larger districts (i.e. large and extra-large districts) came from elite clubs ($\chi^2_{\text{boys}} \approx 647.77; p < 0.05, \nu = 0.406; \chi^2_{\text{girls}} \approx 150.823; p < 0.05, \nu = 0.193$).

Among the selected district players, 71.5% of the boys and 64.6% of the girls were born in the first 6 months of the competitive year. Boy players in extra-large and large
districts were born earlier in the year (Figure 1) ($\chi^2 \approx 33.203, p < 0.05, \nu = 0.053$), whereas for the girls there were no differences between the districts (Figure 2) ($\chi^2 \approx 11.537, p > 0.05$).

Continuation and competitive level in young adulthood

The analysis shows that the boys continued playing football to a higher extent than the girls after the annual district elite training camp (Figure 3). At the age of 17, 88.8% of the girls and 95.5% of the boys still played football. At the age of 21, 62.5% of the girls ($n = 2536$) and 82.8% of the boys ($n = 3252$) still played football. In other words, 37.5% of the selected girls and 17.2% of the selected boys had quit playing football by the age of 21.

Of the 4056 girls and 3943 boys born between 1986 and 1996 who played on a U15 district team and who participated in the national annual elite training camp, 506 girls (12.5%) and 414 boys (10.5%) reached the elite level at age 21. Of the players still playing football at age 21, 20.0% of the active girls ($n = 2536$) and 12.7% of the active boys ($n = 3252$) played at the elite level.

Girls and boys from small football districts had a significantly higher drop-out rate. For girls, 67.8% from extra-large districts were active at age 21 compared to 59.8% from small districts ($\chi^2_{\text{girls}} \approx 19.77; p < 0.05, \nu = 0.070$). For the boys, 89.2% from extra-large districts were active at age 21 compared to 79.1% from small districts ($\chi^2_{\text{boys}} \approx 37.49, p < 0.05, \nu = 0.098$). In addition, at age 21, a significantly higher proportion of the boys and girls who played on the elite level were from extra-large football districts than the other sized districts. At age 21, 27.8% of the boys who played at an elite level were from extra-large districts and 5.2% were from small districts, and the corresponding percentages for girls were 34.5% and 10.0%, respectively ($\chi^2_{\text{boys}} \approx 219.13, p < 0.05, \nu = 0.259; \chi^2_{\text{girls}} \approx 115.20; p < 0.05; \nu = 0.213$).

In relation to birth quarter, girls who still played football at age 21 were born later in the year compared to girls who dropped out ($\chi^2 \approx 8.200; p < 0.05, \nu = 0.045$); for boys, there were no significant differences between a birth quarter of those who continued to play football and those who dropped out ($\chi^2 \approx 4.490; p > 0.05$). However, regarding playing at an elite level at age 21, the data show that the selected boys ($\chi^2$...
The results show further that, at age 15, more boys who belonged to an elite club (85.5%) than a non-elite club (82.0%) played football at age 21 ($\chi^2 = 5.822; p < 0.05, v = 0.038$). However, the reverse was true for girls: at age 15, more girls who belonged to a non-elite club (63.1%) than an elite club (57.7%) played football at age 21 ($\chi^2 = 4.934; p < 0.05, v = 0.035$). The analysis of elite level at age 21 show that more boy players belonging to an elite club (26.4%; $n = 189$) than a non-elite club at age 15 (8.9%; $n = 225$) played football at the elite level ($\chi^2 = 154.343; p < 0.05, v = 0.218$). Similarly, at age 21, more girls belonging to an elite club (37.3%; $n = 94$) than a non-elite club at age 15 (18.0%; $n = 412$) played football at the elite level ($\chi^2 = 52.729; p < 0.05, v = 0.140$).

Of the 225 boys and 412 girls from non-elite clubs at age 15 that played football at the elite level at age 21, 86 (38.2%) of the boys and 187 (45.4%) of the girls come from small or medium football districts (boys small: 14.2%; boys medium: 24.0%; boys large: 25.8%; boys extra-large: 36.0%; girls small: 18.7%; girls medium: 26.7%; girls large: 25.5%; girls extra-large: 29.1%). Corresponding numbers for the boys and girls from elite clubs at age 15 in small or medium football districts that played at the elite level at age 21 are for boys 12.2% ($n = 189$) and for girls 30.9% ($n = 94$) ($\chi^2_{\text{boys}} = 61.800; p < .05, v = 0.390; \chi^2_{\text{girls}} = 14.362; p < 0.05, v = 0.170$).

