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The association between area-level socio-economic status and childhood overweight and the role of urbanicity

Ulrike Igel [a, b, *], Matthias Romppel [c], Johanna Baar [a, b], Elmar Brähler [b], Gesine Grande [d]

[a] Faculty of Architecture and Social Sciences, Leipzig University of Applied Sciences, Germany
[b] Institute of Medical Psychology and Medical Sociology, University of Leipzig, Germany
[c] Faculty of Human and Health Sciences, University of Bremen, Germany
[d] Leipzig University of Applied Sciences, Germany

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ABSTRACT

Background: The relation between area-level socio-economic status (SES) and childhood overweight has primarily been investigated in urban areas. However, study areas have rarely been defined regarding their urbanicity. The aim of this study was to comparatively examine the relation between area-level SES and childhood overweight according to different types of areas within a German city.
Methods: We used the cross-sectional data of 2858 children (mean age 6 years, sd = 0.4, 49% female) who were taking the school entry examination. Individual data (weight status, parental SES) was subsequently linked to area-level SES. Multilevel logistic regression (MLRA) models were conducted to analyse associations between individual- and area-level SES and overweight in children from suburban, urban, and highly urban areas.
Results: Unadjusted analyses showed associations between parental and area-level SES and children's overweight in more urbanised areas but not in suburban areas. In multivariate MLRA models, only parental education remained statistically significant. None of the included SES predictors were associated with overweight in the suburban group.
Conclusions: Whereas individual- and area-level SES are associated with childhood overweight in more urbanised areas, aspects of the physical environment might be more relevant in suburban areas. Levels of urbanicity should be considered when planning community-based obesity-prevention programmes.

1. Introduction

Childhood obesity is a growing concern for public health. Overweight or obesity in childhood may lead to increased risks of type 2 diabetes, hypertension, and coronary heart disease in adulthood (Park et al., 2012). Moreover, obese children are often stigmatised by peers, parents, and educators, and such stigmatisation is associated with lower psychological and social well-being (Puhl and Latner, 2007). Besides genetic factors, overweight and obesity are seen as a result of an energy imbalance, i.e. the consequence of high energy intake and low expenditure. This imbalance is not only a result of individual behaviour but is also influenced by the structures, barriers, and resources an individual faces. Evidence suggests that children from families with low socio-economic status (SES) (e.g. unemployed or with low levels of education and income) are at higher risk of becoming overweight or obese (Shrewsbury and Wardle, 2008). However, this social gradient in the prevalence of obesity and overweight cannot be explained only by individual factors (Schreier and Chen, 2013). With the emergence of social ecological theory, the role of area-level SES as a predictor of (childhood) overweight has been broadly investigated. There are some theoretical models that can help us understand the mechanisms behind the aggregate of socio-economic disadvantages and health. Area-level SES may affect health via a) the availability and accessibility of health-promoting resources (such as recreational and educational facilities) (Jencks and Mayer, 1990; Leventhal and Brooks-Gunn, 2000; Cummins, 2007), b) formal and informal institutions that control children's behaviour (collective socialisation) (Jencks and Mayer, 1990; Leventhal and Brooks-Gunn, 2000), and c) the influence of peers, i.e. the spread of unhealthy behaviours (epidemic model) (Leventhal and Brooks-

* Corresponding author. Faculty of Architecture and Social Sciences, Leipzig University of Applied Sciences, POB 30 11 66, 04251 Leipzig, Germany.
E-mail address: igel@sug.htwk-leipzig.de (U. Igel).

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Gunn, 2000; Jencks and Mayer, 1990). Several studies have demonstrated that there is a higher proportion of overweight or obese children living in deprived areas (El-Sayed et al., 2012; van Vuuren et al., 2014; Carter and Dubois, 2010). However, there are also inconsistent findings. As Macintyre and colleagues stated: There is no universal area effect on health but "some area effects on some health outcomes, in some population groups, and in some types of areas" (Macintyre et al., 2002).

1.1. Urban areas and the role of urbanicity

As most theoretical and empirical work on the association between area SES and childhood obesity has focussed primarily on urban areas (cities), little is known about this relation in non-urban areas. Moreover, although there is no uniform definition of "urban" (Vlahov and Galea, 2002), the areas that have been studied are rarely explicitly described in terms of their urbanicity (conditions such as population density, crime, traffic, and resources that are present to a much greater extent in urban areas) (Vlahov and Galea, 2002). Due to the ongoing processes of urbanization and suburbanisation that have resulted in structural and societal changes within cities (Schäfers, 2006), heterogeneity across inner-city areas needs to be considered (Vlahov and Galea, 2002). Consequently, the "conditions of urbanicity (as well as the process of urbanization) need to be understood to study urban conditions and how they affect health" (Vlahov and Galea, 2002). Given the graduation and variability of urbanicity within cities ("metropolitan" in the centre, predominantly provincial or almost rural in peripheral/suburban areas), the question arises as to whether inconsistent findings on area-level SES and obesity are related to differences in the urbanicity levels of the investigated areas. More precisely, does urbanicity (the urban-ness of an area) moderate the association between area-level SES and obesity? Are the theoretical frameworks mentioned above applicable only in highly urban areas or also in suburban areas?

