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Socioeconomic position, macroeconomic environment and overweight among adolescents in 35 countries

P Due[1], **MT Damsgaard**[2], **M Rasmussen**[2], **BE Holstein**[2], **J Wardle**[3], **J Merlo**[4], **C Currie**[5], **N Ahluwalia**[6], **TIA Sørensen**[7], and **J Lynch**[8,9,10] **on behalf of the HBSC obesity writing group**

[1]National Institute of Public Health, University of Southern Denmark, Copenhagen, Denmark [2]Department of Social Medicine, Institute of Public Health, University of Copenhagen, Copenhagen, Denmark [3]Department of Epidemiology and Public Health, University College London, London, England [4]Faculty of Medicine, Social Epidemiology (Department of Clinical Science), Lund University, Malmö, Sweden [5]Child and Adolescent Research Unit, University of Edinburgh, Edinburgh, Scotland [6]Service Médical du Rectorat de Toulouse, Toulouse, France [7]Institute of Preventive Medicine, Copenhagen University Hospital, Centre for Health and Society, Copenhagen, Denmark [8]School of Health Sciences, University of South Australia, Adelaide, Australia [9]Department of Social Medicine, University of Bristol, Bristol, UK

Abstract

Objective—It is important to understand levels and social inequalities in childhood overweight within and between countries. This study examined prevalence and social inequality in adolescent overweight in 35 countries, and associations with macroeconomic factors.

Design—International cross-sectional survey in national samples of schools.

Subjects—A total of 11-, 13- and 15-year-olds from 35 countries in Europe and North America in 2001–2002 (N = 162 305).

Measurements—The main outcome measure was overweight based on self-reported height and weight (body mass index cut-points corresponding to body mass index of 25 kg/m^2 at the age of 18 years). Measures included family and school affluence (within countries), and average country income and economic inequality (between countries).

Results—There were large variations in adolescent overweight, from 3.5% in Lithuanian girls to 31.7% in boys from Malta. Prevalence of overweight was higher among children from less affluent families in 21 of 24 Western and 5 of 10 Central European countries. However, children from more affluent families were at higher risk of overweight in Croatia, Estonia and Latvia. In Poland, Lithuania, Macedonia and Finland, girls from less affluent families were more overweight whereas the opposite was found for boys. Average country income was associated with prevalence and inequality in overweight when considering all countries together. However, economic inequality as measured by the Gini coefficient was differentially associated with prevalence and

Correspondence: Dr P Due, National Institute of Public Health, University of Southern Denmark, Øster Farimagsgade 5 A, 2nd Floor, Copenhagen 1399, Denmark. pdu@niph.dk.
[10]Members of the HBSC Obesity Writing Group are listed in the Appendix.

Conflict of interest
The authors declare no conflict of interest.

Other important statement
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socioeconomic inequality in overweight among the 23-high income and 10-middle income countries, with a positive relationship among the high income countries and a negative association among the middle income countries.

Conclusion—The direction and magnitude of social inequality in adolescent overweight shows large international variation, with negative social gradients in most countries, but positive social gradients, especially for boys, in some Central European countries. Macroeconomic factors are associated with the heterogeneity in prevalence and social inequality of adolescent overweight.

Keywords

overweight; social inequality; adolescents; international comparisons; macroeconomic factors

Introduction

Public health is concerned with improving both overall levels of health and reducing social inequalities, and rising levels of overweight among adolescents are a growing public health problem in many countries.[1–3] Obesity among children has immediate adverse effects on quality of life,[4] self-esteem[5] and experience of discrimination.[6] Obesity in adolescence is associated with worse cardiovascular risk factor profiles[7,8] and increased type 2 diabetes.[9] Although obesity in childhood tracks into adulthood and its cumulative effects over time can adversely affect adult health,[10,11] adolescent obesity itself can have long-term adverse effects on adult health, regardless of the adult obesity.[1,12–14]

Social disadvantage in childhood has been shown to be a risk factor for adult obesity, even in populations wherein the prevalence of childhood obesity shows no clear social pattern.[15,16] In their 1989 review, Sobal and Stunkard[17] concluded that research on childhood and adolescent obesity showed no clear social pattern in the Western countries. However, more recently, Shrewsbury and Wardle[18] showed that since 1990, the dominant pattern in Western countries is for greater socioeconomic disadvantage to be associated with higher prevalence of overweight and obesity, matching the patterning for adults.

To our knowledge, only one earlier international study has compared the association between socioeconomic position and overweight among children within countries, using the comparable international standardized measures.[19] This study found that Chinese and Russian children from more affluent families were at higher risk of obesity, but in the United States, children from poor backgrounds were at higher risk.

The rapid changes in the prevalence of obesity internationally points to environmental causes, and studies among adults have investigated the importance of macroeconomic factors. An ecological study of adult populations in 21 developed countries found increasing prevalence of obesity with greater socioeconomic inequality, but no association with average income level of the country.[20] In addition, among women, international variations in prevalence and the socioeconomic gradient of obesity seem to be influenced by contextual factors. In a study among women in 37 developing countries, Monteiro *et al.*[21] found higher prevalence of obesity with increasing wealth of the country. Furthermore, obesity was most common in the lower socioeconomic groups in affluent countries, but most common in the higher socioeconomic groups in poorer countries.

This study examined the prevalence and within-country social inequality in overweight among adolescents, using internationally comparable data on body mass index (BMI) and socioeconomic position in 35 countries. It also examined whether country-level macroeconomic factors (average income and economic inequality) were associated with international variations in prevalence and social inequality in adolescent overweight.

Materials and methods

We used internationally comparative data on family affluence and BMI from cross-sectional surveys in 35 countries participating in the 2001–2002-survey of the international World Health Organization (WHO) collaborative study: Health Behavior in School-Aged Children (HBSC) (www.hbsc.org). Participants were 11-, 13- and 15-year-old students (N = 162 305) from nationally representative random samples of schools ($N_{schools}$ = 5998). The primary sampling frame was the class, or school in the absence of a sampling frame for classes. The recommended minimum sample size was based on analyses of earlier international data from this study, and sample sizes ranged from 2875 in the Republic of Ireland to 8185 in France.[22] Surveys were completed by self-report during a school period after instruction from an adult and using the internationally standardized HBSC questionnaire. [23] The study complied with the ethical standards of the relevant country.

