

**Talent hotspots and the role of community density in youth soccer:** 1  
**The unique case of Athletic Club de Bilbao situated in the Basque Country, Spain** 2

**Abstract** 3

Birthplace and the location of residence can impact young players' opportunities to engage in 4  
youth soccer developmental activities, varying considerably based on contextual influences. This 5  
study aimed to identify the 'talent hotspots' contributing the most players to the selection phases 6  
of Athletic Club de Bilbao—a unique professional soccer club in the Basque Country, Spain—. 7  
To achieve this, we analyzed whether contextual variables—such as population density, proxim- 8  
ity to the academy, family income, and the number of clubs within players' municipalities—sig- 9  
nificantly influenced player selection. Using logistic regression on data from 1,411 male players 10  
(aged 9 to 35), we identified Bizkaia, the largest province in the Basque Country, as a statistically 11  
significant talent hotspot ( $p < 0.05$ ). The Odds Ratio revealed that regions with an average popu- 12  
lation density between 150 and 650 male inhabitants aged 0–19 per km<sup>2</sup> were especially relevant 13  
during the selection process, showing statistically significant results in multiple incorporation 14  
stages. The findings suggest that scouting efforts should prioritize these densely populated areas, 15  
while also ensuring equitable access to organized youth soccer across all regions. Finally, the 16  
study highlights the role of the concept of 'sporting development' defined as the conditions and 17  
environments in which players develop their skills—as a critical variable in the talent selection 18  
process. 19

**Keywords:** Talent Hotspots, Sporting development, Youth Soccer Development, Population 20  
Density, Soccer Academies, Soccer Talent Selection 21

**Introduction** 22

The management of sporting talent in the field of soccer has developed and improved over 23  
the recent years. This is due, or at least in part, to our evolving understanding of both the innate 24  
characteristics of the soccer player, which are present from birth, and the acquired skills and 25  
contextual components developed throughout his/her professional career<sup>1</sup>. While coaches and 26  
multidisciplinary teams (MDTs) have traditionally focused on the technical, tactical, physical, 27

and psychosocial skills of players, a growing number of practitioners and academics now argue 28  
that contextual factors—such as place of birth or the population density of the area where players 29  
develop—should also be considered in professional team selection<sup>234</sup>. There is some confusion 30  
in the academic literature regarding geographical and contextual variables, as these are often 31  
introduced without clearly distinguishing their independent roles in talent management<sup>5</sup> (Ros- 32  
sing et al., 2018). Several studies have examined how a player’s birthplace relates to the likeli- 33  
hood of becoming a professional, suggesting that this probability increases when individuals are 34  
born in high-density communities or close to a sports club<sup>6</sup>. 35

Population density has been associated with a higher likelihood of achieving professional 36  
status in soccer, possibly due to greater access to talent pools, sports facilities, and economic 37  
resources<sup>6,7</sup>. However, this relationship remains inconclusive; some studies, such as Ishigami 38  
(2016), suggest that population density does not significantly influence the probability of be- 39  
coming a professional athlete. Rossing et al. (2018) propose population density (inhabitants/km<sup>2</sup>) 40  
as a more precise indicator of the birthplace effect, emphasizing factors such as average house- 41  
hold income and availability of sports facilities<sup>8</sup>. Although this influence has been documented 42  
across various sports contexts<sup>9</sup>, discrepancies in existing research highlight the need for further 43  
investigation. 44

Regarding birthplace, several studies have emphasized the role of community size (i.e., 45  
number of inhabitants), particularly the greater potential of small and medium-sized cities to 46  
detect and develop future professional players<sup>9</sup>. One of the earliest studies on this topic found 47  
that professional athletes were overrepresented in cities with fewer than 500,000 inhabitants<sup>10</sup>. 48  
However, subsequent research pointed to a stronger association between birthplace and player 49  
selection in larger urban areas<sup>11</sup>. These discrepancies may stem from differing geographical units 50  
of analysis—city versus municipality—used across studies in regions with varying population 51  
scales<sup>4</sup>. 52

An additional complexity in studying contextual variables related to the selection and pro- 53  
motion of professional athletes is the conceptual confusion between an athlete's birthplace and 54

their actual location of sports development. Although birthplace is commonly used as a reference to assess contextual effects on athletic success, there is ongoing debate regarding whether this variable accurately reflects the environment in which athletes genuinely acquire and develop their skills. This conceptual limitation has been highlighted by Ishigami (2016), emphasizing the need to clearly distinguish these two concepts to obtain more precise and conclusive findings.

