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The sky is not your limit, but your proximity to a talent club might be

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Abstract

Previous studies have found significant differences in the likelihood of becoming an elite athlete between childhood communities of different population sizes and densities, an effect known as the early place of development, or birthplace effect. However, the results have not been consistent between sports or European countries. Since both professional and voluntary elite clubs are vital to the talent development systems in Europe, the proximity of an athlete's early place of development to the location of talent clubs may be an important predictor of the likelihood of becoming an elite athlete. Therefore, the primary purpose of the study was to investigate the place of early development effect. A novel predictor of the development of expertise was proposed: the effect of proximity to talent clubs. The two samples included talented Danish handball and football youth players. The samples included 579 football and 311 handball elite youth league players and 85 football and 80 handball national youth players with a comparison sample of 147,221 football youth players and 26,290 handball players. Odds ratio analysis showed variations in the optimal community size and density across sports. The results on club proximity clearly showed that most national youth players have grown up near a talent club. The results suggest that proximity may be a predictor that determines development of expertise across sports; therefore, it needs to be investigated along with community population density and size in future research.

Keywords

Athlete development, community size, community density, birthplace effect

Introduction

For decades, a growing body of literature has sought to understand how an individual's early environment contributes to the development of expertise in sport. Several studies have shown that the population size of a birthplace community influences the likelihood of achieving elite status (Côté et al., 2006; Bruner et al., 2011). It also seems to influence both youth athlete participation (Fraser-Thomas et al. 2010; Rossing et al., 2016; Turnnidge et al., 2014) and long-term adherence to the sport (Imtiaz et al., 2014). However, community size has been a less consistent predictor in European birthplace studies (Baker et al, 2009; Lidor et al, 2010; Lidor et al., 2014; Rossing et al., 2016). This inconsistency has led researchers to conclude that future studies should examine other variables that could indicate an ideal setting for talent development in sport (Baker et al., 2009; Bruner et al., 2011).

Recently, the birthplace effect was renamed the "place of early development effect" (Rossing et al., 2016), since the term should accurately highlight the critical role that the "location in which children spent their developmental years" (Côté et al., 2006: 1067) has on athletic development (Baker & Logan, 2007) and early sport participation (Turnnidge et al., 2014). Therefore, the early birthplace studies used the communities in which the athletes were born as a proxy variable for the place of early development in sport. The *early development hypothesis* embraces the notion that some types of early sport participation in children are linked to the probability of achieving expertise as an adult. Nearly all studies conducted so far have used the population size of the athlete's birthplace community as a proxy for the early environment of the athlete, although this proxy may have limitations in its classification of a community.

Community size

The studies on community size, primarily from North America and Australia, have shown that relatively smaller cities or communities (i.e., those with populations between 1,000 and 500,000) have fostered proportionally more elite players than cities with fewer than 1,000 or more than 500,000 inhabitants (Côté et al., 2006; Bruner et al., 2008; Baker et al., 2014; Cobley et al., 2014). However, studies within European countries, such as Germany (Baker et al., 2009), Israel (Lidor et al., 2010), Denmark (Rossing et al., 2016), Sweden and Finland (Bruner et al., 2011), have shown inconsistent results in the optimal community size. There seems to be a continental divide in the significance of community size. Researchers have explained the conflicting results between European and Anglo-American countries with three primary reasons: 1) there is a significantly higher population density in Europe than in Anglo-American countries, which may weaken the importance of community size in Europe (Baker et al., 2009; Schorer et al., 2010), 2) there is a shorter distance between cities in smaller European countries compared to cities in Canada, the USA, and Australia (Lidor et al., 2014) and 3) there are differences in athlete performance levels and the cultures of sport and athlete development between geographical regions (Bruner et al., 2011; Rossing et al., 2016). Since there are multiple geographical and cultural differences between countries and continents, community density was proposed by Baker (2009) as a more accurate variable.

Community density

Baker and colleagues (2009) compared the population density in North American and European countries and revealed that Europe is a far more populated area, which probably affects its opportunities for athlete development. Population density may also better reflect the internal structure of a community since it comprises two dimensions; namely, the total population and the inhabitants per unit area. Previous studies highlight the fact that a low-density community is a strong predictor of higher levels of childhood obesity in Sweden (Moraeus et al., 2012) and higher physical activity levels, but also a greater weight, in US adolescents (Joens□Matre et al., 2008). Low-density communities were also likely to have more green spaces (Forsyth et al., 2007), which promote more leisure walking activities (Forsyth et al., 2007) and stronger social interactions and social networks (Raman, 2010; Dempsey et al., 2012). It is likely that these characteristics have an impact on youth athletes in terms of their opportunities to enroll in sport and their development into elite athletes.

