

The associations of SES, obesity, sport activity and perceived neighbourhood environments: Is there a model of environmental injustice penalising Portuguese children?

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## Abstract

**Objectives:** This study analyses the associations between children's obesity, sports activity (SA) and perceived environmental characteristics with the children's SES.

**Methods:** A sample of 1885 Portuguese children, aged 3-10 years, living in Coimbra, Portugal, was observed. Weight and height were measured and obesity was defined by age- and sex-specific, BMI cut-off points. Questionnaires included variables on SA levels, SES and parental neighbourhood perceptions were done. A CATPCA was performed and two neighbourhood dimensions were achieved. The independent associations of SES with obesity, SA and perceived neighbourhood dimensions was analysed using ordered logistic regressions.

**Results:** Children of low (OR = 1.76; CI = 1.25-1.99) and medium SES (OR = 1.57; CI = 1.34-2.33) were more likely to be obese than their high-SES peers, less likely to participate in SA (low SES OR = 0.177; CI = 0.12-0.26; medium SES OR = 0.357; CI = 0.24-0.53), and their parents were less likely to have positive perceptions of their built environment (low SES OR = 0.516; CI = 0.38-0.70; medium SES OR = 0.565; CI = 0.37-0.86).

**Conclusions:** Obesity increases and SA decreases among children with the lowest SES and these living in neighbourhoods with higher perceived risk. This finding suggests a model of

environmental injustice, whereby differential access to the neighbourhood's resources overlaps with familial socioeconomic disadvantage.

Keywords: childhood obesity; perceptions of neighbourhood environment; social inequities; environmental injustice

## **Introduction**

The level of obesity has tripled in the last decades and Portugal presents one of the highest values in Europe; 31.5% of Portuguese children aged 7-9 years were considered overweight or obese. Although genetic factors play a significant role, they do not fully explain the dramatic increase in obesity rates in recent years (Cohen et al., 2006).

Empirical studies found that children from low SES households exhibit higher levels of obesity (Padez et al., 2004; Timperio et al., 2005), and their behaviours as related to diets and physical activity are influenced by neighbourhood characteristics. Environmental factors that exacerbate unhealthy behaviours among children that can lead to weight gain include living in areas or studying in schools characterised by the scarcity of healthy foods (Zenk and Powell, 2008); the lack of parks, playgrounds and other facilities which encourage physical activity (Burdette and Whitaker, 2003; Brockman et al., 2010); poor access to public transport, unsafe pedestrian and cycling conditions (Timperio et al., 2004; Pont et al., 2009); and high crime rates (Burdette and Whitaker, 2003).

## **Methods**

### *Research aims*

To investigate the associations between obesity, SA, and parent's environmental perceptions among children aged 3 to 10 years across socioeconomic backgrounds. We hypothesised that children from lower SES are more obese, more sedentary, and more likely to live in disadvantaged, obesogenic environments, where opportunities to promote children's physical activity are scarce.

### *Study design and setting*

The sample included 952 girls and 933 boys, aged 3 to 10 years, from preschool to grade 4 of primary school.

### *Measures*

- a) Years of parental education were used as a proxy of children's SES and categorised into three groups: < 9 years - low-SES; 10 to 12 years - middle-SES; >12 years - high-SES.
- b) BMI was calculated as  $\text{weight/height}^2$  (Kg/m<sup>2</sup>). Internationally accepted cut-off points to categorise children's BMI were used (Cole et al., 2000). Participants were grouped into two categories: normal weight and overweight or obese.
- c) Information about the children's SA was measured using a binary variable: practice an extracurricular SA or not.
- d) Parental perceptions of their local neighbourhood were assessed based on the Environmental Module of the International Physical Activity Prevalence Study (IPS, 2002). We used 15 items related to parental perceptions about the importance of access to meaningful destinations; the availability of local infrastructures; aesthetic qualities; street connectivity; access to public transport; neighbourhood safety; and levels of social support.