Both terms are often confused, as some authors implicitly consider that place of birth and location of residence are the same, whereas others argue that a player's residence—where they engage with sport—is distinct from their birthplace and may be a more relevant factor in talent development<sup>4</sup>. Rather, for a soccer player to develop, other variables such as the number of sports facilities or their proximity must be taken into account—something often overlooked in studies that focus solely on the effect of birthplace.

It is important to clarify that a player's birthplace does not necessarily correspond to the location where they were raised or developed their soccer skills. For instance, a player might be born in a hospital outside their usual place of residence. Similarly, if they trained and played soccer in a city or region other than their birthplace, this may lead to misinterpretation. Considering these scenarios, the present study differentiates between the location of development—where the player engaged in soccer—and their specific birthplace.

Considering both the player's location of development and birthplace as a combined variable represents a key advancement in talent identification research. Until now, academic literature has primarily focused on birthplace when examining contextual influences on talent management<sup>4</sup>. Incorporating where players develop athletically offers a clearer understanding of how talent develops in specific geographic areas, shaped by the availability of training environments and resources. It is not just about the location itself, but what that environment provides to support a player's development (Authors, anonymized).

The number of clubs within a given area is a key factor in evaluating the geographical influence on a player's talent development. A greater number of clubs can contribute to the identification and encouragement of sporting talent by providing more development

opportunities which we define as opportunities for players to engage in structured training, competitions, and skill development activities<sup>12</sup>. These clubs also play a broader role in promoting physical activity within society. Research shows that both the number and location of clubs—particularly their proximity to elite facilities—influence the likelihood of becoming an elite player<sup>13,14,5</sup>. By offering training and development opportunities, clubs help young players enhance their skills and understanding of the game. However, this dynamic intersects with the longstanding urban–rural divide. Rural areas typically host fewer clubs than densely populated urban zones<sup>8</sup>, limiting access to resources and development pathways<sup>10</sup>. Proximity to elite clubs has also been shown to provide young players with better training, facilities, and competitive opportunities<sup>4</sup>. Therefore, soccer talent development programmes must consider the geographic context of youth players to ensure more equitable access to elite-level pathways. By introducing the variable of location of development, this study adds an innovative conceptual dimension. Previous research has approached this factor as a new way of classifying player profiles. Players born and developed in the same municipality—termed 'constant development players'—differ from those whose birthplace differs from where they later trained, referred to as 'rooted development players' (Authors, anonymized). This distinction may be critical in talent identification and selection processes, as it highlights the importance of tracking a player's developmental journey across different locations and assessing the environments that supported their growth. Accordingly, we argue that talent management studies should distinguish between: (1) the municipality where the player was born (birthplace), and (2) the location of development—one or more municipalities where the player trained and played, which may not correspond to their birthplace or official residence.

In light of these considerations, this study aimed to identify the 'talent hotspots' that contribute the most players to the selection phases (by stage of incorporation into an academy) within the Basque Country, Spain. It specifically examined whether contextual variables—such as population density, distance to the academy, family income, and number of clubs in each municipality—influence these outcomes. This is a case study of a club with a uniquely constrained

recruitment system: Athletic Club de Bilbao, which recruits exclusively from a defined geographic area. The central research question is: How do contextual variables influence the identification and selection of soccer talent in a geographically limited recruitment system? The findings of this study may benefit soccer academies, coaches, and policymakers by offering insights into more effective talent identification and management strategies, particularly in regions with similar constraints.