A limited number of studies have examined the influence of community density on expertise development in sport. Community density has only been examined in a Danish (Rossing et al. 2016) and a Portuguese context (Hancock et al., 2017). The Danish study found that communities with high density had proportionally more elite football players, while mid-density communities had a higher proportion of elite handball players. Conversely, the study on Portuguese volleyball players showed that less densely populated districts had higher proportions of elite male players; however, there was no apparent relationship between density and the distribution of elite female athletes. In both papers, the authors (Rossing et al., 2016; Hancock et al., 2017) hypothesized that the inconsistent results may be due to shared community pride in communities with dominant clubs in a club-based sport system. As such, the population density of the place of early development by itself may not be an accurate predictor of sport expertise. Lidor and colleagues (Lidor et al., 2010, 2014) have called for a more culture-specific approach that includes other variables that can affect how children develop in sport. One such variable could be their proximity to talent clubs.

Proximity to talent clubs

A young athlete's first club can have a range of available resources, since clubs primarily rely on a number of athletes, voluntary coaches, etc. Recent research in Scandinavia has highlighted the fact that club environment and local role models are vital mechanisms in fostering elite athletes at the junior level (Henriksen et al., 2010; 2011; 2014). These characteristics might already contribute to stronger athlete development by promoting earlier youth sport participation in the community where the dominant clubs are located. Moreover, in a case study with a successful sport community, Balish and Côté (2014) found that community pride was an important characteristic. One could argue that a strong sense of community pride is more likely to exist in communities with an acknowledged talent club that is situated within or near the community. Previous research has also highlighted the fact that passionate coaches are crucial in fostering athletes (Lafrenière et al., 2011). Again, local clubs near a talent club might find it easier to recruit passionate coaches, since some coaches have the incentive to make a career in coaching.

Moreover, proximity might also impact athlete recruitment to talent clubs, as longer commuting distances present the additional challenge of transportation to and from the club. For example, Rossing and colleagues (2016) found that most handball and football talent clubs were located in more urban communities, indicating a physical barrier for potentially talented rural athletes. Therefore, proximity to talent clubs seems to be a variable that is important to examine, along with community size and density.

The purpose of this study was to examine proximity to talent clubs and community size and density as predictors of sport expertise. The study included two samples of talented Danish handball and football youth players. The specific objectives were to investigate: 1) the relation between the probability of becoming a professional football player and the population size and density of the talented player's place of early development, and 2) the relation between the proximity of athlete's place of early development to a talent club and the likelihood of attaining sport expertise.

Methods

Danish Talent Development Structure

The Danish sport structure attempts to balance mass participation and elite sport development (Ibsen & Seippel, 2010). Sport is traditionally a voluntary activity with a so-called heterarchical organizational structure since several key factors such as local clubs, professional clubs and volunteers function highly autonomously and frequently initiate their efforts on their own (Bjørndal, Ronglan, & Andersen, 2015). Volunteerism and non-trained coaches and managers often characterize local sports clubs. Every small or large community in Denmark has both a sports hall and a football field, which is a strong indication that handball and football are among some of the most popular and successful sports in Denmark in terms of youth athlete sport participation and media coverage. Therefore, all Danish children have access to sport participation in both handball and football. Nevertheless, there are noteworthy differences in the talent development structure between Danish handball and football, and data on both sports has therefore been included in the present study to allow for a comparison between sports.

In handball, a national federation ensures that there are regional competition leagues at earlier developmental levels and a national competitive league at under 16 (U16) and under 18 (U18) age groups. Each local sport club and youth team is, in principle, able to qualify for the highest U16 and U18 leagues through an annual series of matches in the pre-season. Local sport clubs primarily select players from their local area and ensure their own economic resources via sponsors and voluntary work. Seven out of the fourteen clubs investigated in the present study participated in both the elite youth league and the Danish Senior Premier League at the time of data collection. In football, clubs can apply for a license from the national federation to be identified as a "talent club." Licenses are divided into three hierarchical categories, A- (12 clubs) and B- (14 clubs) and T-license (13 clubs), with the A-license representing the highest ranked level. The national federation has licensing requirements for both material and human resources, such as the quality of the club's sport facilities and the number of educated coaches. The clubs with A-license approval, or the talent clubs, receive extra economic resources, and their U-17 and U-19 teams are admitted to the highest youth leagues. Eleven of the twelve investigated talent clubs were participating in the Danish Senior Premier League during data collection.

