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# **Sports participation, physical activity, and health in the European regions**

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## **Sports participation, physical activity, and health in the European regions**

### **Abstract**

In a context of stagnation of the level of health-enhancing physical activity in Europe, this study examines the geographical stratification of sports participation and physical activity (PA) at the regional level in 28 European countries. While previous research has focused on the national approach, this study considers the regional level across 208 European regions. Individual survey data from the Eurobarometer 80.2 is combined with a regional-level approach to the 208 regions to quantify sports participation and PA at the regional level. The results show important differences and a geographical stratification of sports participation and PA among the European regions, albeit following different patterns. In particular, a north–south gap is identified in terms of PA rates and an east–west gap is detected in terms of sports participation levels. Applying the cluster technique, a taxonomy of four different European regions is developed considering both types of indicators. Finally, the existence of sports spatial spillovers among regions is verified, obtaining a positive autocorrelation among neighbouring regions for being involved in PA and sporting activities. The results may have significant implications in terms of policy measures to improve health through PA and sports participation at the regional level in Europe.

*Keywords:* Physical activity; Health; Sports participation; European regions; Spillovers; Taxonomy.

## 1. Introduction

Despite the well-established evidence on the links between physical activity (PA) and health (Reiner, Niermann, Jekauc, & Woll, 2013), it is now widely accepted that people do not undertake enough PA. Globally, around 23% of people were not active enough in 2010 (World Health Organization [WHO], 2017). In the case of Europe, in 2013 59% of Europeans reported that they never or seldom participated in PA (European Commission, 2014). This lack of a sufficient level of PA is of great concern due to some negative consequences in terms of health care costs, for example. These have been estimated to be half a million European deaths and 80.4 billion euros per year in Europe, which is equivalent to 6.2% of all European health spending (International Sport and Culture Association [ISCA] and Centre for Economics and Business Research [CEBR], 2015) and 1 million deaths attributable to physical inactivity (WHO, 2015).

In this context public authorities and researchers have been particularly conscious about the relevance of analysing the correlates of PA and sports participation. Traditionally, individual characteristics and personal traits have explained participation (i.e., Bauman et al., 2012; Cabane & Lechner, 2015; Downward, Lera-López, & Rasciute, 2014), although an increasing number of studies have recently highlighted the role played by different characteristics of the municipality, region, or nation (e.g., Filippidis & Laverty, 2016; Lera-López, Wicker, & Downward, 2016; Van Tuyckom & Scheerder, 2010a; Wicker, Breuer, & Pawlowski, 2009).

Despite the difficulties of comparing data across European countries (Gratton, Rowe, & Veal, 2011), some studies have focused on differences in terms of sports participation and PA rates at the country level in the EU. Since the first analysis conducted by Martinez-Gonzalez et al. (2000) with a data set from 15 European countries in 1997, the empirical evidence has shown significant differences in PA and sports participation rates among the European

countries (Hartmann-Tews, 2006; Rütten & Abu-Omar, 2004; Sjöström et al., 2006; Van Bottenburg, Rijnen, & Van Sterkenburg, 2005). When considering only leisure time PA, there is a north–south divide, with Northern European countries showing higher levels of PA than Southern European ones (Demarest et al., 2014). More recently, different studies have shown an additional western and eastern divide for the EU-27. According to these pieces of evidence, leisure time PA declines from north to south and from west to east (Scheerder et al., 2011; Van Tuyckom & Scheerder, 2010a; Van Tuyckom, Scheerder, & Bracke, 2010). Similar results have been obtained considering only sports participation in the EU-27 (Van Tuyckom & Scheerder, 2010b).

When considering PA as a whole, recent studies considering the EU-28 have identified a geographical divide. The Nordic countries and the Netherlands are the most physically active countries, the Southern countries and the new Member States being less active (Gerovasili, Agaku, Vardavas, & Filippidis, 2015; Kornbeck, 2013). Thus, a geographic pattern of western and northern versus southern is emphasized.

At regional level, only a few studies have investigated differences in PA and sports participation at the regional level: Humphreys and Ruseski (2007) for the United States and Kokolakis, Lera-López and Castellanos (2014, 2017) for England. At the European level, there are no studies developing a regional approach, despite evidence of significant differences in many countries such as the UK (Sport England, 2010) and Spain (García & Llopis, 2011). Then, this approach is relevant for understanding these regional differences and for regional level planning purposes in a context of a decentralisation process in many European countries (European Commission, 2014), in particular in sport policies and funding (Lera-López & Lizalde, 2013).

The purpose of this study is to develop a regional approach to analyse the differences in PA and sports participation rates in the EU. In particular, the aims of this paper are: a) to explore

a taxonomy of the European regions employing the cluster analysis technique; b) to compare the geographical patterns of sports participation and PA among the European regions; and c) to test the existence of spatial spillovers in terms of sports and PA among the European regions. A better understanding of these regional differences might be useful for developing European region-specific sport policies overcoming national frontiers. To the best of our knowledge, this paper is the first attempt to explore the geographical stratification of sports participation versus PA and the possibility of spillovers among the European regions. Section 2 explains the data used in the current research and the estimation strategy. Section 3 presents the results, and section 4 concludes with policy implications.