## **Materials and Methodology**

### ***Context and Data Collection***

To identify locations of sporting development, this study focused on players from a professional Spanish First Division club whose inclusion, due to the club's characteristics, would allow us to meet the planned objectives. More specifically, this club's unique philosophy of selection and its promotion of its players are closely linked to the relevant geographical variables (place of birth and location of sporting development.). In addition to its particular territorial philosophy and its development network (through the alliance of its surrounding amateur 'satellite clubs'), this particular club stands out for the stability of its sporting project (it is the only team, along with FC Barcelona and Real Madrid, that has never been relegated from the top Spanish soccer category) and for the productivity of its professional talent academy. Given the need to develop home-grown talent in an increasingly competitive and globalized soccer system, this case study, with its analysis of the phenomenon of sporting development location, is of special interest due to its ability to be extrapolated to other models of home-grown sporting talent development<sup>15</sup>.

From a geographical point of view, the club is located in the Autonomous Community of the Basque Country (BAC), situated in the north of Spain bordering France, a territory in the south of Europe. The club, officially titled the Athletic Club de Bilbao, is one of several professional clubs in which only players from its territory participate, competing at the highest level since its foundation in 1898.

The Autonomous Community of the Basque Country has a total population of 2,440,723 inhabitants, according to data from the National Statistics Institute (INE) as of 2021. This

population is distributed among the three provinces that make up the autonomous community: 137  
Araba (577,713 inhabitants), Gipuzkoa (718,887 inhabitants), and Bizkaia (1,144,123 inhabit- 138  
ants). In addition, and according to the club's philosophy, its player selection processes have been 139  
extended to two more territories, Iparralde-South of France (108,521 inhabitants) and Navarra 140  
(661,197 inhabitants). This implies a population density of 1,134 inhabitants per km<sup>2</sup>, with a sur- 141  
face area of 18,398 km<sup>2</sup>, which makes it one of the most densely populated regions in Spain, thus 142  
carrying important potential for sporting development. Specifically, in the field of soccer, it cur- 143  
rently has three professional teams represented by the three provinces of the BAC in the highest 144  
category of Spanish football (La Liga): Alavés (Araba), Real Sociedad (Gipuzkoa), and Athletic 145  
Club de Bilbao (Bizkaia). 146

In the last edition of the La Liga championship (2023–2024), when considering Span- 147  
ish territorial representation, players born in the provinces of the BAC comprised a total of 59 148  
players in all the teams of La Liga (a total of 25 from the Athletic Club de Bilbao), distributed 149  
across three Basque provinces, out of the total of 52 Spanish provinces. 150

In short, the area has a small population, from which it must detect the places where the 151  
best sporting talent is concentrated, as this is its captive and competitive market. 152

### ***Participants and Sample Distribution*** 153

Data were collected on players who were selected for the academy and who did or did 154  
not make their debut on the club's first team throughout 30 seasons between 1993 and 2021 (N = 155  
1,411). All the records correspond to players who have participated in at least one season (with a 156  
valid date of federation) in the soccer academy of the Athletic Club de Bilbao. 157

It was observed that both in terms of the profile of players with constant sporting devel- 158  
opment and in the case of players with rooted sporting development (Table 1), the most incorpo- 159  
rated players were those corresponding to the U-12 stage. Although players with constant sporting 160  
development were the most represented, comprising 25.2% of the total number of players (1,411), 161  
this particular age group had the greatest weight within the total sample. 162

Regarding the players with rooted sporting development, the table shows how the differential representation between player profiles increased as the categories of incorporation increased, with values of 79.1% in the case of players who directly joined the first professional team. The chi-square test showed a statistically relevant association between the change of place of birth and place of sporting development (chi-square value of 11.070 and a calculated chi-square value of 63.77).

**Table 1.** Players with rooted sporting development and players with constant sporting development

### *Ethical Considerations*

Written informed consent was obtained from the participants' parents or legal guardians through the club, in accordance with the Declaration of Helsinki and the Spanish Data Protection Act 15/1999 (Ethics Committee Ref: ETK-3/21). Additionally, all participants gave their assent to take part in the study. The club also provided signed consent for the inclusion and use of the data.

### *Procedure and Statistical Analysis*

As this study focuses on men's soccer and academy-eligible athletes, in addition to population size being considered in the first of the analyses, a new indicator was incorporated that is more in line with the objective of player recruitment. The density was calculated based on the number of male inhabitants aged 0–19 years in the territories analyzed and the size of these territories in km<sup>2</sup>.