The impact of date of birth, club affiliation and district conditions on continuation and playing level at age 21

A logistic regression analysis (Table 2) shows that girls who belonged to an elite club at age 15 had a decreased probability of playing football at age 21 (OR 0.727), whereas boys who belonged to an elite club at age 15, in contrast to what the bivariate analysis showed, were equally likely to play or not play football at age 21. In addition, both boys and girls from a large or extra-large football district were more likely to play football at age 21 (boys OR large 1.28, extra-large 2.25; girls OR large 1.35, extra-large 1.5). For boys, although the bivariate analysis shows no significant difference between birth quarters, the logistic regression analysis shows that being born quarter 2 or 3 was associated with a higher probability of playing football at age 21.
For men and women who were active at age 21 and played at elite level, the logistic regression analysis shows that larger football districts correlate with playing at an elite level (Table 3). Compared to boys and girls from small football districts, boys (OR 5.5) and girls (OR 4.2) from extra-large football districts had a higher likelihood of playing football at an elite level at age 21. Furthermore, belonging to an elite club at age 15 correlates to playing at an elite level at age 21 for both boys (OR 2.25) and girls (OR 2.1). Moreover, boys born later in the year (OR, Q4 vs. Q1 = 2.3) had an increased likelihood of playing football at an elite level at age 21, a result not found for girls born later in the year.

Discussion

The logistic regression analysis shows that the gender of players and size of football district correlate with whether a 15-year-old selected football player continued to play football into young adulthood. Continuation with football at age 21 is lower for girls (62.5%) than for boys (82.7%) and continuation is higher in large districts. The drop-out rates for the girls at age 17 (11.2%) are lower than what Møllerløkken et al. (2015) found in their meta-study of the annual drop-out rate in youth soccer for ages 10–18 years (26.8%), but the drop-out rate at age 19 (22.3%) is similar. The drop-out rates for boys at age 17 (4.5%) and at age 19 (9.3%) are, however, much lower than what both Møllerløkken et al. (2015) and Delorme et al. (2010b) found for boys under 18 years (21.4% vs. 25.5%). In addition, the drop-out rate for boys at age 21 (17.2%) is also lower than what Delorme et al. (2010b) found for male adults (23.5%). Therefore, being selected to a district team at 15 does not seem to affect in any higher extent whether girls continue to play football in young adulthood. However, the drop-out of 9.3% for boys between 15 and 19 years old is much lower than what both Møllerløkken et al. (2015) and Delorme et al. (2010b) found. It seems that being selected to a district team has a positive effect on a boy’s continuation with football into young adulthood.

Table 2. Binary logistic regression active in football at age 21 for boys (n = 3943) and girls (n = 4056).

| Boysa | Girlsb | 95% C.I for Exp (B) | 95% C.I for Exp (B) |
|-------|--------|---------------------|---------------------|
| Odds ratio | Sig. | Lower | Upper | Odds ratio | Sig. | Lower | Upper |
| Birth date quartile (ref. quarter 1) | | | |
| Quarter 2 | 1.222 | 0.050 | 1.000 | 1.493 | 1.025 | 0.758 | 0.875 | 1.201 |
| Quarter 3 | 1.280 | 0.041 | 1.010 | 1.623 | 1.100 | 0.284 | 0.924 | 1.311 |
| Quarter 4 | 1.218 | 0.187 | 0.909 | 1.631 | 1.333 | 0.006 | 1.085 | 1.638 |
| District age 15 (ref. small = 1) | | | |
| Medium | 1.213 | 0.091 | 0.970 | 1.516 | 1.042 | 0.613 | 0.887 | 1.225 |
| Large | 1.283 | 0.023 | 1.036 | 1.589 | 1.350 | 0.001 | 1.128 | 1.616 |
| Extra-large | 2.249 | 0.000 | 1.708 | 2.960 | 1.502 | 0.000 | 1.232 | 1.831 |
| Elite club at age 15 (0 = no, 1 = yes) | 1.008 | 0.948 | 0.799 | 1.271 | 0.727 | 0.003 | 0.592 | 0.894 |
| Constant | 3.307 | 0.000 | 1.404 | 0.000 | 1.404 | 0.000 |