### *Statistical procedures*

The 15 perceived environmental variables were reduced through a Categorical Principal Component Analysis (CATPCA); two neighbourhood dimensions were retained and subsequently dichotomized based on a median split (negative *versus* positive overall perceptions).

- i. First Dimension:* composed of variables related to land-use and urban design: infrastructures, access to amenities, the availability and quality of maintenance of infrastructures and aesthetics (*Cronbach's Alpha* = 0.8). It represents the neighbourhood's built and physical environment.
- ii. Second Dimension:* comprised of variables related to social environment and neighbourhood safety, including perceptions of disorder, crime, violence, and safety, including road safety (*Cronbach's Alpha* = 0.6).

The independent association of SES with obesity, SA and perceived neighbourhood dimensions as dependent variables was analysed using ordered logistic regressions, adjusted for age and gender. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated, and robust standard errors were used to account for the clustering of participants in schools. The statistical analysis was performed using SPSS 19.0.

## Results

Adjusting for the child's gender, age and the clustering of children in schools, children from low and medium SES backgrounds were more likely to be obese than their high SES peers (i.e., OR=1.767 and OR=1.574, respectively) (table 1).

Table 1. Differences in demographics, physical and behavioural characteristics according to SES groups

	Age (X +/- SD)	Gender (% female)	BMI (% overweight/obesity)*	Sport activity besides school (%)*
<b>SES</b>				
<i>High</i>	7.35+/-1.96	50.1	20.3	77.5
<i>Medium</i>	7.06+/-2.09	51.6	29.5	47.4
<i>Low</i>	7.88+/-2.01	50.0	33.3	31.6

\*p < 0.01: Pearson's chi-square test of significance.

Furthermore, our data showed that low- and medium-SES children were significantly more likely to be sedentary than their high-SES counterparts, even after accounting for gender and age differences. The OR showed that low-SES children are 82.3% less likely than high SES children to practice SA, whereas medium SES children are 64.3% less likely. In subsequent models that account for neighbourhood characteristics, children's demographic characteristics (i.e., gender and age) do not appear to be significantly associated with parental perceptions about the neighbourhood. In terms of perceptions about the built environment by SES, results showed that parents from low- (OR=0.516) and medium- (OR=0.565) SES were less likely than parents from high SES to perceive their built environment as convenient. Most of the predictors in the model are not significantly associated with the social environment and neighbourhood safety (the second CATPCA dimension). However, Table 2 also shows that children of medium and low SES were 6.6% and 15.2% (i.e., OR=0.934 and OR=0.848), respectively, less likely than their high-SES peers to live in neighbourhoods with positive social environments based on parental perceptions.

Table 2. Logistic regression analysis showing estimating results of BMI, physical activity, and neighbourhood perceptions with SES as independent variable

Obesity					Sports activity besides school					
	Unadj. OR	95% IC	Adjusted OR	95% IC		Unadj. OR	95% IC	Adjusted OR	95% IC	
			<i>Gender (girl)</i>	1.426**	1.182-1.720			<i>Gender (girl)</i>	0.795	0.624-1.01 ws
			<i>age</i>	1.094*	1.036-1.156			<i>age</i>	1.186**	1.118-1.259
<b>SES</b>			<b>SES</b>			<b>SES</b>		<b>SES</b>		
<i>High</i>	ref (1)		<i>High</i>	ref (1)		<i>High</i>	ref (1)	<i>High</i>	ref (1)	
<i>Medium</i>	1.536**	1.207-1.955	<i>Medium</i>	1.574**	1.34-2.33	<i>Medium</i>	0.347**	<i>Medium</i>	0.357**	0.239-0.532
<i>Low</i>	1.786**	1.363-2.34	<i>Low</i>	1.767**	1.248-1.985	<i>Low</i>	0.192**	<i>Low</i>	0.177**	0.122-0.257