## **2. Method**

### **2.1 Data and variables**

The data employed in our analysis correspond primarily to individual participation in sports and PA from the Eurobarometer 80.2 (European Commission, 2014). *Sport* is defined as any form of physical activity which is done in a sport context or sport-related setting, such as swimming, training in a fitness centre or a sport club, etc. This definition is based on the conceptualisation of sport suggested by the European sport charter (Council of Europe, 2001). *Physical activity* is defined as any bodily movement produced by skeletal muscles that requires energy expenditure and could be developed in four domains: working, active transportation, house chores and recreational activities (WHO, 2015). The universe of the study was the population aged 15 years and over resident in the 28 European Union member states. The probability sample contained 27,919 individuals selected by a multistage sampling design covering the 28 EU countries. Approximately 1,000 individuals were surveyed for all countries, except Cyprus, Luxembourg and Malta, where only approximately 500 individuals were sampled. The data were obtained through face-to-face interviews conducted in people's homes

during November and December 2013. This individual information is regionalized to estimate the regional participation rates for sports and PA. Estimations are provided at level of disaggregation 2 according to the *Nomenclature d'Unité Territoriales Statistiques* (NUTS2) defined by EUROSTAT. As an exception, data from UK and German regions correspond to level 1, because no information about the NUTS2 level was provided. The group under study is composed of a total of 208 regions. Additional details on the methodology and questionnaire, as well as the data set, are publicly available (European Commission, 2014); hence, no ethical approval was required.

The Eurobarometer 80.2 considers sports practice and being involved in PA separately. The variables measuring the two kinds of participation result from two questions in the survey: “How often do you exercise or play sport?” and “How often do you engage in a physical activity outside sport such as cycling from a place to another, dancing, gardening, etc.?” The possible answers to both questions were “five times a week or more”, “three or four times a week”, “one to two times a week”, “one to three times a month”, “less often”, “never”, and “do not know”. Following Lera-López et al. (2016), we created two variables to measure the basic level of sport and PA participations, respectively, by recoding the first four previous categories as 1 and the categories “less often” and “never” as 0, and afterwards we estimate for each region the percentage of people involved in basic PA and basic sports. Therefore, the *basic PA* and *basic sports* indicators measure the percentage of individuals at regional level that participate at least once a month in PA and sports, respectively. Since regular participation is recommended by European governments (i.e. Department for Culture, Media and Sport, 2002), we also created two variables capturing the percentage of individuals in each region who participate regularly in PA and sports. Following arguments made by previous research, we considered practice to be regular when it is performed at least once per week (Van Tuyckom, Scheerder, & Bracke, 2010; Wicker et al., 2009). Thus, *regular PA* and *regular sports* measure the percentage of

individuals at the regional level participating at least once a week in PA and sports, respectively. Finally, considering the WHO recommendations for health-enhancing activity (HEPA) and previous studies (Van Tuyckom, 2013), we estimated for each region the percentage of individuals who have been involved at least three times a week in PA (*healthy PA*) and in sports (*healthy sports*).

A similar definition of variables has been used in previous empirical evidence at the country level in the EU (Lera-López et al., 2016; Scheerder et al., 2011; Van Tuyckom, 2013; Weiss, Norden, Nader, & Arnusch, 2016), which enabled us obtain comparable results as well as to make a distinction among participation frequencies (basic, regular, and healthy). Although the questionnaire provides some measurements of activity duration, the way they are measured makes difficult to get reliable estimations for PA and sports separately. These arguments led us to discard the information about days and intervals of minutes included in the questionnaire. Table 1 shows the main descriptive statistics of the variables under study.

**Table 1.** Main descriptive statistics

	Sports participation, %			Physical activity participation, %		
	<i>Basic</i>	<i>Regular</i>	<i>Healthy</i>	<i>Basic</i>	<i>Regular</i>	<i>Healthy</i>
Minimum	8.4	5.3	2.7	19.4	13.3	2.9
(region)	(BG42)	(BG34)	(BG34)	(ITF3)	(ITF3)	(AT21)
Maximum	80.7	76.0	50.0	94.0	85.5	75.9
(region)	(DK01)	(ES53)	(ES11)	(SE21)	(SE21)	(NL13)
Mean	44.2	39.1	19.7	57.0	48.6	28.7
Standard deviation	15.6	14.8	9.6	18.5	17.5	14.5

Notes: Percentage rates of people participating in a *basic* (at least 1 to 3 times per month), *regular* (at least once per week), or *healthy* way (at least 3 times per week).

## 2.2 Methodology

The main purpose of this paper is to develop a taxonomy of the European regions according to the practice of sports and PA. Accordingly, we employ cluster analysis. Cluster



analysis tries to maximize the homogeneity of the elements within the cluster while also maximizing the heterogeneity between the clusters. The multivariate profile of the elements is defined by the set of variables included as input in the analysis. Based on the distribution of PA and sports participation across regions, a hierarchical cluster procedure is applied in a preliminary stage to explore the number of clusters. Several linkage rules and different distance measures are used to identify the number of clusters that best fits the data (Hair, Black, Babin, & Anderson, 2010; Johnson & Wichern, 2007). The hierarchical procedures point to four natural groups of regions. Once the number of clusters is determined, a more accurate assignment of the regions to each cluster is obtained by running the *K*-means non-hierarchical procedure (Hair et al., 2010). The same methodology has been applied previously to classify European countries in terms of frequency of sports participation and organizational context (Van Tuyckom, 2013) and reasons for engagement in PA (Ríos, Cubedo, & Ríos, 2013).