aCorrect classification 82.7%, Nagelkerke’s $R^2 = 0.020$; bCorrect classification 62.5%, Nagelkerke’s $R^2 = 0.012$. (OR, Q3 vs. Q1 = 1.28; Q2 vs. Q1 = 1.22); for girls, being born quarter 4 increased the probability of playing football at age 21 (OR, Q4 vs. Q1 = 1.33).
For the 15-year-old selected district players investigated in this study who reached an elite level in young adulthood, we found that 12.5% of the girls and 10.5% of the boys played at an elite level at age 21. Of the 2536 girls and 3252 boys who were still active in football at age 21, 20.0% of the girls and 12.7% of the boys played at an elite level at the age of 21. We have not found similar numbers for girls in the literature, which illustrates that talent development research seldom focuses on girls’ football participation (cf. Lidor et al., 2014; Smith et al., 2018). The higher percentage of girls reaching elite level may be due to less competition compared to boys since the second division for women in Sweden consisted of two series during the investigated period and this was changed to one in 2013. Our results for boys are similar to Grossman and Lames (2015) results in a study of U17 Bundesliga boy players; they found that 9.9% of the players played at the elite level in young adulthood. In the following part, we will continue discussing the effect of football district size, affiliation to an elite club at the age of 15 and RAE as it relates to boys’ and girls’ continuation with football and participation at an elite level in young adulthood.

### District players’ continuation with football at age 21

One of the central findings from this study is that district players continuation with football in young adulthood is related to football district size (i.e. total number of 15-year-old football players in a region). Continuation is much lower in small football districts for both girls and boys. That is, drop-out differs between the regions in Sweden. For example, growing up in a small football district seems to have a negative effect on boy and girl districts players’ continuation process. However, we have not found any previous studies that acknowledge the relationship between continuation with football and regional conditions such as the size of the districts in terms of the number of football players or community size as a proxy for birthplace effects. Lower rates of continued participation in small football districts may depend on the fact that there are fewer junior and adult players compared to larger districts and consequently fewer teams, which makes it harder for the youth to find a team to play with as he/she gets older.

### Table 3. Binary logistic regression of active players playing at the elite level at age 21, boys (n = 3252) and girl (n = 2536).

|                        | Boys |                        | Girls |
|------------------------|------|------------------------|-------|
|                        | Odds ratio | 95% C.I for Exp (B) | Odds ratio | 95% C.I for Exp (B) |
| Birth date quartile    |      |                        |      |                        |
| (ref. quarter 1)       |      |                        |      |                        |
| Quarter 2              | 1.401 | 0.013 1.074 1.828 1.100 1.828 | 1.069 | 0.611 0.826 1.384 |
| Quarter 3              | 1.490 | 0.010 1.100 2.020 1.251 | 1.111 0.950 1.648 |
| Quarter 4              | 2.274 | 0.000 1.596 3.241 1.285 | 0.109 0.946 1.746 |
| District age 15        |      |                        |      |                        |
| (ref. small = 1)       |      |                        |      |                        |
| Medium                 | 1.786 | 0.004 1.207 2.642 2.036 | 0.000 1.509 2.747 |
| Large                  | 2.318 | 0.000 1.630 3.297 2.542 | 0.000 1.875 3.448 |
| Extra-large            | 5.505 | 0.000 3.920 7.730 4.186 | 0.000 3.087 5.677 |
| Elite club at age 15   |      |                        |      |                        |
| (0 = no, 1 = yes)      | 2.247 | 0.000 1.764 2.861 2.072 | 0.000 1.556 2.759 |
| Constant               | 0.035 | 0.000 | 0.000 | 0.096 | 0.000 |

*Correct classification 87.3%, Nagelkerke’s $R^2 = 0.146$; *bCorrect classification 79.7%, Nagelkerke’s $R^2 = 0.087$. 