Measures

Body mass index (kg/m^2) was calculated from self-reported height without shoes and weight without clothes, and overweight/obesity was determined using the internationally standardized age- and sex-specific metric proposed by Cole *et al*.[24] This metric provides cutoff points for BMI in childhood linked to adult BMIs of 25 and 30 kg/m^2. Overweight and obesity combined were selected as the outcome, because there were insufficient numbers of children classified as obese in some groups (for example, no children were obese among the most affluent in Russia).

Socioeconomic position at the individual level was measured by the family affluence scale (FAS), a summary index of four items: does your family own a car, van or truck? (0–2 points); do you have your own bedroom? (0–1 points); during the past 12 months, how many times did you travel away on holiday with your family? (0–2 points) and how many computers does your family own? (0–2). This produces a score ranging from 0 (lowest affluence) to 7 (highest affluence). The FAS has been specially developed for the international nature of the HBSC study, and is less subject to non-response bias than other socioeconomic measures. It has been validated against measures, such as information on FAS from parents, parental occupation and macroeconomic indicators at a country-level, and is sensitive in differentiating levels of affluence across countries.[25]

The Gini coefficient, taken from UNDP's Human Development Report 2003 (http://hdr.undp.org/reports/global/2003/), served as an indicator of country-level economic inequality. The Gini coefficient reflects the distribution of income among the population, and varies between 0 (perfectly equal distribution) and 1 (one individual has all the income and all others have none).

As the measure of economic level of each country, we used gross national income per capita (GNI) from 2002 from the World Development Indicators database, World Bank 2003 (www.worldbank.org). GNI is the gross national income in current US dollars divided by the mid-year population and measures the total domestic and foreign income claimed by the residents of the economy. It comprises gross domestic product (GDP) plus net factor income from abroad, which is the income residents receive from abroad for factor services (labor and capital) minus similar payments made to nonresidents, who contributed to the domestic production. GNI in US dollars is calculated according to the World Bank Atlas method of conversion from national currency to US dollar terms. These data were available for 33 of the 35 countries, leaving Greenland and Malta out of analyses that include GNI and Gini.

Statistical analyses

The analyses excluded 3574 students (2.2%) with missing information on family affluence and 23 463 students (14.7%) with missing information on height or weight. The amount of missing information on BMI varied across countries from 0.5 to 20%. Three countries had more than 30% missing information on BMI (England 40.8%, Scotland 51.6% and Ireland 60.4%). For all three countries, however, the socioeconomic distribution among students missing data on height and weight, was similar to the social distribution among the adolescents included in the current analyses.

We calculated age-standardized overweight prevalence proportions for each sex and family affluence group using equal weights for the three age groups. To reflect both absolute and relative inequality, three standard measures of inequality in overweight were calculated sex-specifically for each country: (1) prevalence difference; (2) the slope index of inequality (SII) and (3) the relative index of inequality (RII). Prevalence difference was calculated as the difference between overweight proportion in the lowest (0–3) and highest (6–7) family affluence groups. To calculate the SII and RII, each of the eight family affluence categories (ranked 0–7) was given a score based on the midpoint of its range in the cumulative family affluence distribution in the country sample. The proportion overweight in each category was then regressed on these midpoint scores by weighted least square linear regression.[26] The generated slope index (SII) can be interpreted as the absolute difference in the prevalence of overweight between the individuals with the hypothetically lowest and hypothetically highest family affluence taking account of the affluence levels of all groups in between. Likewise, the RII was calculated as the ratio of overweight prevalence between the individuals with the hypothetically lowest (represented by the intercept) and hypothetically highest family affluence.[27]

We used linear regression to assess the association between country-level variables (GNI, GINI) and age-adjusted country-level prevalence of overweight, SII and RII, for all 33 countries. The analyses were repeated, stratified for GNI levels into high- vs middle-income economies according to the classification from the World Development Indicators Database, World Bank 2003 (www.worldbank.org) with analyses of high-income countries, respectively, in- and excluding the three countries with more than 30% missing data for BMI.

Finally, we used multilevel logistic regression (SAS 9.1.2 Proc Glimmix, CARY NC: SAS Institute Inc., 2004) to assess associations between country-level macroenvironmental factors and individual-level overweight in three consecutive models. In model I, we analyzed the crude school and country variance. In Model II, we included individual-level data on age and FAS, and in Model 3, we included country-level macroeconomic factors (GNI and Gini). These analyses did not inform the results further, and are therefore not included in the paper. Results are available on request. Sensitivity analyses were conducted with obesity as the outcome, and although some analyses could not be performed because of missing data in some categories, results were generally robust to change in the definition of the outcome. We used SAS software version 9.1.2 (SAS Institute Inc, 2004) for all analyses.

Results

There were large variations across countries in the proportions of overweight and obese students (Table 1). The lowest prevalence was found in Lithuanian girls (3.5%) and the highest in boys from the United States and Malta (United States: 28.6%, Malta: 31.7%). GNI and Gini coefficients reflect the large socioeconomic diversity of the countries involved in the study, from Ukraine (GNI_{2002} = 770 USD per capita) to Switzerland (GNI_{2002} = 37930 USD per capita). Gini coefficients range from 24.4 in Hungary to 45.6 in the Russian

Federation. Table 1 also shows the distribution of family affluence. Ukraine had the highest level of low family affluence (73.0%), whereas Norway had the highest level of high family affluence (57.5%). Family affluence was strongly correlated to GNI of the country ($r = 0.83$, $P < 0.001$).

Social inequality in prevalence of overweight within countries

Table 2a and b shows that English-speaking and Mediterranean countries were among those with the highest prevalence of overweight, whereas all Central European countries had a lower prevalence of overweight. Absolute social inequality (SII) ranged from 9.8% higher prevalence of overweight among the most affluent Macedonian boys, to 17.6% among the least affluent Irish boys.

Relative social inequality for overweight ranged from 0.51 in Estonian boys to 4.80 in girls from the Czech Republic, and was not related to country prevalence of overweight. We found inverse social inequalities (RII > 1) in overweight for both sexes in 21 out of 24 high-income countries. Only in Finnish boys and girls from Sweden and Greenland did children from more affluent backgrounds have a higher prevalence of overweight (prevalence differences for Finland and Sweden < 3%). The same pattern of inequality was seen in four middle-income countries: Russia and especially the Czech Republic, Hungary and Ukraine. Prevalence of overweight was higher for children from more affluent families (RII < 1) in three middle-income countries: Croatia, Estonia and Latvia. In Poland, Lithuania and to some extent in Macedonia, there was a negative association between family affluence and overweight in girls, whereas the opposite was seen for boys.