Finally, we use Moran's *I* test for assessing spatial interdependence (Moran, 1950), since we would expect positive spatial spillovers in terms of PA and sports participation among the European regions. The *I* statistic evaluates spatial autocorrelation by comparing the observed values in any region with the values in neighbouring regions for the same variable. Being *y* a particular variable observed in the spatial regions  $i, j = 1, \dots, n$ , the global Moran's *I* statistic is defined by

$$I = \frac{\sum_i \sum_j w_{ij} z_i z_j}{\sum_i z_i^2} \quad (1)$$

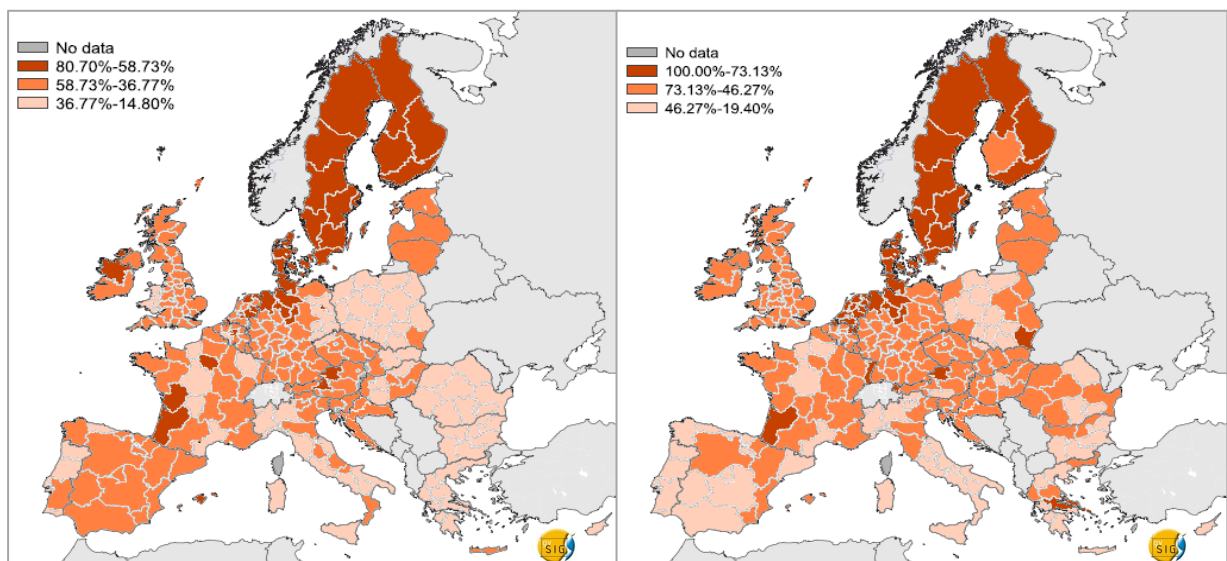
where  $w_{ij}$  denotes the non-zero off-elements of the row-standardized spatial weights matrix (**W**) and  $z_i$  represents the deviation of the region *i* from the sample mean ( $z_i = y_i - \mu$ ). **W** is a square  $n \times n$  matrix that depicts the spatial arrangement, and its elements  $w_{ij}$  represent the potential spatial interaction between each  $i, j$  possible pair of regions. Under the null hypothesis of no global spatial autocorrelation, Moran's statistic is asymptotically normal and the expected value is  $E(I) = -1/n-1$ .

### 3. Results

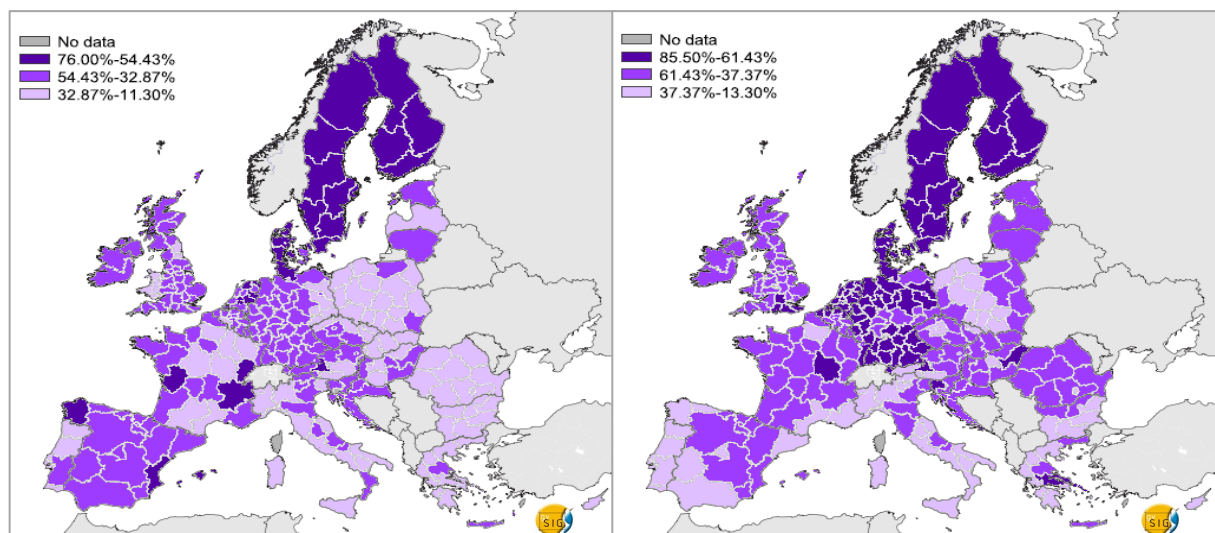
#### 3.1 Exploring the regional distribution of PA and sports participation

As a preliminary exploratory analysis, we mapped each of the six variables to gain a better understanding of their distribution across the European regions. Figures 1 - 3 show each variable according to three levels of participation. The levels correspond to the three intervals of equal length calculated on the range of each indicator. We used as software the gvSIS version 2.2. The first relevant result is the different distribution at the regional level among the PA variables and the sports variables. This distinction is robust through the three different levels of being involved in PA and sports: *basic*, *regular*, and *healthy* participation.