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Moreover, affiliation with an elite club at age 15 means different things for girls than for boys in terms of continuing to play football. The analysis shows that belonging to an elite club at age 15 reduces the likelihood of girls playing football at age 21, but it has no effect on the likelihood of boys playing football at age 21. The fact that belonging to an elite club at age 15 decreases the likelihood of girls continuing to play football at age 21 may be the result of weak boundaries between youth and senior football and the structure of talent development in women’s club football. In general, girls mature earlier than boys and there are fewer girl players and fewer junior girl teams, which may explain why girls start to play on senior teams at a younger age than boys. For many girls, the only opportunity to play football in late adolescence is to compete for spots on senior teams. This competition is tougher in the elite clubs compared to non-elite clubs and, as our results show, the drop-out starts earlier and is larger for girls who belonged to an elite club at age 15.

The analysis shows that girls born in quarter 4 and boys born in quarter 2 and 3 have an increased likelihood of playing football at age 21. This finding, however, does not align with previous studies that found both boys and girls born in the last half of the competitive year were significantly overrepresented in the drop-outs (Delorme et al., 2010a, 2010b). That is, being selected for a district football team at age 15 may affect whether girls and boys born later in the year continue to play football.

**District players that attained elite level in football at age 21**

For district players who continued with football and reached an elite level at age 21, the football district where they grew up influenced whether they reached an elite level in young adulthood. Living in an extra-large district with many 15-year-old footballers and senior elite teams increases the likelihood that boys (5.5-fold) and girls (4-fold) will play at an elite level in young adulthood. In other words, boy and girl district players from small districts with fewer 15-year-old footballers and no elite teams have a decreased likelihood that they will play football at an elite level in young adulthood. Similarly, playing football in larger districts with proximity to elite clubs (a majority of players belonging to a non-elite club at age 15 who played at an elite level at age 21 came from large or extra-large districts) increased the likelihood of both girls and boys playing at an elite level at age 21. The analysis shows further that belonging to an elite club at age 15 (cf. Larsen et al., 2013; Rossing et al., 2018) increased the likelihood of both girls and boys playing at an elite level at age 21, a finding that could be explained by the clubs’ talent development program (TDP). TDP provides long-term training and high-training volume as well as high-profile coaching, especially for boys. In these milieus, players are trained early in the adult way of playing football – that is, players who best fulfil the game played at the elite level (Lund & Söderström, 2017). This level of training and coaching continues after age 15, especially for boys since they were equally likely to play football at age 21 as non-elite players, and ensures a smoother transition from junior to senior elite football. This type of intense training and coaching is not, to the same extent, available to players in non-elite clubs. Other studies also note that developing high-level skills requires investment over many years.
(Gülich & Cobley, 2017; Haugaasen & Jordet, 2012), and elite clubs probably facilitate this better than amateur clubs, which rely on volunteer coaches.

Although girls and boys affiliated with an elite club at age 15, compared to players affiliated to a non-elite club, were more likely (2-fold) to reach a senior elite level, a majority (e.g. number of players) of all district players that played at an elite level in young adulthood came from non-elite clubs (cf. Gülich, 2014). The players who belonged to a non-elite club at age 15 (225 boys and 412 girls) and reached an elite level in young adulthood have, in Gülich and Cobley (2017) terms, developed outside the elite club’s talent development program. Although this development may be explained by the uniqueness of these individuals, it may also be a consequence of their proximity to elite clubs in their district. A majority of the players belonging to a non-elite club at age 15 who at age of 21 reached senior elite level came from larger districts, which have more elite teams than small districts (Table 1). Elite clubs may affect the amount and quality of training among all clubs in a district as well as provide better opportunities for youth to adopt local role models and a sense of community pride (cf. Rossing et al., 2016). Therefore, this study confirms other studies that showed that proximity to elite clubs increases the likelihood of playing at an elite level (Rossing et al., 2016, 2018). This study indicates that elite clubs have a radiating effect on the development of players who do not belong to an elite club, which enhances the performance level within the talent pool near the elite club (cf. Gülich, 2014; Rossing et al., 2016, 2018). Although becoming an elite player increases if elite and talent clubs in the player’s place of early development are present, whether and how radiating effects operate in a region cannot be discerned in this study as we do not have exact data on where players grew up within a district. This is a topic for future studies to investigate.