Despite their very different prevalence levels, Germany and the United States both had large relative as well as absolute inequalities in overweight for both boys and girls, whereas Wales, England and Russia had low absolute and relative inequality. Figure 1 illustrates the complex interrelation between prevalence of overweight and socioeconomic inequality in overweight across countries, including five countries, which represent high and low prevalence of overweight (for example, USA and Russia), and opposite socioeconomic patterns (for example, Macedonia and Germany). Further, findings from Germany and USA illustrate how two countries can have almost the same level of absolute socioeconomic inequality in overweight (SII), whereas having very different relative inequality (RII).

Macroeconomic factors and country prevalence of overweight

Country-level analyses in Table 3 show that when including all 33 countries with GNI and Gini information, GNI was positively associated with overweight prevalence especially among girls ($R^2_{boys}=10.0; R^2_{girls}=27.6$). However, in analyses stratified by economic level of the country, GNI was only associated with overweight in middle-income countries.

In analyses of all countries together, the Gini coefficient was not associated with prevalence of overweight. However, in analyses stratified by average country income, stronger associations between economic inequality and prevalence of overweight were observed, but in opposite directions. In high-income countries, higher economic inequality was associated with higher prevalence of overweight ($R^2_{boys}=28.8; R^2_{girls}=30.3$), whereas in middle-income countries, those with a high Gini coefficient had a lower prevalence of adolescent overweight ($R^2_{boys}=43.6; R^2_{girls}=49.2$).

Macroeconomic factors and absolute social inequality in overweight

Country-level prevalence of overweight explained some of the absolute social inequality (SII) in overweight, especially for girls ($R^2 = 27.3$) (Table 4). In addition, economic level of

the country (GNI) was significantly positively associated with absolute socioeconomic inequality in overweight (SII) for both sexes (R^2_{boys}=32.7;R^2_{girls}=22.7). When stratified by average income, country-level factors explained between 18.2 and 35.6% of the variance in SII taken together, although all associations between macroeconomic factors and absolute socioeconomic difference in overweight became statistically insignificant. As was the case for prevalence levels, economic inequality at the country level had opposite associations with inequality in overweight in high- and middle-income countries. Although higher Gini was associated with higher levels of social inequality in overweight in high-income countries, the opposite was true in middle-income countries, especially for girls.

Macroeconomic factors and relative social inequality in overweight

For relative inequality (RII) in overweight, results were quite similar to those of absolute inequality (Table 5), although generally less variance in relative inequality was explained by macroeconomic factors, especially for girls.

Discussion

Prevalence of overweight

The large international differences in prevalence of overweight, ranging from 3.5% among Lithuanian girls to 31.7% among boys from Malta have been reported earlier.[28] These results confirm findings from the 1990's based on measured heights and weights from adolescents aged 14–17 years, from 21 European countries, wherein prevalence of overweight ranged from 8% in Slovenia to 23% in Greece, with a higher prevalence among countries from south-western Europe.[29]

Macroeconomic factors and prevalence of overweight

We found the economic level of the country to be associated with the country-level variation in prevalence of adolescent overweight when considering all countries together. However, in analyses stratified into high- and middle-income economies, economic level was not associated with overweight in high-income countries, and insignificantly associated with adolescent overweight prevalence in middle-income countries. These results are consistent with the findings of Pickett *et al.*,[20] in which obesity among adults was unrelated to average country-level income in 21 high-income countries. In addition, a Danish study found that prevalence of overweight and obesity rose in phases, when studying measurements on all children from the Copenhagen area born between 1930 and 1983,[30] and these phases were not paralleled by trends in economic growth. The results from middle-income countries are in line with the finding by Monteiro *et al.*[21] that obesity prevalence increased with level of gross national product per capita in women from 37 middle- and low-income economies.

What has not been shown before is that economic inequality in the countries, as measured by Gini coefficient, was not related to prevalence of adolescent overweight, when considering all countries together. However, analyses stratified by macroeconomic level showed that economic inequality of the country was important in explaining the level of overweight among adolescents, but with opposite gradients in high- vs middle-income economies. Although larger socioeconomic differences were strongly associated with higher prevalence of overweight in high-income economies, the opposite was the case in middle-income economies. This is consistent with findings by Pickett *et al.*[20] of a positive relationship between income inequality and prevalence of obesity among adults in 21 developed countries.

Social inequality in overweight within countries

In most countries, there were socioeconomic inequalities in adolescent overweight, with absolute inequalities (SII) over 5% in 17 of 35 countries for girls and in 20 of 35 countries for boys. The size of social inequalities in overweight varied, with the United States and Germany showing the largest absolute as well as relative socioeconomic differences, and Wales, England and Russia showing the smallest socioeconomic inequality, but with social gradients in different directions.

Our results are not directly comparable with the literature in this field, as no other studies have used RII or SII and family affluence to describe the socioeconomic differences in overweight among adolescents across countries. Wang[19] used income tertiles in his description of socio-economic differences in prevalence of overweight among children from China, Russia and the United States. The study reported odds ratios between 1.2 and 1.5, when comparing overweight prevalence among children from the lowest/highest family income tertiles with children from middle-income families.

Macroeconomic factors and social inequality in overweight

We found inverse social gradients in overweight in almost all high-income countries, consistent with findings from several national and one international study.[18,19,31,32] The unexpected lack of inequality in adolescent overweight in England observed in this study, may be because of a large number of English students with missing information on BMI (41%). For middle-income countries, social gradients in adolescent overweight shifted. In 4 of 10 middle-income countries, we found negative associations between family affluence and overweight for both sexes, as seen in high-income economies. In three middle-income economies, we found positive associations between family affluence and overweight in both sexes, and in the three middle-income countries with the lowest average income, there was a negative association between family affluence and overweight for girls, whereas a positive association was seen for boys. Some studies in Western countries have shown inverse gradients for boys and girls, but no other studies have had data from nationally representative populations.[18] The inverse gradients for boys and girls seen in three Central European countries, may reflect more interest in westernized lifestyles, such as dieting and physical activity among girls from affluent families in these countries.

In a study of inequality in obesity among adult women in 37 middle- and low-income countries, belonging to a lower socio-economic group was found to confer strong protection against obesity in low-income economies, but was a systematic risk factor for obesity in upper-middle income developing economies.[21] This study also found that the economic development of the country influenced the direction of the association between socioeconomic factors and obesity, such that the gradient shifted at a value of about US $2500 per capita.

In this study, the three countries with positive gradients between family affluence and overweight had GNIs below US$5000 per capita, and all 25 high- and middle-income countries with negative gradients had GNIs above US$5000. However, Russia and Ukraine, two of the three most deprived countries in our study with GNI's of US$2140 and US$770, respectively, also had a negative gradient between family affluence and adolescent overweight.