Sample

Three different competitive levels of youth handball and football player samples were included in the study. The first samples, representing the lowest competitive level, was comprised of 147,221 registered male youth football players and 26,290 male youth handball players. The samples were obtained from the Danish football federation (DBU) and the Danish handball federation (DHF) and contained youth players under 12 years of age who were registered (2003) as players in a club. The youth players under 12 were chosen because they represent a broad sample of competitive and recreational players, as talent clubs mostly recruit players who are 12 years old or older. The second group of samples included Danish male youth players from the highest youth leagues in 2015 who were under 16 years (U16) or 18 years (U18) in handball (n=311), with a mean age of 17.6 years. It also included U17 and U19 in football (n=589), with a mean age of 17.3 years. Each team received a demographic questionnaire by mail that asked the players to fill in their primary city of residence from birth to the 12th year of age. The inclusion criteria for players were (1) born in Denmark; (2) lived in Denmark for the first 12 years of their life; (3) on the first team roster, regardless of the number of games they had played in the season. The club response rate was 100% for football (30 teams) and 100 % for handball (24 teams). A small subset of youth players in both handball (n=4) and football (n=19) failed one or more inclusion criteria and was excluded. Finally, a third sample representing the highest competitive levels included 80 (handball) and 85 (football) national male youth players who all had been selected for the Danish national youth teams during 2013, for the U16, U17, U18, U19 and U21 football teams and the U18, U20 and U21 handball teams. The football players ranged from 15-21 years of age (mean age=17.8 years), while the handball players ranged from 15-21 years of age (mean age=18.6 years). The sample data were obtained by email contact with either the secretary or coach of each national youth team. Consequently, all national youth teams (8) in both sports participated in the study.

Data analysis

The analysis of community size and density was carried out in two steps. First, the odds ratio (OR) was calculated by comparing the odds of being a youth elite league player (sample 2) to the odds of being a youth player (sample 1) in a community category, thus assuming that only the youth players in each sport are eligible for the youth elite league level. This approach follows previously applied methods for analyzing OR in early development studies (Rossing et al., 2016; Woolcock & Burke, 2013). The second step calculated the OR by comparing the odds of being a national youth player (sample 3) to being a youth player (sample 1) in the same community category.

The subsamples were based on national census sub-divisions. Communities were divided into five sub-divisions by population size (<10,000; 10,000– 30,000; 30,000– 50,000; 50,000– 100,000; >100,000). Similar to a previous study (Rossing et al., 2016), communities were also divided into six sub-divisions by density (population per km^2). The division was based on sub-divisions of density in European countries from the Nordregio analysis institute (Hansen et al., 2011). Ninety-five percent confidence intervals (CI) were calculated for the OR. An OR with CI limits (lower and upper) above 1 indicates that a disproportionately high number of youth elite league players or national youth players were observed in a given sub-division compared to what would be expected based on the size of the youth player population. Similarly, an OR with CI lower and upper limits below 1 indicates that a disproportionately low number of national youth players or elite youth league players were observed. Statistical analyses were performed using Microsoft Excel version 2010.

The data analysis on proximity to talent clubs was carried out in four steps. First, we calculated the handball and football OR for being both a youth elite league and national youth player compared to being a youth player in each community. Second, we linked our statistical data with geo-coded data on Danish communities within a geographical information system (GIS) called QGIS. GIS allows statistical geo-coded data to be symbolized on maps (Brewer, 2006), and it can include additional information, such as the locations of the talent clubs. Third, we used the Jenks method (also called natural breaks) to categorize the communities into five groups based on their OR. This method was chosen because it minimizes the variation between communities in the five categories and maximizes the variation between categories. This means that the units on the map that share the same color are statistically more similar to each other than to other units with alternative colors (Brewer, 2006). Finally, we specified the geographical location of the talent clubs on the maps.

Results

Table 1 shows the distribution of youth football players in each category of community density and size in comparison to the proportion of youth elite league and national youth players in football. The OR and CI indicate whether the communities have an over- or an under-representation of elite league or national youth players.

The results show that most urban communities of population size (>30,000) and density (>250 pop./km^2) have developed proportionally more youth elite league football players, while there is an underrepresentation of youth elite league players in the most rural communities of size (< 30,000) and density (< 100 pop./km^2). The results also show that urban communities of size (<50,000) and density (>1000 pop./km^2) have proportionally more national youth football players, while rural communities of size (<10,000) and density (<100 pop./km^2) have proportionally fewer. Overall, the results show that rural youth players are underrepresented at the elite youth league level, and even more so at the national youth level, while urban youth players are overrepresented at the elite youth league level, especially at the national youth level.

Table 2 shows the distribution of youth handball players for each category of community density and size in comparison to the proportion of youth elite league and national youth players in handball. OR with CI indicate whether youth elite league players and national youth players are over- or under-represented compared to the proportion of registered youth players.