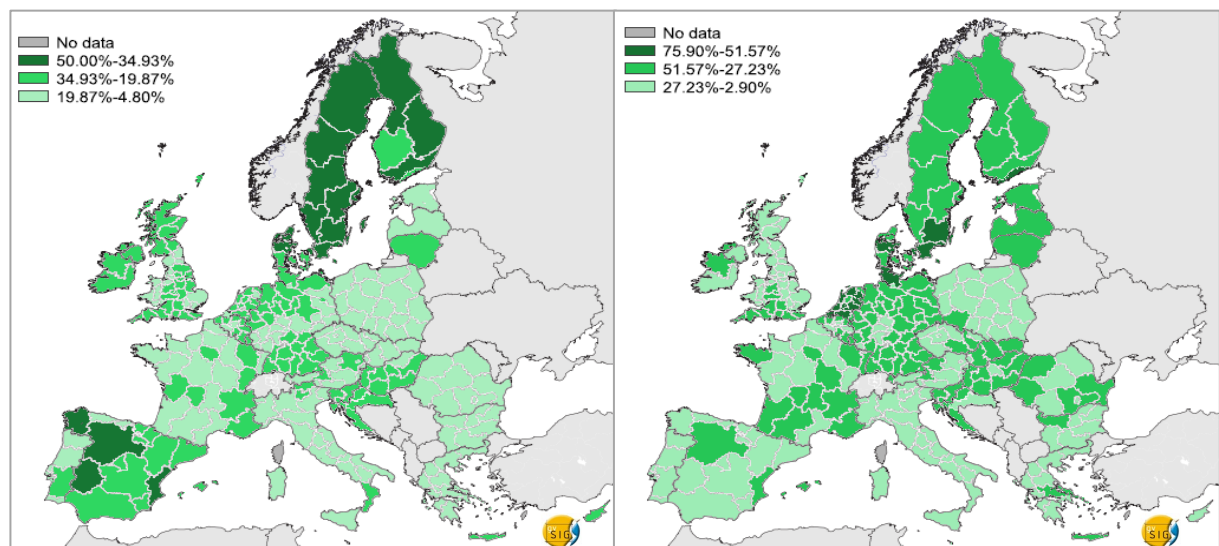
In general Scandinavian regions show the highest levels of sports participation and PA, but this is the only common feature of the six indicators under study. Eastern regions show higher levels of PA than of sports participation in comparative terms, while among the southern regions the opposite case applies: comparatively higher levels of sports participation than PA. Logically, the values of sports participation are always lower than the values of PA for each frequency under study, but the results suggest a different distribution of PA and sports participation rates among the European regions.



**Figure 1.** Basic sports participation (left) and basic physical activity (right) according to participation level across the EU regions



**Figure 2.** Regular sports participation (left) and regular physical activity (right) according to participation level across the EU regions



**Figure 3.** Healthy sports participation (left) and healthy physical activity (right) according to participation level across the EU regions

Secondly, among the PA and sports indicators, there are significant differences in terms of the frequency of PA and sports participation. Comparing the basic PA indicators, only Scandinavian (Sweden and Finland), Danish, and some German, Dutch, and French regions show more than 70 per cent of the population being involved in PA. On the other hand, the regions with the lowest values of the population involved in PA are in Spain, Italy, Greece, and some eastern countries, such as Poland, Romania, and Bulgaria. A similar regional distribution is made in terms of regular PA, with regions in Germany and Austria with over 61% of the

population engage in PA at least once a week. Nevertheless, in terms of healthy PA, only a minor number of regions belonging to Finland, Sweden, Denmark, the Netherlands, and Belgium have values of over 51% of the population performing PA at least three times a week. On the other hand, many regions in the UK, Spain, Ireland, France, Italy, Greece, Poland, Romania, and Bulgaria, among others, show values indicating that less than 27% of the population engages in PA at least three times a week.

The differences among the three variables under study are smaller in terms of sports participation than in terms of PA. In general the regions with values of over 54–58% of the regional population practising basic or regular sporting activities belong mainly to Sweden, Finland, Denmark, Germany, the Netherlands, and France. The regions with a larger proportion of the population practising sporting activities at least three times a week belong to only four European countries: Sweden, Finland, Denmark, and Spain.

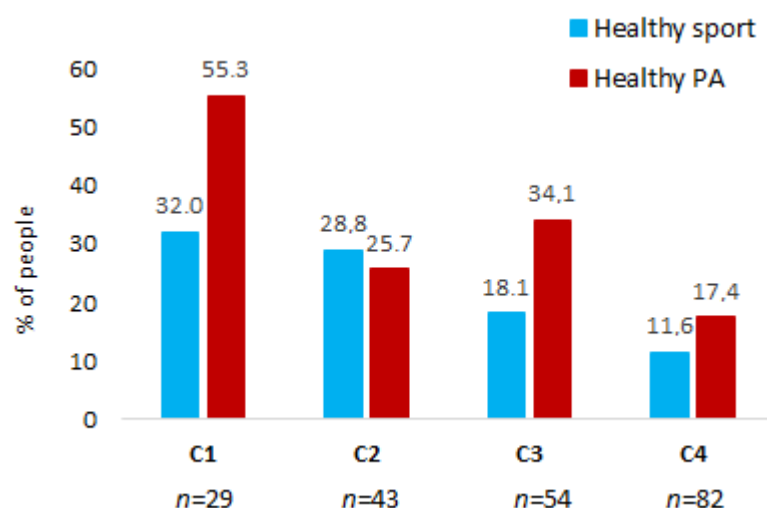
To sum up, in terms of PA levels, there is no evidence of an east–west gap among regions considering *basic* and *regular PA*, although it is a reality for the northern and southern regions. However, surprisingly, in terms of *healthy PA*, there is no clear geographical pattern. The regions with a small proportion of the population engaging in PA at least three times a week belong to a wide set of countries in the south (Spain, Italy, Greece), in the east (Poland, Bulgaria, Romania), and in the north (Ireland, the UK).