For the location of talent concentration sites, coefficients were calculated by dividing the number of players per 1000 inhabitants in each of the provinces by the total number of players per 1000 inhabitants in the whole territory<sup>17</sup>. Table 2 and Figure 1 show the provinces as territorial units of analysis while Figure 2 shows the municipal territorial units. The calculation of 'per 1000' was completed by dividing the number of players identified from each province by the total population of that province and then multiplying by 1000 to standardize the rate per 1000 inhabitants<sup>9</sup>.

Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated by comparing the relative frequencies of sporting development locations by municipality<sup>18</sup>. A hierarchical binary logistic regression model was constructed to determine the probability of a player being selected for the academy and making a debut on the professional team. Statistical analyses were carried out using R Studio software (R 4.3.0), primarily employing the lme4, stats, and broom packages to estimate and interpret the regression models.

## Results

The analysis of the coefficients calculated for each of the territories is shown in Table 2. The results of the first analysis show that the province of Bizkaia, with a population size of 1,144,123, is the territory in which the largest number of players were identified, selected, and promoted in all categories (also the territory where the club and its high-performance centre were located).

**Table 2.** Player coefficients of sporting development in the selection phases

Graphically, the provincial map (Figure 1) represents the concentration of talent with selection values of 10.42 players and with 1.17 debut players per 1,000 inhabitants, which indicates that Bizkaia is the territory with the highest concentration of talent.

**Figure 1.** Provincial territorial unit in the selection phases by stage of incorporation into the academy. The red dot identifies the location of the headquarters and the academy of the professional club.

Looking at the selection phase by stage of incorporation into the academy, Bizkaia continued to emerge as the territory with the highest values, with a total of 10 (per 1,000 inhabitants) players above the rest. Within the identification phase of the classification stage, soccer players are incorporated according to their age cohort. As can be seen in the table 2, players under 12 years of age (U-12) had much higher values than those in the other categories, with at least five more players than the rest of the age cohorts. This means that the fundamental stage of incorporation into the club takes place at the age of 12, and at this age, the main territory was still Bizkaia.

In the rest of the age groups, Bizkaia's values continued to be higher than those of the other territories. This again places the weight of talent identification in this territory.

The same trend was maintained in the promotion phase, where the total number of debutants was higher than one player per 1,000 in Bizkaia. The contribution of the rest of the territories was found to be anecdotal, as in the case of the North Basque Country, where hardly any players made their debut (0.10). In the case of those players who did not pass through the academy, their incorporation into the first team was considered the result of a transfer to a Basque team. In this case, the data show that there is no one territory that was more representative than any other.

When we delve deeper into the specific areas within the territory of Bizkaia (municipal territorial unit) that could be points of interest for the club, the analysis carried out on the municipalities gives a scattered picture of these points of talent concentration (Figure 2).

**Figure 2.** Municipal territorial unit in the selection phases by stage of incorporation into the academy. The red dot identifies the place where the headquarters and the academy of the professional club are located.

When examining which of the other variables could have influenced a player's sporting development, a distinction was made between one of the key moments in talent management: the selection phase (Table 4). In this phase, the density variable became more relevant than the rest of variables. Table 3 describes the main contextual variables used in this study.

**Table 3.** Definitions and descriptive data of the contextual variables. M and SD represent the mean, standard deviation, and skewness.

In the selection phase, the results shown in Table 4 indicate that among the four explanatory variables of the effect of the place of growth on player selection, density was the variable with the greatest predictive power at all stages of incorporation into the academy. Three typologies of density were established, and it was the municipalities of between 150 and 650 inhabitants, with values between 1.17 and 1.49, which showed the greatest predictive power in all stages of selection, except in the U-14 category. In contrast, municipalities with fewer than 150 inhabitants had

values between 0.65–0.86, and municipalities with densities of more than 650 had values of 0.84–1.09.