The 225 boys and 412 girls belonging to a non-elite club at age 15 who attained elite level at age 21 illustrate that early selection to an elite club is not a prerequisite for attaining a senior elite level in football. Previous studies have also shown that Bundesliga players were recruited into a youth elite academy at an older age than less successful senior players (Gülich, 2014). In addition, studies of national women team players (Canada and Germany) show that they were selected later to youth national teams than youth national players who did not play in the senior national team (Gülich, 2019; Hendry et al., 2019). District players at age 15 in this study who belonged to a non-elite club and attained senior elite level at age 21 were selected by an elite club after the annual elite training camp, whereas those belonging to an elite club at age 15 and not reaching an elite level in adulthood were replaced by others. Gülich’s (2014) study of German elite youth football and Bundesliga players and Ford et al.’s (2020) study of professional youth academies also showed that elite football in adulthood is an effect of repeated selection and de-selection procedures across ages. In this study, we have no data on players’ club movements after age 15, which is a limitation. However, it is possible that the phenomenon of non-elite club players at age 15 who transitioned to senior elite might be related to the Swedish upper-secondary school sport system. All district team players began the fall after the elite training camp in upper-secondary school and many upper-secondary schools in Sweden offer football training, which, in most cases, are led by coaches from nearby football clubs.
(elite and non-elite clubs). It is likely that many of the district players participated in this school football training, where player development is in focus. If an elite club is responsible for this training, they can recruit players from the school training milieu. If the training is not conducted by an elite club, football in school can be a window for being discovered by clubs in higher leagues, which gradually contributes to being selected by an elite team later and playing elite football in young adulthood. However, as the results show, such a selection procedure for district players belonging to a non-elite club is a much more likely scenario in a large or extra-large district with many elite teams, especially for boys.

The selection of non-elite club players by an elite club after age 15 might also be due to the fact that these players to a higher extent participated in peer-led football in childhood (cf. Hornig et al., 2016). However, we have no data on the micro-structures of practice and its relation to early or late selection to elite clubs, which is a topic for future studies to investigate. Hypothetically, it is possible that the players affiliated to non-elite clubs at age 15, through the school sport system, transition to higher-level squads in their club, or change of club affiliation, increased their organised football practice and high challenge activities, which positively affected their football development (cf. Hendry et al., 2019). From this perspective, the non-elite club players at age 15 may have participated in peer-led football and participation in other sports at a later age, which Güllich (2019) found to differentiate female national team players from Bundesliga players. The possible increase of organised football training during adolescence put forth here has also been found to distinguish between male Bundesliga players and amateurs (Hornig et al., 2016).

The main player selection principle the Swedish FA advocates is that players who have come the furthest in their football development should be selected (https://fogis.se/barn-ungdom/utvecklingslager). This approach, as our results show, means that players born in quarters 1 and 2, as an effect of a successive selection process in the districts that starts when the players are 13 years old, dominate the district teams at age 15 as the coaches in the 24 districts choose players according to skill level alone (cf. Meylan et al., 2010). Similarly, other studies of youth selected to football elite development programs (Finnegan et al., 2017) or football academies (Kelly et al., 2020) show an over-representation of players born in quarters 1 and 2. However, the logistic regression analysis also shows that boys born quarter 2 and 3 and girls born quarter 4 on district teams have a higher likelihood of continuing playing football at all at the age of 21 and, for the boys, a higher likelihood of playing at the elite level at the age of 21. These findings regarding the boys confirm findings from other studies. Kelly et al. (2020) showed, for example, that football academy players born in quarter 4 were more likely to achieve a professional contract. In addition, Grossman and Lames (2013) found that relatively younger football players have a higher probability to make it to the top possibly because talented players born late in the year have to develop their football skills further to compete with physically stronger athletes (cf. Delorme et al., 2010a; van den Honert, 2012). Research on talent identification also shows that coaches use their experience and ‘gut feeling’ to evaluate talent (Christensen, 2009). That is, a coach’s taste for talent guides his or her judgments of which physical, mental and technical qualities and competencies a future elite soccer player should have.
at a given age’ (Lund & Söderström, 2017, p. 250). This attitude could mean that young players would have to exhibit extraordinary talent and skills to satisfy the coach’s taste. Moreover, relatively younger players might have more room for mental and physical development, which affects the likelihood of developing into an elite football player (see Deprez et al., 2013; and van den Hornet, 2012, regarding the diminishing of birthdate effects after puberty).