### **3.2 Clusters of regions based on PA and sports participation**

After detecting differences in the rates of PA and sports among the European regions, the next step is to develop a taxonomy of the European regions by applying the cluster analysis technique. To derive a successful taxonomy, highly redundant variables should be avoided as input. The exploratory analysis of the six variables under study shows positive and linear relationships among all of them, the coefficient of correlation being 0.68 between the *basic PA* and the *basic sports* variable, 0.65 between *regular* practices, and 0.50 between *healthy sports*

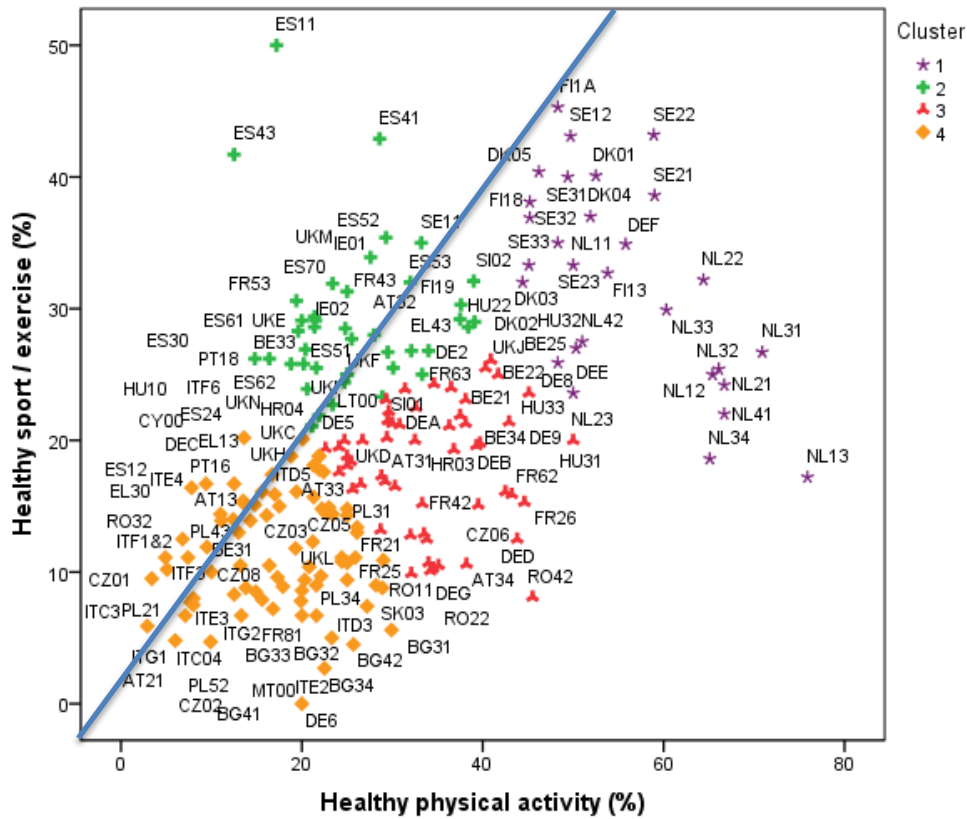
and *healthy PA*. Considering this, *healthy* practices of both sports and PA are selected to define the healthy profile of the European regions, since the more frequent the practice is, the more differentiated their distributions are and the less information the variables share. Additional justifications for choosing the *healthy* variables are the recommendations made by the WHO and the empirical evidence about the positive effects of frequent and constant PA and sports participation on health and subjective well-being outcomes (Dolan, Kavetsos, & Vlaev, 2014).

Applying a preliminary hierarchical cluster procedure, a robust four-cluster solution is found in the map of the EU-28's regions based on the standardized healthy sports and PA participation variables. Figure 4 depicts the centroids of the final four-cluster solution.



**Figure 4.** Cluster centroids: Average values of the indicators in each region group

Each bar in Figure 4 represents the mean value of each indicator calculated in each cluster and defines the profile of the group. The cluster solution provides us with a taxonomy of the European regions that can be mapped in a two-dimensional space (see Figure 5). The regions belonging to each cluster are listed in Table A1 in the Appendix.



**Figure 5.** Taxonomy of European regions

C1 is the smallest cluster (29 regions, 13.9% of the total sample and representing the 8.2% of the EU population) and shows a remarkable value for *healthy PA* practice (55.3% of people). This cluster also shows the highest value for *healthy sport* participation (32.0%) and includes regions belonging mainly to the Netherlands, Sweden, Finland, and Denmark (see Figure 5). This group of European regions might be named “healthy” regions. The opposite cluster is C4: the largest in size (82 regions, 39.4% of the total and 35.2% in terms of population) and the least healthy group: only 11.6% and 17.4% of people practice *healthy sports* and *healthy PA*, respectively. These percentages are around one-third of the participation levels in the “healthy cluster”. The members of this less healthy group belong mainly to southern countries such as Italy (14 regions), France (7 regions), Portugal (4 regions), Greece (3 regions), Eastern countries like Poland (10 regions), Romania (6), Bulgaria (6), the Czech Republic, and

Slovakia, and some regions from Belgium (2), Austria (5), and the UK (4). This cluster might be named “unhealthy” regions.