Although we found absolute inequalities in overweight at the country level to be partly attributed to economic level of the country across 33 countries with wide economic variation, this does not fully explain the different direction of gradients among European middle-income countries. In stratified analyses of the 23 high-income and 10 middle-income countries with less economic variation, economic level of the country explained little of the

social inequality. Economic inequality as measured by Gini coefficient was more important in explaining both level of and inequality in overweight among adolescents.

It is important to acknowledge the social patterning of overweight, which in most countries, and presumably in a growing number of countries, leaves low social class children at higher risk of the long-term effects on health. Therefore, less affluent families will be exposed to more health problems, which will over time increase the existing gap between rich and poor, especially in countries without welfare benefits.

When studying health issues that show large variation internationally and over time, it is important to consider macro-level influences, as this approach may yield useful information not apparent from studies of individual-level factors.[33] The childhood obesity epidemic can primarily be attributed to environmental factors[34] and our analyses show that in high-income countries, large economic inequality is associated with higher prevalence of adolescent overweight. Pickett *et al.*[20] also found income inequality to be positively related to the prevalence of obesity among adult populations from 21 developed countries, and argued that the psychosocial effects of social position or relative income may contribute to behavioral or physiological processes leading to obesity. Our results do not support this argument as the gradient in the association between socioeconomic inequality (Gini) and overweight shifts from a negative to a positive association across countries. For the argument by Pickett *et al.*[20] to be valid in explaining our results, it would require that this mechanism did not occur until a threshold value of country affluence was reached.

Other mechanisms may play a role in explaining differences between countries as well as individuals. Drewnowski and Specter[35] have suggested the 'low economic cost of becoming obese' as a major factor influencing obesity patterns. They have shown that in the United States, cost per energy unit is much lower for food like butter, sugar and meat than for fish, whole grain products and vegetables. They suggest that low-income consumers and food insecure families will select more energy-dense foods to offer the most dietary energy at the lowest cost. As globalization spreads westernized way of living into less affluent countries, mechanisms like the ones pointed out by Drewnowksi and Specter[35] are likely to reverse social gradients in overweight and obesity in these countries as well. Women may be more susceptible to these new global behavioral patterns,[16] which may explain why inequality patterns in overweight are changing to Western gradients in girls, but not yet in boys in countries like Poland and Lithuania. Whether the reverse social gradients in overweight in Croatia and Hungary can be attributed to difference in costs for low-energy-dense foods, or to other environmental factors like access to televisions and computers in private homes, are important future research questions. In addition, as suggested by Keith *et al.*[36], factors other than physical activity and eating patterns may be contributing to the obesity epidemic. The distribution and socioeconomic pattern of some of these risk factors (for example, time spent awake, average home temperature, age patterns of the population giving birth) are likely to be socially patterned and may be part of the mechanism behind socioeconomic patterning in overweight at both individual and country level.

Limitations

As is the case among adults, adolescents overestimate their height and underreport their weight, generating an underestimate of the prevalence of overweight and obesity.[37,38] Whether the misclassification varies with socioeconomic position has not been widely studied, but the two studies we have found show misclassification to be larger among adolescents from a low social-class background,[39,40] which should in turn mean that associations in our study are underestimated. There is also the question of whether underestimation varies by country, which cannot be resolved in these analyses. Using BMI

has weaknesses,[41] but it is currently the best available measure for large representative international surveys, such as the HBSC.

The FAS is a reliable measure among adolescents and concurs with parental reports.[42] It has shown to be sensitive in differentiating levels of affluence, when validated against other socioeconomic measures. Nevertheless, it is constructed by items that are sensitive to the cultural and structural surroundings, and studies are currently ongoing to further disentangle and address this weakness of the measure.[25]

Studies show that inequality in obesity decreases with increasing prevalence of obesity,[43] perhaps simply because of the mathematical relationship between higher prevalence and lower relative and absolute social differences. However, our study indicates that prevalence and level of inequality in adolescent overweight are not associated internationally. Although the economic level of the country may explain part of the inequality in overweight when studying groups of countries with large economic variation, this is not the case when analyses are restricted to high-income Western countries.

High and rising prevalence of obesity among children is a key issue of concern. Findings from this study indicate that the economic inequality of each country is a relevant factor, which may mirror important within-country societal mechanisms influencing adolescent overweight.

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References

1. Lobstein T, Baur L, Uauy R. Obesity in children and young people: a crisis in public health. Obes Rev. 2004; 5:4–85. [PubMed: 15096099]
2. Strauss RS, Pollack HA. Epidemic increase in childhood overweight, 1986–1998. JAMA. 2001; 286:2845–2848. [PubMed: 11735760]
3. Wang Y, Monteiro C, Popkin BM. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China and Russia. Am J Clin Nutr. 2002; 75:971–977. [PubMed: 12036801]
4. Swallen KC, Reither EN, Haas SA, Meier AM. Overweight, obesity, and health-related quality of life among adolescents: the national longitudinal study of adolescent health. Pediatrics. 2005; 115:340–347. [PubMed: 15687442]
5. Strauss RS. Childhood obesity and self esteem. Pediatrics. 2000; 105:e15. [PubMed: 10617752]
6. Puhl R, Brownell KD. Bias, discrimination, and obesity. Obes Res. 2001; 9:788–805. [PubMed: 11743063]
7. Okasha M, McCarron P, McEwen J, Davey-Smith G. Determinants of adolescent blood pressure: findings from the Glasgow University student cohort. J Hum Hypertens. 2000; 14:117–124. [PubMed: 10723118]
8. Goodman E, Dolan LM, Morrison JA, Daniels SR. Factor analysis of clustered cardiovascular risks in adolescence: obesity is the predominant correlate of risk among youth. Circulation. 2005; 111:1970–1977. [PubMed: 15837951]
9. Kaufman FR. Type 2 diabetes mellitus in children and youth: a new epidemic. J Pediatr Endocrinol Metab. 2002; 15:737–744. [PubMed: 12092688]

10. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med. 1997; 337:869–873. [PubMed: 9302300]
11. Eriksson J, Forsen T, Osmond C, Barker D. Obesity from cradle to grave. Int J Obes Relat Metab Disord. 2003; 27:722–727. [PubMed: 12833117]
12. Must A, Jacques PF, Dallal GE, Bajema CJ, Dietz WH. Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 1922 to 1935. N Engl J Med. 1992; 327:1350–1355. [PubMed: 1406836]
13. Gortmaker SL, Must A, Perrin JM, Sobol AM, Dietz WH. Social and economic consequences of overweight in adolescence and young adulthood. N Engl J Med. 1993; 329:1008–1012. [PubMed: 8366901]
14. Power C, Lake JK, Cole TJ. Measurement and long-term health risks of child and adolescent fatness. Int J Obes Relat Metab Disord. 1997; 21:507–526. [PubMed: 9226480]
15. Parson TJ, Power C, Logan S, Summerbell CD. Childhood predictors of adult obesity: a systematic review. Int J Obes Relat Metab Disord. 1999; 23:S1–S107.
16. Power C, Graham H, Due P, Hallqvist J, Joung I, Kuh D, et al. The contribution of childhood and adult socioeconomic position to adult obesity and smoking behaviour: an international comparison. Int J Epidemiol. 2005; 34:335–344. [PubMed: 15659473]
17. Sobal J, Stunkard AJ. Socioeconomic status and obesity: a review of the literature. Psychol Bull. 1989; 105:260–275. [PubMed: 2648443]
18. Shrewsbury V, Wardle J. Socioeconomic status and adiposity in childhood: a systematic review of the literature 1990 to 2005. Obesity. 2008; 16:275–284. [PubMed: 18239633]
19. Wang Y. Cross-national comparison of childhood obesity: the epidemic and the relationship between obesity and socioeconomic status. Int J Epidemiol. 2001; 30:1129–1136. [PubMed: 11689534]
20. Pickett KE, Kelly S, Brunner E, Lobstein T, Wilkinson RG. Wider income gaps, wider waistbands? En ecological study of obesity and income inequality. J Epidemiol Community Health. 2005; 59:670–674. [PubMed: 16020644]
21. Monteiro CA, Conde WL, Lu B, Popkin BM. Obesity and inequities in health in the developing world. Int J Obes. 2004; 28:1181–1186.
22. Currie, C.; Roberts, C.; Morgan, A.; Smith, R.; Settertobulte, W.; Samdal, O., et al. Young People's Health in Context. Health Behaviour in School-Aged Children (HBSC) Study: International Report from the 2001/2002 Survey. WHO: Copenhagen; 2004.
23. Roberts C, Currie C, Samdal O, Currie D, Smith R, Maes L. Measuring the health and health behaviours among adolescents through cross-national survey research: recent developments in the Health Behaviour in School-aged Children (HBSC) study. J Public Health. 2007; 15:179–186.
24. Cole TJ, Bellizi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. Br Med J. 2000; 320:1240–1243. [PubMed: 10797032]
25. Currie C, Molcho M, Boyce W, Holstein BE, Thorsheim T, Richter M. Researching health inequalities in adolescence: the development of the HBSC family affluence scale. Soc Sci Med. 2008; 66:1429–1436. [PubMed: 18179852]
26. Pamuk ER. Social class inequality in mortality from 1921 to 1972 in England and Wales. Population Stud. 1985; 39:17–31.
27. Mackenbach JP, Kunst AE. Measuring the magnitude of socioeconomic inequalities in health: an overview of available measures illustrated with two examples from Europe. Soc Sci Med. 1997; 44:757–771. [PubMed: 9080560]
28. Janssen I, Katzmarzyk PT, Boyce WF, Vereecken C, Mulvihill C, Roberts C, et al. The Health Behaviour in School-Aged Children Obesity Working Group. Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. Obes Rev. 2005; 6:123–132. [PubMed: 15836463]
29. Lobstein T, Frelut ML. Prevalence of overweight among children in Europe. Obes Rev. 2003; 4:195–200. [PubMed: 14649370]
30. Bua J, Olsen LW, Sørensen TI. Secular trends in childhood obesity in Denmark during 50 years in relation to economic growth. Obesity. 2007; 15:977–985. [PubMed: 17426333]

31. Popkin BM, Gordon-Larsen P. The nutrition transition: world-wide obesity dynamics and their determinants. Int J Obes. 2004; 28:S2–S9.
32. Wang Y, Beydoun MA. The obesity epidemic in the United States—sex, age, socioeconomic, racial/ethnic, and geographical characteristics: a systematic review and meta-regression analysis. Epidemiol Rev. 2007; 29:6–28. [PubMed: 17510091]
33. Rose G. Sick individuals and sick populations. Int J Epidemiol. 2001; 30:427–432. [PubMed: 11416056]
34. Ebbeling CB, Rawlak DB, Ludwig DS. Childhood obesity: public health crisis, common sense cure. Lancet. 2002; 360:473–482. [PubMed: 12241736]
35. Drewnowski A, Specter SE. Poverty and obesity: the role of energy density and energy costs. Am J Clin Nutr. 2004; 79:6–16. [PubMed: 14684391]
36. Keith SW, Redden DT, Katzmarzyk PT, Boggiano MM, Hanlon EC, Benca RM, et al. Putative contributors to the secular increase in obesity: exploring the roads less traveled. Int J Obes. 2006; 30:1585–1594.
37. Goodman E, Hinden BR, Khandelwal S. Accuracy of teen and parental reports of obesity and body mass index. Pediatrics. 2000; 106:52–58. [PubMed: 10878149]
38. Elgar FJ, Roberts C, Tudor-Smith C, Moore L. Validity of self-reported height and weight and predictors of bias in adolescents. J Adolesc Health. 2005; 37:371–375. [PubMed: 16227121]
39. Himes JH, Hannan P, Wall M, Neumark-Sztainer D. Factors associated with errors in self-reports of stature, weight, and body mass index in Minnesota adolescents. Ann Epidemiol. 2005; 15:272–278. [PubMed: 15780774]
40. Jansen W, van de Looij-Jansen PM, Ferreira I, de Wilde EJ, Brug J. Differences in measured and self-reported height and weight in Dutch adolescents. Ann Nutr Metab. 2006; 50:339–346. [PubMed: 16809901]
41. Taylor RW, Jones IE, Williams SM, Goulding A. Evaluation of waist circumference, waist-to-hip ratio, and the conicity index as screening tools for high trunk fat mass, as measured by dual-energy X-ray absorptiometry, in children aged 3–19 years. Am J Clin Nutr. 2000; 72:490–495. [PubMed: 10919946]
42. Andersen A, Krolner R, Currie C, Dallago L, Due P, Richter M, et al. High agreement on family affluence between children's and parents' reports: international study of 11-year-olds. J Epidemiol Community Health. 2008; 62:1092–1094. [PubMed: 18413436]
43. Zhang Q, Wang Y. Using concentration index to study changes in socio-economic inequality of overweight among US adolescents between 1971 and 2002. Int J Epidemiol. 2007; 36:916–925. [PubMed: 17470489]