The results in handball show that there is an overrepresentation of elite league youth players from mid-urban communities of size (30,000 to <100,000) and density (250 to <1000 pop./km^2), while rural youth players are underrepresented in communities of size (<30,000) and density (<100 pop./km^2). The results at the national youth level demonstrate that there is an overrepresentation of national youth players in communities with a population size ranging 30,000 to <50,000, while there is an underrepresentation of national youth players in the more rural communities of size (10,000 to < 30,000) and density (50 to <100 pop./km^2). It is noteworthy and surprising that the least dense communities (<50 pop./km^2) seem to have a smaller but insignificant underrepresentation of national youth players. Consistent with football, rural youth handball players were underrepresented at the elite youth league level, although the results varied at the national youth level. Furthermore, there was no consistent, significant overrepresentation of elite youth players at the elite youth level or the national youth level. As in football, the findings indicate that rural youth handball players have more difficulty reaching the elite and national youth competitive levels than those in other areas, although there are some exceptions.

Figure 1 illustrates the distribution of national youth football players' place of early development in comparison to the distribution of youth players in each community. Each community is categorized according to its OR, which indicates whether the national youth players are over- or under-represented compared to the proportion of registered youth players. Each talent club is located on the map. With few exceptions, communities located at or close to an approved talent club have higher proportions of national youth football players than communities located farther away from talent clubs. One noteworthy exception to the trend is in Northern Jutland, on the western peninsula, where national youth players seem to come from various communities that are close to or farther away from the talent club.

Figure 2 illustrates the distribution of national youth handball players' place of early development in comparison to the distribution of youth players in each community. Each community is categorized according to its OR, which indicates whether the national youth players are over- or under-represented in comparison to the proportion of registered youth players. Each talent club is located on the map. The figure highlights a trend that communities located at or close to a talent club have higher proportions of national youth handball players than communities located farther away from talent clubs. One noteworthy exception to the trend is in Western Jutland, where national youth players seem to come from communities that are farther away from talent clubs. However, at the time of data collection, three senior elite league clubs were located in this area.

Discussion

There are two main findings from the study. First, we observed variations in the optimal community size and density for players at the elite youth league and national youth levels for handball and football. Second, there was a general trend that both national youth handball and football players mostly come from communities near talent clubs.

1. Community size and density

The results showed variations in the optimal community size or density between sports. However, players from rural communities of various densities and sizes were proportionally underrepresented in both sports, while mid-sized communities in handball and the densest communities in football had proportionally more players at the elite youth league and national youth levels. The inconsistency of the results across sports in this study and in previous studies in Europe (Baker et al., 2009; Lidor et al., 2014; Hancock et al., 2017) suggest that there is no common optimal community size or density across sports or countries.

2. Proximity

A unique aspect of this study was its exploration of the athletes' proximity to talent clubs as a predictor of sport expertise. The results highlight a clear trend in both sports that communities near a talent club have developed proportionally more national level youth players compared to communities that are located farther away from talent clubs. Although previous retrospective studies with elite athletes have shown that successful athletes have moved to larger cities in order to train with better coaches and have better training facilities (Law et al., 2011; Phillips et al., 2010), our results suggest that some resources for athlete development seem to be important at a considerably earlier stage than adolescence. These resources seem to provide an early advantage to youth players who are located near talent clubs when compared to their peers who are farther away from the talent clubs.

General discussion

The consistent effect of proximity to talent clubs across sports suggests that it may be a more accurate predictor of developing expertise than community population size and density. Supplementary results emphasize, because they show that the proportion of youth elite league football players from remote communities is somewhat smaller than that from communities near talent clubs (supplementary Figure 3). This tendency is even more marked for youth elite league handball players (supplementary Figure 4). Therefore, we suggest two feasible explanations for the effect of proximity. First, communities located near a talent club may be at an advantage in promoting athlete development. Second, talent clubs seem to prefer youth players from neighboring communities when identifying and selecting talented youth athletes.

In comparison to more remotely located communities, those located near a talent club may take advantage of their proximity by adopting local role models and owning a sense of community pride, which previous studies have indicated are important in athlete development (Henriksen et al., 2010; Balish & Côté, 2014). Additionally, communities situated near talent clubs may also be more favored for athlete development by passionate coaching (Lafrenière et al., 2011), as coaches have better recruitment opportunities near the talent clubs. Youth players from communities near talent clubs may also be favored in the talent identification process. Talent club coaches have been shown to identify talents based on their own cultural background and experiences (Christensen, 2009; Csikszentmihalyi & Robinson, 2014). This may support the characteristics of the youth players near the talent clubs, because they may have been trained with a similar cultural understanding of the talent club and therefore have an advantage in the talent identification process, creating a cultural bias in the selection process.