C2 and C3 are both middle groups, as they show intermediate values for both indicators *healthy sports* and *healthy PA*. Comparing the groups, they have asymmetrical centroids. The regions belonging to C3 stand out for PA (the second-largest value, 34.1%), whereas C2 members are conspicuous by their remarkable sports participation level (28.8%, a value close to the highest, 32%, observed in C1). The C2 cluster includes 43 regions (20.7% of the total, with the 22.9% of the EU population) that mainly belong to Spain (15 regions), the UK (6 regions), and France (4 regions) and might be named “intermediate sports-biased regions” or “sporting” regions, being the only group of regions where the sports participation rates, on average, are higher than the PA rates. Lastly, 54 regions belong to C3 (26.0% of the total, a 33.7% of the population) and mainly include German, Belgian, and French regions; due to the differences between *healthy PA* and *healthy sports* participation they may be named “intermediate PA-biased” regions.

Finally, Figure 5 shows the general and positive relationship between PA and sports participation rates. It also enables us to identify the regions with higher rates of PA than sports participation (below the blue line) and the regions with higher sports participation rates than PA rates (above the line).

### **3.3 Spatial spillovers in PA and sports among the European regions**

Looking at the cluster solution, it is appreciable that many regions from one country or even neighbouring geographical zones are classified in the same cluster. That is, high or low values for the PA and sports participation variables tend to cluster in space, which points to the presence of positive spatial autocorrelation (Anselin & Bera, 1998). We carry out a spatial analysis using Moran’s *I* test to explore the existence of spatial spillovers on the sporting practices across the European regions.

The null hypothesis of no global spatial autocorrelation is rejected for both types of indicators with strong significance. The results support the hypothesis of positive spatial interdependence among the European regions in *healthy sports* ( $I=.120$ ,  $p\text{-value}=.000$ ) and in *healthy PA* ( $I=.164$ ,  $p\text{-value}=.000$ ). The Moran's  $I$  values are even larger for *basic sports* ( $I=.178$ ,  $p\text{-value}=.000$ ) and *basic PA* ( $I=.181$ ,  $p\text{-value}=.000$ ). The significant Moran  $I$  statistic implies that the values of the indicator are not randomly distributed across the regions, whereas its positive sign means that the value of the indicator in each region tends to be similar to the values taken by the same indicator in geographically neighbouring regions.

#### **4. Discussion and conclusions**

The aim of this paper is to develop a regional analysis of PA and sports participation rates in the European regions. Individual survey data from the Eurobarometer 80.2 with information about the EU-28 countries (European Commission, 2014) is combined with a regional-level approach to the 208 regions within these 28 countries. Applying cluster and spatial econometric methodologies, we develop the first attempt to explore the geographical stratification of sports participation and PA levels at the regional level for the EU-28 countries. The results show important differences among European regions in terms of sports participation and PA rates, confirming the previous empirical evidence about the differences in sports (Van Tuyckom & Scheerder, 2010b) and PA participation (Gerovasili et al., 2015; Hartmann-Tews, 2006; Kornbeck, 2013; Sjöström et al., 2006) among countries in the EU. The results also suggest a different distribution of PA and sports participation rates among the European regions. In particular, a north–south gap is shown in terms of some PA rates while the results only confirm an east–west gap for the percentage of the population practising sports. Nevertheless, in terms of *healthy sports* and *healthy PA*, the results show neither a north–south pattern nor an east–west geographical stratification. Consequently, it could be argued that the



traditional gap between northern and southern in terms of sports participation, previously shown at national level by Van Tuyckom and Scheerder (2010b), is less evident when a regional analysis is developed. We might speculate that these regional differences and the lack of a specific geographical pattern may be a consequence of the decentralization process in many European countries in policy decisions about health care, including sport and PA (European Commission, 2014). When sport and PA policies are developed and implemented by regional governments, differences in aims and funding appear and consequently sports participation and PA rates may diverge among regions of each country. Previous empirical studies have not considered this approach and this might explain the differences shown in this research compared to previous studies at national level.

Finally, the paper shows for the first time the existence of positive spatial spillovers for four indicators, applying Moran's *I* test to assess spatial interdependence. This result is very interesting, because it means that it might be an imitation effect among neighbouring regions in terms of PA and sports. The practice of sports and PA seems to permeate national boundaries and might be explained by other reasons apart from a national perspective such as regional decentralization in health care and PA policies, cultural reasons, migration movements and the effect of natural environment. Further research should try to explain these differences considering regional and national determinants and checking their potential role for explaining sports compared to PA.

Two interesting implications for policies can be described. Firstly, the results emphasize the relevance of a regional approach and regional coordination at the EU level for boosting PA and sports participation as a way to reduce regional disparities and promote health-enhancing PA. Moreover, the presence of spatial interdependence might justify the development of an European sport and PA policy that considers the regional differences more than the national ones. Secondly, the different clusters of regions obtained in this study may suggest the

importance of developing specific measures considering the particular situation of the European regions in terms of PA versus sports participation. Then, in regions with low level of PA, measures could emphasize the health and well-being effects of practising PA, for example through the “medical prescription” of PA (connecting general doctors recommendations with detailed sports programmes offered by sport specialists) and improvements in physical education; while in other regions with low level of sports participation rates, measures might promote the development of sport clubs and organised competitions, for example.

This study has certain limitations that could be addressed in further research. A more consistent use of the concept of sports and PA in the EU might be very useful in undertaking a comparative analysis at the national and regional levels in the EU. Further data and research should also develop a longitudinal analysis with comparable outcomes over time to check the evolution of inequalities in sports participation and PA rates among the European regions. Additionally, future research should include some regional characteristics to explain these geographical variations in sports participation and PA across European regions.

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#### Disclosure statement

The authors declare that they have no conflict of interest.

#### Ethics Approval

The data set and the questionnaire that we have used in this manuscript are publicly available (European Commission, 2014); hence, no ethical approval was required.