Appendix

Members of the HBSC Obesity Writing Group: A Borraccino, Department of Public Health and Microbiology, University of Turin, Turin, Italy; I Borup, Nordic School of Public Health, Göteborg, Sweden; W Boyce, Social Program Evaluation Group, Queens University, Kingston, Ontario, Canada; F Elgar, Department of Psychology, Carleton University, Ottawa, Ontario, Canada; SN Gabhainn, Department of Health Promotion, National University of Ireland, Galway, Ireland; R Krølner and C Svastisalee, Department of Social Medicine, Institute of Public Health, University of Copenhagen, Copenhagen, Denmark, MC Matos, Faculdade de Mortricidade Humana, Universidade Tecnica de Lisboa, Lisbon, Portugal; T Nansel, National Institute of Child Health and Human Development, Bethesda, MD, USA; H Al Sabbah and C Vereecken, Department of Public Health, Faculty of Medicine and Health Science, Ghent University, Ghent, Belgium; R Valimaa, Department of Health Sciences, University of Jyväskylä, Jyväskylä, Finland.

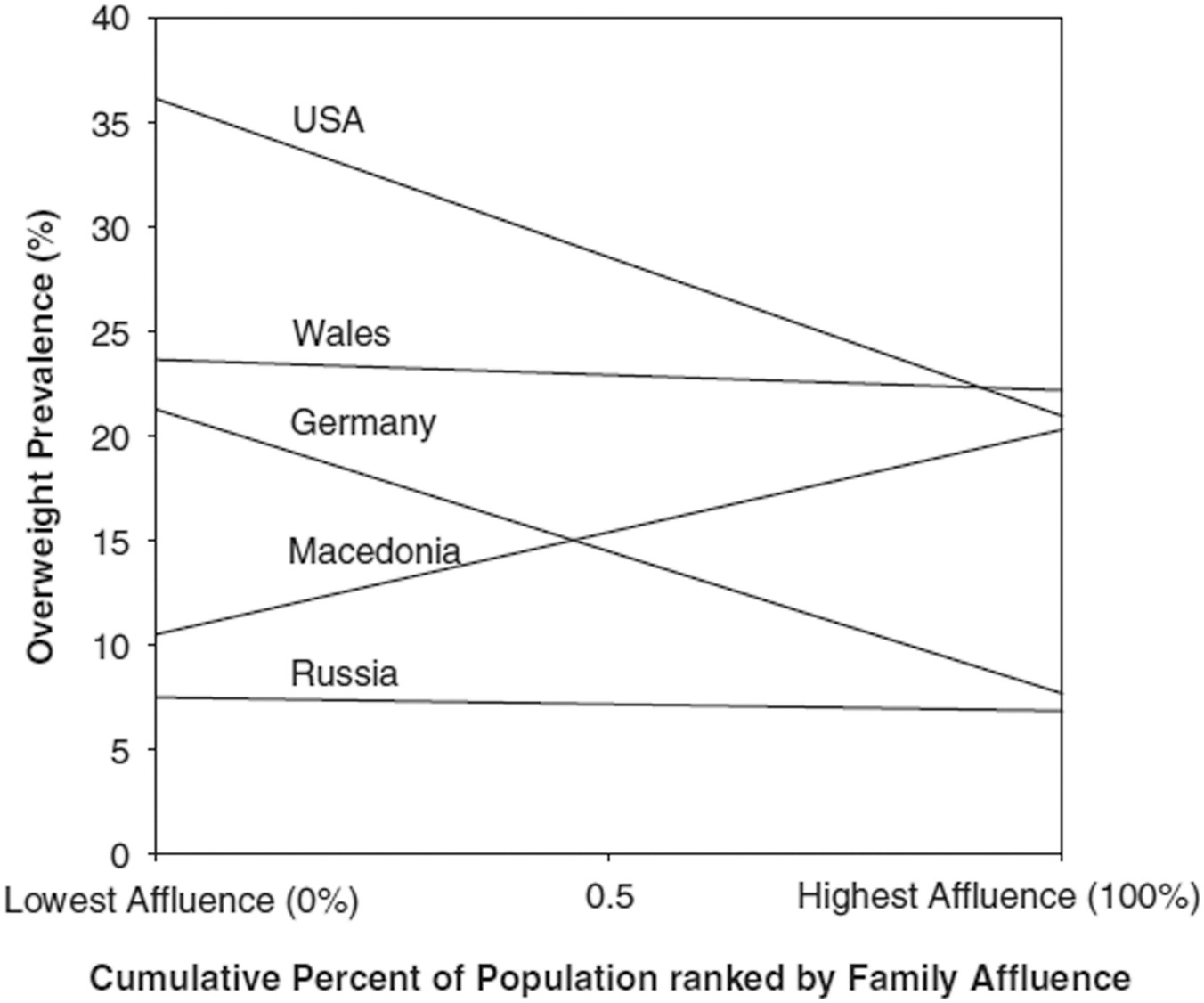

Figure 1.
Example of overweight inequality regression lines for 11-, 13- and 15-year-old boys from the Health Behavior in School-aged Children study.

Table 1

Study populations, GNI, Gini, distribution of family affluence in three categories (%) and age-standardized prevalence of overweight and obesity among 11, 13 and 15-year olds (%)