Limitations:

The most valued Danish elite youth handball and football players in the investigated age groups may have already been selected for a senior competitive level or signed a contract with a foreign club, either of which would have removed these players from our data set. Furthermore, since the composition of handball clubs in the Danish youth elite leagues varies each year, the location of these talent clubs (as shown in the figures) is a more temporary representation than it is for football. Spatial data analysis has highlighted a broad trend across the country, but it cannot give a more detailed account of the specific development places in each community, which would be worth pursuing.

Perspective

This study complements previous research (Baker et al., 2009; Bruner et al., 2011; Schorer, 2010) by adding to the notion that there is no optimal community population size or density for developing talented athletes across sports or countries. This study also extends previous work by proposing proximity to talent clubs as a new predictor of sport expertise; this predictor appears to be more consistent across sports than population size and density.

Several studies have now documented the place of early development effect by comparing the observed numbers of selected talent or elite players to the expected numbers based on community categories, such as community population size, population density and, now, proximity to talent clubs. The results from these analyses have shown that there are certain types of communities that have been more inclined to produce elite athletes than others. However, these analyses do not reveal the underlying mechanisms. Knowledge of these mechanisms is needed if sport organizations and clubs are to move forward with adjusting their policies and practices. Therefore, we suggest that future studies explore the underlying mechanisms by qualitative approaches. We propose that future studies should have a more explorative approach, using qualitative methods to understand why some communities and clubs succeed in talent development while others do not.

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Table 1. Odds ratios (OR) and confidence intervals (CI) for being Danish elite U17-19 players and national youth players in football in comparison with registered youth players across community population sizes and densities.

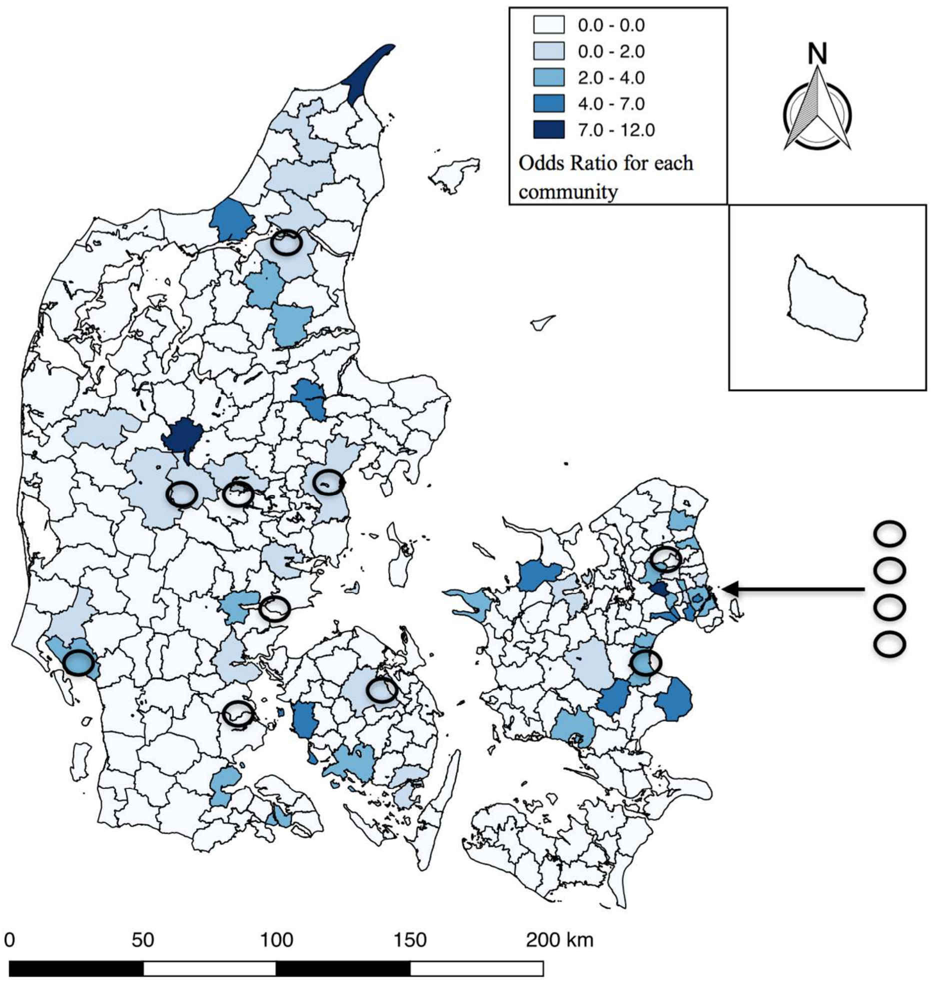
	Youth players		Elite U17-U19 players				National youth players			
	No.	%	No.	%	OR	95 % CI	No.	%	OR	95 % CI
Community size*										
≥ 100	20878	14.4	120	20.4	1.53	1.25 to 1.87	22	25.9	2.08	1.34 to 3.23
50 to < 100	20281	14.0	145	24.7	2.02	1.67 to 2.44	22	25.9	2.15	1.38 to 3.34
30 to < 50	22960	15.8	121	20.6	1.38	1.13 to 1.69	15	17.6	1.14	0.67 to 1.93
10 to < 30	48898	33.7	142	24.2	0.63	0.52 to 0.76	23	27.1	0.73	0.47 to 1.12
< 10	32004	22.1	59	10.1	0.39	0.24 to 0.65	3	3.5	0.13	0.04 to 0.40
Community density (pop. /km^2)										
≥ 1000	17319	16.2	103	17.5	1.57	1.27 to 1.94	24	28.2	2.90	1.90 to 4.44
500 to < 1000	20950	16.1	116	19.8	1.46	1.19 to 1.79	17	20.0	1.48	0.90 to 2.43
250 to < 500	20461	15.3	119	20.3	1.55	1.27 to 1.89	17	20.0	1.52	0.93 to 2.50
100 to < 250	29509	19.2	121	20.6	1.02	0.83 to 1.24	15	17.6	0.84	0.50 to 1.42
50 to < 100	32568	20.7	83	14.1	0.57	0.45 to 0.72	9	10.6	0.41	0.21 to 0.80
< 50	24214	12.4	45	7.7	0.41	0.31 to 0.56	3	3.5	0.18	0.06 to 0.57