## References

- Anselin L., & Bera, A. K. (1998). *Spatial dependence in linear regression models with an introduction to spatial econometric*. In: Ullah A, Giles D (eds) *Handbook of applied economic statistics*. Marcel Dekker, New York, pp 237-289
- Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J., Martin, B. W., & Lancet Physical Activity Series Working Group. (2012). Correlates of physical activity: Why are some people physically active and others not? *The Lancet*, 380(9838), 258-271.
- Cabane, Ch., & Lechner, M. (2015). Physical activity of adults: A survey of correlates, determinants and effects. *Jahrbucher fur Nationalokonomie und Statistik*, 235(4-5), 376-402.
- Council of Europe (2001). *The European sports charter (revised)*. Brussels: Council of Europe.
- Demarest, S., Van Oyen, H., Roskam, A. -, Cox, B., Regidor, E., Mackenbach, J. P., & Kunst, A. E. (2014). Educational inequalities in leisure-time physical activity in 15 European countries. *European Journal of Public Health*, 24(2), 199-204.
- Department for Culture, Media and Sport (2002). *Game Plan: A strategy for delivering the government's sport and physical activity objective*. London: Department for Culture, Median and Sport. [http:// www.gamesmonitor.org.uk/files/game\\_plan\\_report.pdf](http://www.gamesmonitor.org.uk/files/game_plan_report.pdf) (8 March 2017, date last accessed).
- Dolan, P., Kavetsos, G., & Vlaev, I. (2014). The happiness workout. *Social Indicators Research*, 119, 1363-77.
- Downward, P., Lera-López, F., & Rasciute, S. (2014). The correlates of sports participation in Europe. *European Journal of Sport Science*, 14, 592-602.
- European Commission (2014). *Investment for jobs and growth. Promoting development and good governance in EU regions and cities*. Sixth report on economic, social and territorial cohesion. Brussels: European Union.
- European Commission. (2014). *Eurobarometer 80.2 (2013)*. TNS Opinion [producer]. GESIS Data Archive, Cologne. ZA5877 Data file Version 1.0.0, doi:10.4232/1.12010
- Filippidis, F. T., & Lavery, A. A. (2016). Perceptions of opportunities for physical activity in 28 European countries. *Preventive Medicine*, 86, 136-140.
- García, M., & Llopis, R. (2011). *Ideal democratico y bienestar social. Encuesta sobre hábitos deportivos en España 2010*. Madrid: CIS and CSD (Survey about sport habits in Spain 2010).

- Gerovasili, V., Agaku, I. T., Vardavas, C. I., & Filippidis, F. T. (2015). Levels of physical activity among adults 18-64 years old in 28 European countries. *Preventive Medicine*, 81, 87-91.
- Gratton, C., Rowe, N., & Veal, A. (2011). International comparisons of sports participation in European countries. An update of the COMPASS Project. *European Journal for Sport & Society*, 8(1-2), 99-116.
- Hair, J.F., Black, W.C., Babin, B.J. & Anderson, R.E. (2010). *Multivariate data analysis a global perspective*, 7<sup>th</sup> edn., Pearson Prentice Hall, New Jersey.
- Hartmann-Tews, I. (2006). Social stratification in sport and sport policy in the European Union. *European Journal for Sport and Society*, 3(2), 109-124.
- Humphreys, B., & Ruseski, J. (2007). Participation in physical activity and government spending on parks and recreation. *Contemporary Economic Policy*, 25, 538-552.
- ISCA & CEBR. (2015). *The economic cost of physical inactivity in Europe*. Retrieved 26 Sept 2016 from [http://inactivity-time-bomb.nowwemove.com/download-report/The%20Economic%20Costs%20of%20Physical%20Inactivity%20in%20Europe%20\(June%202015\).pdf](http://inactivity-time-bomb.nowwemove.com/download-report/The%20Economic%20Costs%20of%20Physical%20Inactivity%20in%20Europe%20(June%202015).pdf)
- Johnson, R.A. & Wichern, D.W. (2007), *Applied multivariate statistical analysis*, 6<sup>th</sup> edn., Pearson Prentice Hall, New Jersey.
- Kokolakakis, T., Lera-López, F., & Castellanos, P. (2014). Regional differences in sports participation: The case of local authorities in England. *International Journal of Sport Finance*, 9, 149-171.
- Kokolakakis, T., Lera-López, F., & Castellanos, P. (2017). Differences in formal and informal sports participation at regional level in England. *International Journal of Sport Policy and Politics*, 9(3), 491-504.
- Kornbeck, J. (2013). The European union, sport policy and health-enhancing physical activity (HEPA): The case of exercise by prescription. *Deutsche Zeitschrift Fur Sportmedizin*, 64(6), 157-161.
- Lera-López, F., & Lizalde, E. (2013). Spain: sport system and financing. In; K. Petry and K. Hallmann, editors. *Comparative sport development – systems, participation and public policy*. New York: Springer-Verlag, 149-166.
- Lera-López, F., Wicker, P., & Downward, P. (2016). Does government spending help to promote healthy behavior in the population? Evidence from 27 European countries. *Journal of Public Health*, 38(2), e5-e12.