Country (Principal investigator)	No of pupils	No of schools	GNI[a]	Gini[b] (year of survey)	Family affluence			Overweight[c] (98% CI)		Obesity[c]	
					Low (0–3)	Medium (4–5)	High (6–7)	Boys	Girls	Boys	Girls
Austria (W Dür)	4472	204	23 390[I]	30.5 (95)	16.8	48.2	35.0	13.3 (11.9–14.7)	10.4 (9.1–11.7)	2.2	1.4
Belgium VLG (L Maes)	6289	162	23 250[I]	25.0 (96)	16.9	46.8	36.4	11.0 (9.8–12.1)	8.6 (7.7–9.6)	1.5	1.5
Belgium Val/Bru (D Piette)	4323	181	23 250[I]	25.0 (96)	23.0	42.6	34.4	12.0 (10.6.13.4)	10.3 (9.0–11.5)	1.5	1.7
Canada (W Boyce, A King)	4361	179	22 300[I]	31.5 (97)	10.7	39.1	50.2	22.8 (20.9–24.6)	14.7 (13.3–16.1)	4.4	3.5
Croatia (M Kuzman)	4397	131	4640[II]	29.0 (01)	43.5	42.9	13.6	15.3 (13.8–16.9)	7.8 (6.7–8.9)	2.2	1.2
Czech Republic (L Csèmy)	5012	80	5560[II]	25.4 (96)	40.2	48.4	11.4	11.9 (10.6–13.2)	6.1 (5.2–7.0)	1.5	0.5
Denmark (P Due, B Holstein)	4672	68	30 290[I]	24.7 (97)	13.5	47.2	39.3	11.7 (10.4–13.0)	9.7 (8.6–10.9)	1.5	0.8
England (A Morgan, M Hickman)	6081	80	25 250[I]	36.0 (95)	15.2	46.6	38.3	20.6 (19.9–22.0)	15.7 (14.4–17.0)	6.0	4.2
Estonia (M Maser)	3979	60	4130[II]	37.6 (98)	40.1	45.5	14.4	9.1 (7.8–10.3)	4.7 (3.8–5.6)	1.4	0.5
Finland (J Tynjälä, L Kannas)	5388	277	23 510[I]	25.6 (95)	17.8	48.2	34.1	16.1 (14.7–17.5)	10.8 (9.7–12.2)	3.1	1.6
France (E Godeau, C Dressen)	8185	554	22 010[I]	32.7 (95)	16.1	42.0	42.0	12.4 (11.4–13.4)	9.2 (8.3–10.1)	1.6	1.4
Germany (K Hurrelman)	5650	121	22 670[I]	38.2 (98)	16.4	44.4	39.2	13.9 (12.6–15.2)	7.8 (6.8–8.8)	2.1	1.0
Greece (A Kokkevi)	3807	411	11 660[I]	35.5 (98)	28.7	48.5	22.8	21.0 (19.2–22.9)	11.0 (9.6–12.4)	2.8	1.4
Greenland (M Pedersen)	891	32	—	—	54.7	36.0	9.3	19.0 (15.1–22.9)	17.7 (14.4–21.0)	1.7	1.3
Hungary (A Aszmann)	4164	120	5280[II]	24.4 (98)	38.7	42.4	18.8	15.4 (13.8–17.1)	10.0 (8.7–11.2)	2.9	1.6
Israel (Y Harel)	5661	139	16 710[I,d]	35.5 (97)	27.5	41.2	31.4	12.9 (11.6–14.2)	8.0 (7.1–9.0)	2.4	1.1
Italy (F Cavallo)	4386	265	18 960[I]	36.0 (98)	26.0	47.4	26.7	22.0 (20.2–23.7)	11.1 (9.8–12.4)	3.3	1.3
Latvia (I Ranka)	3481	122	3480[II]	32.4 (98)	55.9	34.3	9.8	6.7 (5.5–8.0)	4.3 (3.4–5.2)	0.5	0.5
Lithuania (A Zaborskis)	5645	33	3660[II]	36.3 (00)	53.1	37.8	8.2	5.7 (4.9–6.6)	3.5 (2.8–4.2)	0.5	0.2
Macedonia (LK Unkovska)	4161	98	1700[II]	28.2 (98)	42.7	44.1	13.3	15.8 (14.3–17.4)	8.7 (7.5–9.9)	3.0	1.7
Malta (M Massa)	1980	38	9200[I,d]	—	43.1	45.1	11.8	31.7 (28.7–34.8)	18.9 (16.6–21.2)	10.2	5.0
The Netherlands (W Vollebergh)	4268	136	23 960[I]	32.6 (94)	9.0	45.2	45.8	7.9 (6.8–9.1)	6.5 (5.5–7.6)	0.9	0.6
Norway (O Samdal, B Wold)	5023	165	37 850[I]	25.8 (95)	5.8	36.7	57.5	14.1 (12.7–15.4)	9.3 (8.1–10.4)	3.1	1.1
Poland (B Woynarowska)	6383	274	4570[II]	31.6 (98)	43.1	43.6	13.3	10.4 (9.4–11.5)	5.3 (4.5–6.1)	1.1	0.8

Country (Principal investigator)	No of pupils	No of schools	GNI[a]	Gini[b] (year of survey)	Family affluence			Overweight[c] (98% CI)		Obesity[c]	
					Low (0–3)	Medium (4–5)	High (6–7)	Boys	Girls	Boys	Girls
Portugal (MG de Matos)	2940	122	10 840[I]	38.5 (97)	28.9	46.1	25.0	19.7 (17.7–21.8)	14.5 (12.8–16.3)	3.8	1.9
Rep. of Ireland (SN Gabhain)	2875	93	23 870[I]	35.9 (87)	20.7	48.3	31.0	15.0 (13.1–16.9)	11.3 (9.8–12.9)	2.9	1.8
Russian Federation (A Komkov)	8037	149	2140[II]	45.6 (00)	58.3	34.7	7.0	7.1 (6.3–7.9)	3.8 (3.3–4.4)	0.8	0.3
Scotland (C Currie)	4404	194	25 250[I]	36.0 (95)	20.2	45.5	34.4	16.7 (15.1–18.2)	13.3 (11.9–14.8)	3.0	2.7
Slovenia (E Stergar)	3956	194	9810[I]	28.4 (98)	20.5	48.1	31.4	17.4 (15.7–19.0)	10.3 (9.0–11.7)	2.6	0.9
Spain (R Mendoza, Md C Moreno)	5827	217	14 430[I]	32.5 (90)	22.4	47.9	29.7	22.7 (21.2–24.2)	13.0 (11.8–14.2)	3.1	1.7
Sweden (U Marklund)	3926	102	24 820[I]	25.0 (95)	9.3	41.1	49.6	12.3 (10.9–13.8)	7.9 (6.7–9.1)	1.5	1.1
Switzerland (BJ Jacquat, H Schmidt)	4679	429	37 930[I]	33.1 (92)	13.1	46.0	40.8	9.7 (8.5–11.0)	6.8 (5.8–7.8)	1.3	1.0
Ukraine (O Balakireva)	4090	277	770[II]	29.0 (99)	73.0	23.6	3.4	6.9 (5.7–8.0)	4.4 (3.5–5.2)	0.7	0.4
USA (M Overpeck, P Scheidt)	5025	233	35 060[I]	40.8 (97)	13.1	36.7	50.2	28.6 (26.7–30.4)	20.1 (18.6–21.7)	8.4	5.2
Wales (C Roberts, C Tudor-Smith)	3887	61	25 250[I]	36.0 (95)	14.4	46.5	39.2	22.6 (20.8–24.4)	17.1 (15.4–18.8)	5.7	2.8
Entire study (C Currie)	162 305	5998			27.6	43.1	29.3	14.3	9.3	2.5	1.4

[a] GNI from 2002: www.worldbank.org, World Development Indicators Database, World Bank 2003. Classification according to the database, countries marked with [I] classified as high-income economies, and [II] as middle-income economies. (not available for Greenland).