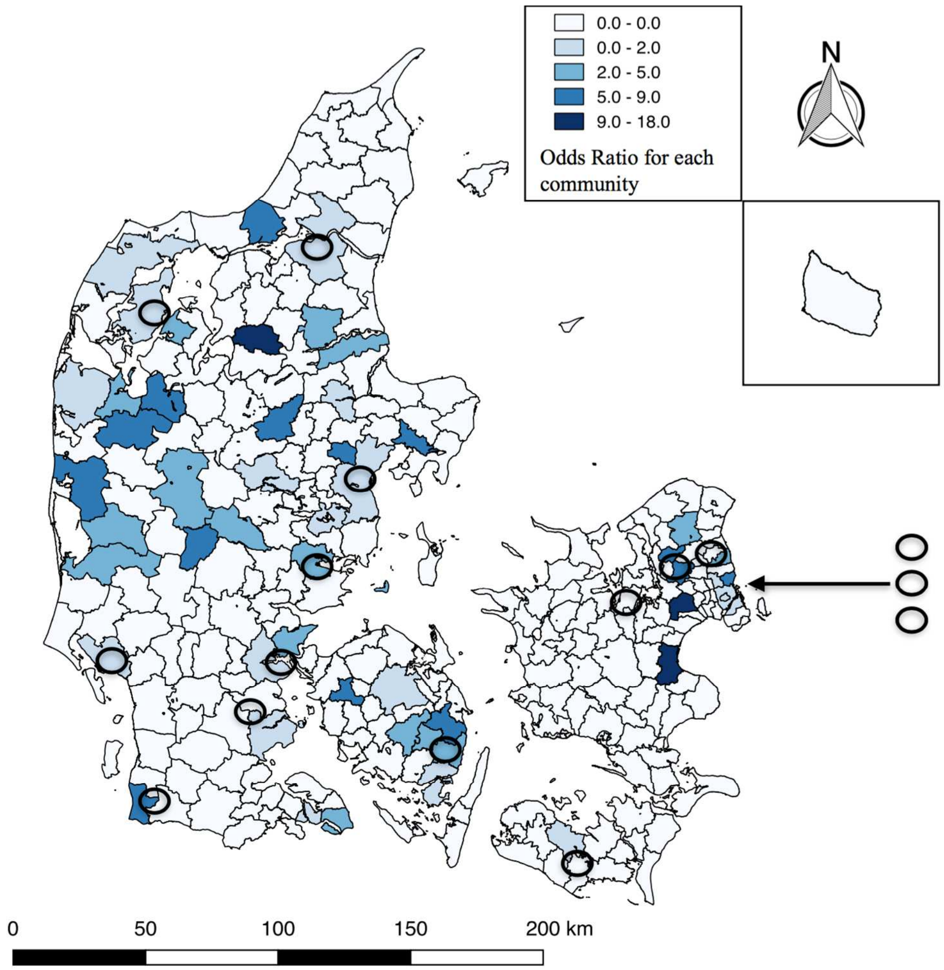
*: Numbers are in 1000s.