Concluding remarks

This study shows how contextual factors such as the number of football players and elite clubs in a region influence whether boys and girls continue to play football and whether they play at an elite level as young adults. Our findings, from an overall perspective, mostly confirm previous research findings that the general population size in a region and proximity to elite clubs affect whether a boy or girl develops into an elite player (e.g. Gutierrez Diaz Del Campo et al., 2010; Hancock et al., 2018; Lidor et al., 2014; Rossing et al., 2016). However, as our data show, these contextual factors are also related to the probability of playing football at all in adulthood. We found that girl and boy district players who come from large and extra-large football districts have a greater opportunity to continue playing football into adulthood, but they also have a greater likelihood that they will play elite-level football. Sweden is an elongated country that stretches north and south with differences between football districts, including the size, population density, and climate. Southern Sweden, the most populated and the most densely populated part of Sweden, has almost all the large and extra-large football districts and has a warmer climate (i.e. fewer days with snow on the ground). The large and extra-large football districts not only have more players and more grass-root and elite teams but also are located in a warmer climate, which most likely impacts the continuation and competitive level at age 21 (cf. Ishigami’s, 2016 study of Japanese elite football players). Since our data are based on the football population in a district and reflects the depth of football competition in the districts, no direct comparisons can be done with other studies that used community population size as a proxy to examine birthplace effects (e.g. Bruner et al., 2011; Lidor et al., 2014; MacDonald et al., 2009). In addition, it is difficult to compare different countries because, in Lidor et al. (2014, p. 21) terms, ‘the cultural and structural makeup of a given country’ will influence factors associated with a senior elite level in sport. Although the results in this study regarding district affiliation and competitive level in football at age 21 deviate from previous research that found that elite athletes, for example, were from smaller cities in North America (female soccer and golf players, MacDonald et al., 2009) or a smaller district and less densely populated districts in Portugal (e.g. male volleyball players) (Hancock et al., 2018), we need to be aware of that a small city or less-densely populated area in Sweden might not be the same. If we consider other contextual and cultural factors, such as median income and non-western background related to population density, which van Nieuwstadt et al. (2021) found affected the probability of male youth club players attaining elite level football in the Netherlands, the complexity surrounding birthplace effects increases. Baker et al. (2009) also point out the complexity surrounding the social and cultural
mechanisms that relate to the birthplace effect. This suggests that birthplace effects are highly contextual with respect to the sport and the country (cf. Lidor et al., 2014).

The finding that both girls and boys affiliated with an elite club at age 15 increase the likelihood of playing at an elite level in young adulthood suggests the more strategic work needs to take place at the national level. Players connected to an elite club typically receive training based on the elite club’s structure. However, boy and girl football players, especially in small districts, may not belong to nor live near an elite club. If radiating effects exist (Güllich, 2014), the Swedish FA needs to create a development culture in districts that do not have elite clubs, as such work will likely help retain the girl and boy players from the small and medium districts as well as increase their opportunities to develop into an elite football player.

Finally, we are aware that our analysis only captures some aspects of the place of early development on athletes’ performance in adulthood. If we had added population density to the analysis, we might have better captured the internal structures in a city or a region, which most likely would have added strength to the analysis of continuation pathways (cf. Hancock et al., 2018). Birthplace effects need to be studied in a more fine-graded way in relation to the specific country to capture an extended understanding of how place influences early development. These issues should be considered in future studies. To gain more knowledge about how place influences early development and the transition from junior to senior level football, other variables and perspectives need to be considered that capture more aspects of football regions, their structure, and organization and their football cultures, including whether players live in rural or urban areas in a district, players’ movements between or within districts during their upbringing, players’ perspectives on being in a specific place, and the influence of place on the continuation with football and elite-level participation into young adulthood.

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Notes

1. Club affiliation could not be classified for 13 boys.

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