Having analysed the data, density emerged as an indicator based on its explanatory power for the selection of players who had grown up playing soccer within the territory. Within this territory (Bizkaia), those municipalities with a density of 150 to 650 inhabitants per km<sup>2</sup> are where the selectors should focus their attention. Having determined the predictive power of density, it should be noted that both the level of equipment resources (number of clubs) and the distance to the centre of the area played a secondary role in selection over and above average household income. Furthermore, a distance between 13–20 km to a high-performance centre was considered highly relevant to the sporting development of a player and his possibility of being selected.

**Table 4.** Selection OR: Incorporation stage, with reference to contextual variables

## Discussion

The purpose of this study was to use the unique case of Athletic Club de Bilbao to better understand the influence of birthplace and the location of sporting development on selection and development in youth soccer. According to population size, and on the territorial scale of province, the greatest concentration of talent selection was in Bizkaia, the territory where the head office and its football academy were located. This was the territory with the largest population size, with a total of 1,144,123 inhabitants and a size of 2,217 km<sup>2</sup>, which would be in line with studies suggesting that there is a relationship between population size and density, both in terms of participation in individual sports and collective sports in general<sup>19</sup> as well as in soccer in particular<sup>20</sup>. Being born in larger cities brings a greater likelihood of both participation and sporting excellence<sup>17</sup>. These regions also have more opportunities for learning and development, as well as a greater diversity of people and perspectives. **This means that there are more opportunities to play either in clubs or in soccer schools, which in turn increases the likelihood of being seen by academy scouts, particularly in areas closer to the Academy.**

A special case emerged in Bizkaia, however, which is a province in which cities and municipalities of different sizes and population densities are grouped together. Its capital, Bilbao, with a total of 346,843 inhabitants and a population density of 8,521, is paradoxically not a focal point for detecting talent, nor a place of birth or a place of sporting development for soccer players who form part or have formed part of the soccer academy and have made their debut on the first team. While early studies on the effect of place of birth showed that male athletes born in cities of less than 500,000 people were more likely to play in professional leagues and achieve a high level of performance than athletes born in larger cities, this study shows that the concentration of talent did not emerge in the capital city of the territory. The results are thus in line with those investigations that highlight an over-representation of players born in places of smaller size and density<sup>10</sup> (MacDonald et al., 2009). It is the smaller cities, in the orbit of the metropolitan area of Bilbao, where soccer players were born and grew up playing the sport most effectively. While some of the players born in the city of Bilbao could be mentioned, in the overall count, they remain anecdotal.

After the size of the territory, a second level of analysis illuminated the role that density plays in the configuration of talent hotspots. Previous studies have used population density as a predictor in the selection of talented athletes, and the results of this research confirm this predictive power. However, it should be noted that, unlike all previous studies, this study took density to refer to that part of the population that is likely to be selected for the professional soccer academy, which would be males aged 0–19 years old. Taking this more specific type of density as a reference, within the territory of Bizkaia, the cities with a density of 150 to 650 of the 0–19 years-of-age cohort per km<sup>2</sup> are those from which the greatest number of players were selected. After the main city (capital of the province), which was not a reference for the selection of talent, 13 mid-range cities appeared as the main talent hotspots. These were cities of different sizes and densities, and it is difficult to find a common population characteristic. They are distributed across the map and together show a network of talent hotspots that form the core of the academy.

One of the reasons that could explain this distribution of talent hotspots is that these 289  
smaller cities have a physical environment that is more conducive to unstructured play activities 290  
between young people of different ages, as well as to experimentation with different forms of 291  
sporting activities<sup>21</sup>. The practice of soccer requires conditions that large cities do not provide. 292  
Specifically, the high densities or the orography of large cities do not facilitate the practice of 293  
soccer, which requires the open spaces that these 13 cities provide. This physical environment of 294  
smaller cities offers a greater possibility for the quality and quantity of soccer practice that favours 295  
the acquisition of technical and relational skill—in short, of soccer dynamics<sup>14</sup>. 296