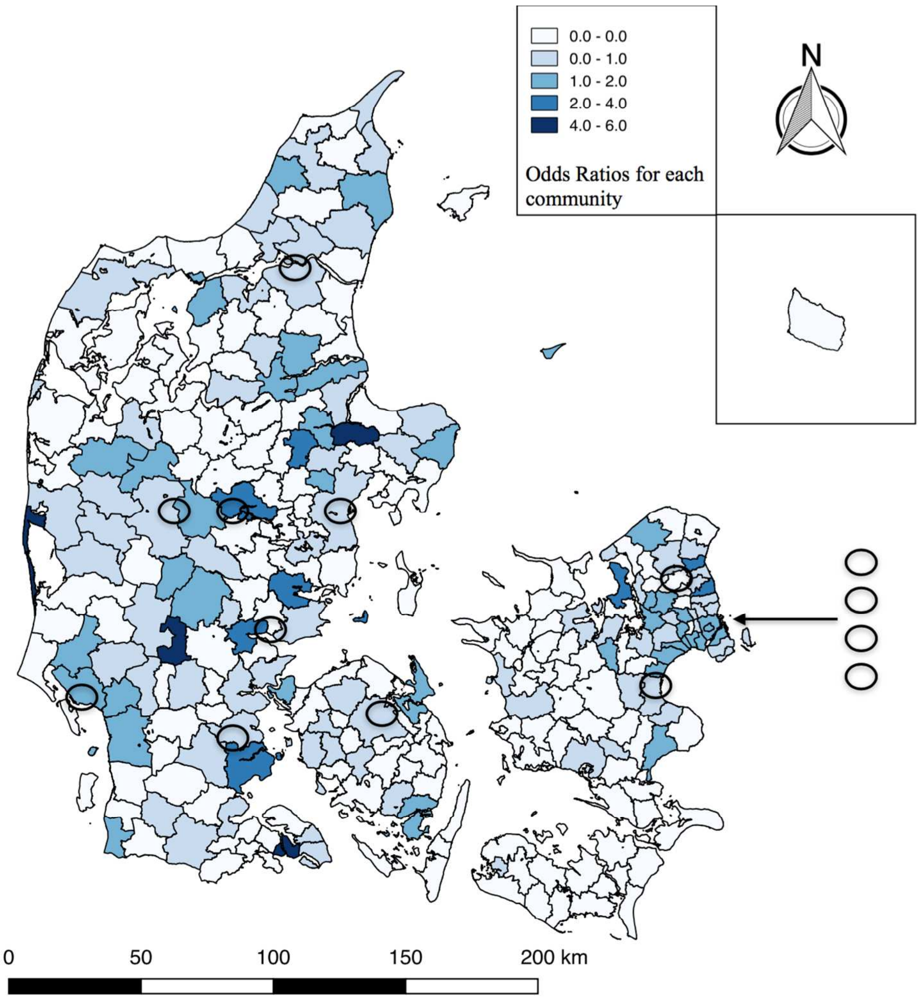
Table 2. Odds ratios (OR) with confidence intervals (CI) for being Danish elite U16-18 players and national youth players in handball in comparison with registered youth players across community sizes and densities.

	Youth players		Elite U16-U18 players				National youth players			
	No.	%	No.	%	OR	95 % CI	No.	%	OR	95 % CI
Community size*										
≥ 100	4639	12.9	38	12.1	0.93	0.66 to 1.31	12	15.0	1.19	0.64 to 2.20
50 to < 100	3890	10.8	63	20.1	2.07	1.57 to 2.73	14	17.5	1.75	0.98 to 3.11
30 to < 50	4125	11.5	52	16.6	1.53	1.14 to 2.07	18	22.5	2.24	1.32 to 3.79
10 to < 30	14145	39.3	102	32.5	0.74	0.59 to 0.94	19	23.8	0.48	0.29 to 0.80
< 10	9149	25.5	59	18.8	0.68	0.51 to 0.90	17	21.3	0.79	0.46 to 1.35
Community density (pop. /km^2)										
≥ 1000	3056	8.5	28	8.9	1.05	0.71 to 1.56	9	8.4	1.36	0.68 to 2.73
500 to < 1000	3097	8.6	64	20.4	2.72	2.06 to 3.58	10	14.3	1.52	0.78 to 2.94
250 to < 500	3956	11.0	56	17.8	1.76	1.31 to 2.35	10	9.1	1.16	0.60 to 2.24
100 to < 250	7409	20.6	56	17.8	0.84	0.63 to 1.12	23	29.9	1.55	0.96 to 2.52
50 to < 100	10963	30.5	78	24.8	0.75	0.58 to 0.97	13	23.4	0.44	0.24 to 0.80
< 50	7467	20.8	32	10.2	0.43	0.30 to 0.62	15	14.9	0.88	0.50 to 1.54

*: Numbers are in 1000s.