\*\* P<0,001; \* p<0,05

Table 2. Logistic regression analysis showing estimating results of BMI, physical activity, and neighbourhood perceptions with SES as independent variable

Perceived a convenient built environment					Perceived a convenient social environment and safety					
	Unadj. OR	95% IC	Adjusted OR	95% IC		Unadj. OR	95% IC	Adjusted OR	95% IC	
			<i>Gender (girl)</i>	0.934	0.759-1.15 ws			<i>Gender (girl)</i>	0.944 ws	0.793-1.124
			<i>age</i>	1.033	0.92-1.094 ws			<i>age</i>	1.058*	1.006-1.113
<b>SES</b>			<b>SES</b>			<b>SES</b>		<b>SES</b>		
<i>High</i>	ref (1)		<i>High</i>	ref (1)		<i>High</i>	ref (1)	<i>High</i>	ref (1)	
<i>Medium</i>	0.565**	0.375-0.849	<i>Medium</i>	0.566**	0.372-0.859	<i>Medium</i>	0.944 ws	<i>Medium</i>	0.934 ws	0.753-1.157
<i>Low</i>	0.516**	0.379-0.704	<i>Low</i>	0.516**	0.379-0.703	<i>Low</i>	0.834 ws	<i>Low</i>	0.848 ws	0.706-1.019

\*\* P<0.001; \* p<0.05, ws (without significance)

## **Discussion and conclusions**

We found that SES predicted both children's obesity and their participation in SA and that lower-SES children tend to live in neighbourhoods characterised by their scarcity of public spaces, lack of amenities and infrastructures, poor maintenance and poor aesthetics. Our results about the social environment and safety showed an association between children's low-SES and lack of social support and safety, although without statistical significance. Most extant studies have taken a narrow approach in studying child obesity. Mota et al. (2011) concluded that girls from higher-SES backgrounds were more likely to be active and to have more positive perceptions about their built environment than their lower-SES counterparts. They also found no significant SES gradient in terms of perceptions of the social environment and safety. Bois et al. (2005) found a positive association between SES and levels of physical activity, arguing that psychosocial pathways related to the increased capacity of higher SES families to transport their children to SA and the greater valuation of physical activity as a form of leisure explain that SES gradient. Santos et al. (2004) have also found that adolescents from higher SES backgrounds are more likely to participate in formal SA. However, neither of these studies examines the role of environmental factors. Timperio et al. (2004) concluded that high-SES parents reported more sports venues, well-lit areas, crosswalks, and public transport in their neighbourhoods than did low-SES parents. Moreover, high SES children were more likely to walk and cycle to local destinations, suggesting that their neighbourhoods had better-built environments and better infrastructure, as corroborated by their parents' positive neighbourhood perceptions.

We argue that low-SES children are more likely to be obese. Likewise, they tend not to participate in as many extracurricular SA as their higher SES counterparts. Furthermore, these children tend to live in neighbourhoods perceived by their parents as disadvantaged. Low-SES families tend to have low income and poor access to information, which restrict their spending on health-related products and services. Beyond that, they tend to live in disadvantaged areas, where resources – both tangible and intangible – and facilities that promote health and wellbeing are scarce. Parents from lower SES reported negative perceptions about their neighbourhoods, concerning issues of land use, urban design, social organisation and safety. Those negative perceptions reflect the challenges facing the residents of these neighbourhoods, including poor access to a wide range of amenities, lack of public spaces, poor quality of infrastructures, including sidewalks and cycle paths, fear of crime, heavy traffic, unsafe roads, and generally unattractive surroundings. Given that these parents live in perceptibly unpleasant neighbourhoods, where opportunities are scarce, they restrict and discourage their children from engaging in outdoor activities, including sports. Ultimately, this discouragement leads to their tendency for weight gain. We suggest that this chain of detrimental conditions constitutes a problem of environmental justice, or a deprivation amplification model (Macintyre et al., 2008; Nogueira, 2010) as neighbourhood environmental risks magnify individual vulnerability.

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