- Martinez-Gonzalez, M. A., Varo, J. J., Santos, J. L., De Irala, J., Gibney, M., Kearney, J., & Martinez, J. A. (2001). Prevalence of physical activity during leisure time in the European union. *Medicine and Science in Sports and Exercise*, 33(7), 1142-1146.
- Moran, P. (1950). A test for serial independence of residuals. *Biometrika*, 37, 178-181
- Reiner, M., Niermann, C., Jekauc, D., & Woll, A. (2013). Long-term health benefits of physical activity – a systematic review of longitudinal studies. *BMC Public Health*, 13, 813.
- Ríos, D., Cubedo, M., & Ríos, M. (2013). Graphical study of reasons for engagement in physical activity in European union. *Springerplus*, 2(1), 1-6.
- Rütten, A., & Abu-Omar, K. (2004). Prevalence of physical activity in the European union. *Sozial- Und Praventivmedizin*, 49(4), 281-289.
- Scheerder, J., Vandermeersch, H., Van Tuyckom, C., Hoekman, R., Breedveld, K. & Vos, S. (2011). *Understanding the game. Sport participation in Europe: Facts, reflections and recommendations*. Sport, Policy and Management Report 10. Leuven: K.U. Leuven
- Sjöström, M., Oja, P., Hagströmer, M., Smith, B. J., & Bauman, A. (2006). Health-enhancing physical activity across European union countries: The Eurobarometer study. *Journal of Public Health*, 14(5), 291-300.
- Sport England (2010). *Understanding variation in sports participation*. London: Sport England.
- Van Bottenburg, M., Rijnen, B., & Van Sterkenburg, J. (2005). *Sports participation in the European Union: Trends and differences*. Nieuwegein: Arko.
- Van Tuyckom, C. (2013). Six sporting worlds. A cluster analysis of sports participation in the EU-25. *Quality and Quantity*, 47(1), 441-453.
- Van Tuyckom, C., & Scheerder, J. (2010a). A multilevel analysis of social stratification patterns of leisure-time physical activity among Europeans. *Science and Sports*, 25(6), 304-311.
- Van Tuyckom, C., & Scheerder, J. (2010b). Sport for all? insight into stratification and compensation mechanisms of sporting activity in the 27 European union member states. *Sport, Education and Society*, 15(4), 495-512.
- Van Tuyckom, C., Scheerder, J., & Bracke, P. (2010). Gender and age inequalities in regular sports participation: A cross-national study of 25 european countries. *Journal of Sports Sciences*, 28(10), 1077-1084.
- Van Tuyckom, C., Van De Velde, S., & Bracke, P. (2013). Does country-context matter? A cross-national analysis of gender and leisure time physical inactivity in Europe. *European Journal of Public Health*, 23(3), 452-457.

- Weis, O., Norden, G., Nader, M., & Arnusch, F. (2016). European Sport Index: the social significance of sport in 28 European countries. *European Journal for Sport and Society*, 13(2), 167-182.
- WHO (2015). *Physical activity strategy for the WHO European Region 2016-2025*. Working document, World Health Organization, Regional Committee for Europe, Vilnius, Lithuania, 14-17 September 2015.
- WHO. (2017). *Physical activity*. Fact sheet. Retrieved 22 February 2017 from <http://www.who.int/mediacentre/factsheets/fs385/en/>
- Wicker, P., Breuer, C., & Pawlowski, T. (2009). Promoting sport for all to age-specific target groups – The impact of sport infrastructure. *European Sport Management Quarterly*, 9(2), 103-118.

## Appendix

**Table A1.** Classification of European regions according to sporting practice

C1	C2		C3		C4		
DE8	AT32	IE01	AT12	FR26	AT11	ES12	PL33
DEE	BE10	IE02	AT31	FR41	AT13	FR21	PL34
DEF	BE33	ITD1&2	AT34	FR42	AT21	FR22	PL42
DK01	DK02	ITF6	BE21	FR52	AT22	FR23	PL43
DK03	EL43	LU00	BE22	FR61	AT33	FR25	PL52
DK04	ES11	PT18	BE23	FR62	BE31	FR30	PL61
DK05	ES21	SE11	BE24	FR72	BE32	FR51	PL62
FI13	ES22	SI02	BE25	FR82	BG31	FR81	PL63
FI18	ES23	UKE	BE34	HR03	BG32	ITC4	PT11
FI1A	ES24	UKF	BE35	HU23	BG33	ITC1&2	PT15
HU32	ES30	UKG	CZ06	HU31	BG34	ITC3	PT16
NL11	ES41	UKI	CZ07	HU33	BG41	ITD3	PT17
NL12	ES42	UKK	DE1	ITE1	BG42	ITD4	RO12
NL13	ES43	UKM	DE2	LT00	CY00	ITD5	RO21
NL21	ES51		DE3	LV00	CZ01	ITE2	RO22
NL22	ES52		DE4	NL23	CZ02	ITE3	RO31
NL31	ES53		DE5	PL41	CZ03	ITE4	RO32
NL32	ES61		DE7	PL51	CZ04	ITF1&2	RO41
NL33	ES62		DE9	RO11	CZ05	ITF3	SK01
NL34	ES70		DEA	RO42	CZ08	ITF4&5	SK03
NL41	FI19		DEB	SI01	DE6	ITG1	UKC
NL42	FR43		DED	SK02	DEC	ITG2	UKH
SE12	FR53		DEG	SK04	EL11	MT00	UKL
SE21	FR63		EE00	UKD	EL12	PL11	UKN
SE22	FR71		EL14	UKJ	EL13	PL12	
SE23	HR04		EL24		EL21	PL21	
SE31	HU10		ES13		EL23	PL22	
SE32	HU21		FR10		EL25	PL31	
SE33	HU22		FR24		EL30	PL32	

*Note:* AT: Austria, BE: Belgium, BG: Bulgaria, CY: Cyprus, CZ: Czech Republic, DE: Germany, DK: Denmark, EE: Estonia, EL: Greece, ES: Spain, FI: Finland, FR: France, HR: Croatia, HU: Hungary, IE: Ireland, IT: Italy, LT: Lithuania, LU: Luxembourg, LV: Latvia, MT: Malta, NL: the Netherlands, PL: Poland, PT: Portugal, RO: Romania, SE: Sweden, SI: Slovenia, SK: Slovakia, UK: United Kingdom.