0.0 - 0.0
0.0 - 2.0
2.0 - 4.0
4.0 - 7.0
7.0 - 12.0
Odds Ratio for each community
N
0
50
100
150
200 km


0.0 - 0.0
0.0 - 2.0
2.0 - 5.0
5.0 - 9.0
9.0 - 18.0
Odds Ratio for each community
N
0
50
100
150
200 km


0.0 - 0.0
0.0 - 1.0
1.0 - 2.0
2.0 - 4.0
4.0 - 6.0
Odds Ratios for each community
N
0
50
100
150
200 km

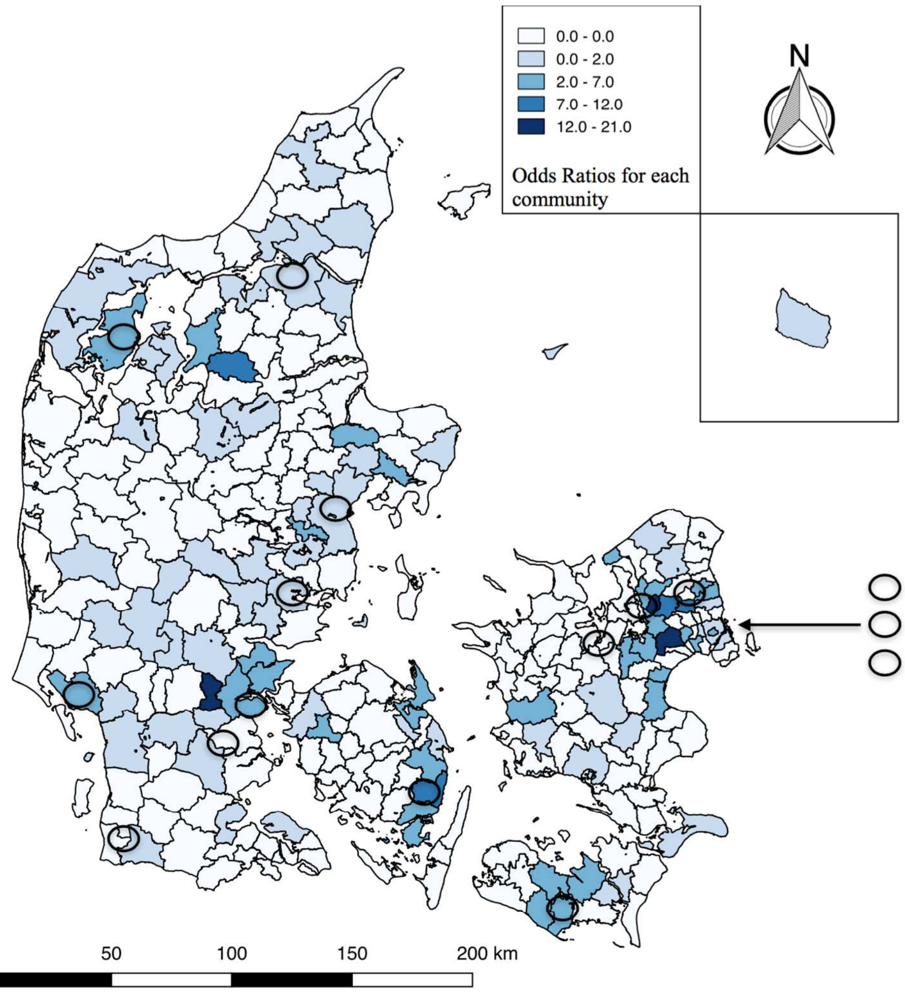

0.0 - 0.0
0.0 - 2.0
2.0 - 7.0
7.0 - 12.0
12.0 - 21.0
Odds Ratios for each community
N
0
50
100
150
200 km

Figure 1:

Title: Spatial analysis of national youth football

Legend: Proportion of national youth football players in comparison with youth player registrations in each community and location of talent clubs.

Figure 2:

Title: Spatial analysis of national youth handball

Legend: Proportion of national youth handball players in comparison with youth player registrations in each community and location of talent clubs.

Figure 3:

Title: Spatial analysis of elite league youth football

Legend: Proportion of elite league youth football players in comparison with youth player registrations in each community and location of talent clubs.

Figure 4:

Title: Spatial analysis of elite league youth handball

Legend: Proportion of elite league youth handball players in comparison with youth player registrations in each community and location of talent clubs.