The aim of this study was to comparatively investigate the association between area-level SES and childhood overweight according to urbanicity levels. On the basis of theoretical models and empirical findings, we expected that a lower area-level SES would be related to an increased prevalence of overweight and obesity in children. Assuming that areas of different urbanicity levels differ in terms of their physical and social structures and resources, we expected that the impact of area- and individual-level SES on childhood obesity would vary according to area type. We hypothesised that residents of suburban (less urbanised) districts would be more homogeneous in terms of their norms and values and that socio-economic characteristics would be less important and would consequently have a smaller impact on health outcomes.

2. Subjects, materials and methods

2.1. Sample

The study was conducted in Leipzig (Germany), a city of approximately 544,000 inhabitants located in the federal state of Saxony (former GDR). We used cross-sectional data from the school entry health examination, which is carried out annually by the Public Health Department of Leipzig. Data were collected between October 2010 and May 2011 by the staff of the Public Health Department of Leipzig. Ethics approval was obtained from the Ethics Committee of the University of Leipzig (361-10-13122010).

Parents of all children who were expected to start school in 2011 and who were living in Leipzig (N = 4372) were asked to participate in our study. We obtained informed consent from the parents of 3156 children (response rate 72%). Parents were asked to fill out a short questionnaire about their socio-economic situation while waiting for their child's examination. Medical data and information on the residential district were provided by the Public Health Department. Individual data were subsequently linked to objectively assessed area-level characteristics. 2858 children with medical and survey data residing in Leipzig were included in the analysis (65.2% of the population). Drop-out analyses were conducted by the staff of the Public Health Department. Participants and non-participants did not differ significantly with regard to their overweight status (German references) (7.6% vs. 9.3%; $X^2 = 3.45$, $p = 0.063$) but did differ in their living environment. This resulted in fewer children from more disadvantaged areas participating in our study (% of children receiving welfare: 31.9 vs. 36.1, $T = 7.48$, $p < 0.001$; % of residents with low levels of education: 18.8 vs. 19.8, $T = 4.57$, $p < 0.001$; unemployment rate: 10.0 vs. 10.9, $T = 7.17$, $p < 0.001$). The response rate was higher among children from suburban (71.2%) compared with highly urban (63.3%) and urban (65.5%) areas ($X^2 = 11.99$, $p = 0.002$).

2.2. Individual-level variables

2.2.1. Overweight and obesity

Children were measured for height and weight without shoes or outdoor clothing by a staff member of the Public Health Department (a doctor or nurse). BMI z-scores were calculated using the German age-and-gender-specific reference curves (Kromeyer-Hauschild et al., 2001). According to this definition, children above the 90th percentile ($z_\alpha = 1.282$) are overweight and those above the 97th percentile ($z_\alpha = 1.881$) are obese. For model testing, overweight and obese were combined into a dichotomous variable with 0 = "underweight and normal weight" and 1 = "overweight and obese".

2.2.2. Parental socio-economic status

Educational attainment was assessed by parents' highest level of school graduation and dichotomised into high (1 = university entrance qualification "Abitur") and other (0 = no exam, basic school qualification "Hauptschulabschluss", certificate of secondary education "mittlere Reife"). Due to the high correlation of educational attainment between the two parents, maternal values were used (if maternal data were missing, paternal data were used). Employment status was also dichotomised into "at least one parent unemployed" vs. "other" (i.e. full-time, part-time, professional, or tertiary education for both parents). Living with a partner (1 = "yes", 0 = "no") was also assessed as a potential confounding variable.

2.3. Area-level variables

The spatial units of analysis were the 63 districts ("Ortsteile") of the city of Leipzig. These administrative units differed in terms of their size and structure but they had been historically established, i.e. they were perceived as communities or large neighbourhoods. Sixteen of them had been incorporated after 1990, i.e. these were former villages that had been "urbanised". Data from the "Ortsteilkatalog" (Leipzig Office for Statistics and Elections, 2010, 2013) 2008 and 2011 were used to assess the area-level characteristics.

2.3.1. Level of urbanicity

On the basis of theoretical (Halfacree, 1993) and empirical work (Dahly and Adair, 2007; McDade and Adair, 2001) as well as indicators suggested by the Federal Institute for Research on Building, Urban Affairs, and Spatial Development (Federal Institute for Research on Building, Urban Affairs and Spatial Development, 2010), districts were categorized in three groups: suburban,