At the same time, and according to the data on the role played by the number of clubs in 297  
these places of concentrated talent, the players who made selection came from places with a 298  
greater number of soccer clubs or had grown up as athletes in places with more than one club, and 299  
this can only happen in areas with a high ratio of clubs. Having many teams in a given territory 300  
increases the options of playing in all the categories offered by the club, and this, in turn, means 301  
a competitive structure that increases the sporting level of the territory. Internal competition 302  
within clubs through their own categories and external competition between clubs can help play- 303  
ers challenge themselves and improve their skills. 304

Another relevant variable in the detection of the concentration of talent was access to the 305  
sports facilities provided by the different clubs in other categories for young soccer players<sup>9</sup>, 306  
which, in this study, was approached through the distance to the academy. The academy has be- 307  
come a major focus of attraction due to the training facilities and the sporting culture it provides 308  
for young soccer players in this area, and the results show that it brought together, in its immediate 309  
surroundings, a network of small points of talent concentration<sup>22</sup>. 310

In short, there are several contextual factors that can explain the configuration of the 311  
points of concentration of talent in men's soccer in this territory. Overall, this study has high- 312  
lighted that the selection processes of talent in soccer are influenced by the conditions offered by 313  
medium-sized cities. Cities that offer spaces, resources, and better sports infrastructure have an 314  
impact on the acquisition of skills through the practice of soccer. Taking into account that talent 315

selection processes have their main focus on the search for the player with the best qualities, based on these results, attention should be paid to the places where a player is born and grows up. Looking at the place of birth alone, however, is a short-sighted view. Determining the complete path that a player follows to becoming a professional player is the challenge that lies ahead of professionals in the field of sports talent management.

### **Limitations**

Despite the correlation with other research, it cannot be ignored that comparability with other studies is complex due to the different territorial scales used in different geographical, social, and cultural contexts. As pointed out in the introduction to the study, many authors forget that when talking about place of birth, there are other variables in that space that impact how it transforms the growth of a player. The difficulty would be in determining the ideal size of these spaces or places, since each of the studies has different ideas of what a medium-sized or small city is. On the other hand, the dependence on the availability of the data provided by the sports entity has made it impossible to use variables that could have complemented and underpinned the results obtained. It will also be important to capture such influences in women's and girls' soccer, and more specifically within Athletic Club de Bilbao, as gender-related mechanisms may paint a different picture and findings from this male study should not be considered homogeneous.

### **Conclusions**

A high percentage of players develop their skills in municipalities other than their birthplace, highlighting the importance of sporting development over birthplace in talent development. This suggests the need to track player trajectories to understand where talent emerges. The area surrounding the club, characterized by higher concentrations of talent, showed ratios close to or above two players per 1,000 inhabitants during selection and promotion phases. Municipalities with population densities between 150 and 650 males aged 0–19 per km<sup>2</sup> were the most represented, indicating that medium-density areas serve as key hotspots.

Population density emerged as the strongest predictor of talent selection. Fewer players were selected from low-density, distant municipalities with limited club presence. However, although

more players were selected from medium-density areas, rural regions may still offer favourable developmental environments. 343  
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### **Practical Applications** 345

This study introduces several innovative approaches to further deepen our understanding of the 'birthplace effect' in soccer. As a starting point, the reference point for players was the place of sporting development and not the place of birth, resolving the gap that recent studies pointed out when analysing this phenomenon. At the same time, despite the fact that we had a determined population size for the first level of analysis (provincial), we added a new indicator adjusted to the analysis of the selection phase, which refers to the density of cities or municipalities of men aged between 0 and 19 years. 346  
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Finally, it should be noted that this study analysed the phases of the identification and selection of talent for the academy from its different stages of incorporation. The analysis of this decisive phase in the management of talent, with a view to its applicability in professional soccer academies, should allow for greater efficiency in decision-making on the selection and incorporation of players into professional academies. 353  
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### **Disclosure Statement** 358

No potential conflicts of interest were reported by the author(s). 359

### **Author Contributions** 360

Conceptualization, L.H-S. and M.A-C.; methodology, L.H-S.; validation, M.A-C.; formal analysis, L.H-S.; investigation, L.H-S.; writing—original draft preparation, L.H-S. and J.C-G.; writing—review and editing, A.L.C.; supervision, A.L.K. and J.C-G.. All authors have read and agreed to the published version of the manuscript. 361  
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