[b] GINI from UNDP Human Development Report 2003 (not available for Greenland and Malta).

[c] Overweight and obesity according to the age- and sex-specific cut points from Cole *et al.*[24]

[d] 2002 data not available. Ranking from UNDP is approximate. The same GNI and GINI coefficients have been used for the two Belgian areas and the numbers for The United Kingdom have been assigned to the three countries: England, Scotland and Wales.

Table 2

Age-standardized overweight prevalence, relative index of inequality, overweight prevalence difference and slope index of inequality for adolescent (a) boys and (b) girls by country, ranked by mean country prevalence of overweight.

Country	Mean prevalence of overweight	RII[a]	Prevalence difference[b]	SII[c]
(a) *Boys*				
Malta	31.7	1.39	1.5	10.8
USA	28.6	1.73	11.5	15.2
Canada	22.8	1.27	4.1	5.4
Spain	22.7	1.80	10.6	13.3
Wales	22.6	1.07	−0.7	1.5
Italy	22.0	1.39	5.7	7.4
Greece	21.0	1.08	0.8	1.6
England	20.6	1.15	2.8	2.9
Portugal	19.7	1.30	2.5	5.1
Greenland	19.0	1.35	8.5	5.7
Slovenia	17.4	1.12	0.6	1.9
Scotland	16.7	1.74	7.5	9.3
Finland	16.1	0.91	−0.9	−1.5
Macedonia	15.8	0.52	−7.7	−9.8
Hungary	15.4	1.63	4.5	7.6
Croatia	15.3	0.89	−2.3	−1.8
Rep. of Ireland	15.0	3.38	13.0	17.6
Norway	14.1	1.52	3.1	5.9
Germany	13.9	2.78	8.2	13.6
Austria	13.3	1.49	3.1	5.5
Israel	12.9	2.05	7.2	9.2
France	12.4	1.92	5.9	7.9
Sweden	12.3	2.22	7.4	9.3
Belgium Val/Bru (Valonia)	12.0	2.25	8.2	9.4
Czech Republic	11.9	1.51	3.4	4.9
Denmark	11.7	1.10	3.5	1.1
Belgium VLG (Flandern)	11.0	2.39	4.6	9.1
Poland	10.4	0.63	−3.4	−4.7
Switzerland	9.7	2.80	6.7	9.4
Estonia	9.1	0.51	−3.8	−5.6
The Netherlands	7.9	1.36	3.6	2.5
Russian Federation	7.1	1.10	−1.2	0.7
Ukraine	6.9	1.54	1.8	2.8
Latvia	6.7	0.71	−1.2	−2.3
Lithuania	5.7	0.92	−0.2	−0.5
(b) *Girls*				

Country	Mean prevalence of overweight	RII[a]	Prevalence difference[b]	SII[c]
USA	20.1	2.17	10.2	15.3
Malta	18.9	1.12	1.8	2.1
Greenland	17.7	0.63	−10.2	−7.7
Wales	17.1	1.12	0.2	1.9
England	15.7	1.28	4.7	3.8
Canada	14.7	2.11	10.7	10.4
Portugal	14.5	1.69	4.8	7.3
Scotland	13.3	1.43	4.6	4.7
Spain	13.0	2.05	6.7	8.8
Rep. of Ireland	11.3	1.34	1.8	3.3
Italy	11.1	3.38	8.4	12.1
Greece	11.0	1.38	3.1	3.5
Finland	10.8	1.08	1.3	0.8
Austria	10.4	1.49	2.9	4.0
Belgium Val/Bru (Valonia)	10.3	2.23	5.5	7.8
Slovenia	10.3	1.73	3.6	5.4
Hungary	10.0	1.95	5.7	6.3
Denmark	9.7	1.90	4.7	5.8
Norway	9.3	2.76	9.6	8.7
France	9.2	1.97	5.1	6.0
Macedonia	8.7	1.06	−3.2	0.5
Belgium VLG (Flandern)	8.6	2.06	3.7	5.9
Israel	8.0	2.18	2.9	5.9
Sweden	7.9	0.92	2.8	−0.7
Croatia	7.8	0.88	4.6	−1.0
Germany	7.8	4.29	7.5	9.5
Switzerland	6.8	2.66	−0.9	6.0
The Netherlands	6.5	1.89	6.5	4.0
Czech Republic	6.1	4.80	5.8	7.8
Poland	5.3	1.45	2.4	1.9
Estonia	4.7	0.94	1.2	−0.3
Ukraine	4.4	1.83	−18.6	2.6
Latvia	4.3	0.88	−0.1	−0.6
Russian Federation	3.8	1.26	0.2	0.9
Lithuania	3.5	1.71	2.4	1.8

[a] RII, relative index of inequality.

[b] Prevalence difference: prevalence of overweight in FAS groups 0–3-prevalence of overweight in FAS groups 6–7.

[c] SII, slope index of inequality.

Table 3

Estimates, standard error and R-square of the association between GNI, Gini, and overall prevalence of overweight, among adolescents in all 33 countries, and stratified into 23 high-income and 10 low-income countries[a]

Country prevalence of overweight	All 33 countries				23 high-income countries[a]				10 middle-income countries[a]			
	Crude	R^2	Adjusted[b]	R^2	Crude	R^2	Adjusted[b]	R^2	Crude	R^2	Adjusted[b]	R^2
Boys												
GNI												
Est	0.0017		0.0017		−0.0014		−0.0009		0.0090		0.0042	
s.e.	0.0009	10.8	0.0008		0.0015	4.2	0.0020		0.0082	13.0	0.0075	
Gini												
Est	0.0019		0.0021		0.0056		0.0054		−0.0040		−0.0036	
s.e.	0.0018	3.4	0.0017	15.0	0.0019	28.8	0.0013	30.3	0.0017	41.1	0.0019	43.6
Girls												
GNI												
Est	0.0019		0.0019		0.0000		0.0003		0.0044		0.0014	
s.e.	0.0005	27.6	0.0005		0.0010	0.0	0.0009		0.0047	10.1	0.0040	
Gini												
Est	0.0011		0.0014		0.0033		0.0034		−0.0024		−0.0023	
s.e.	0.0013	2.4	0.0011	31.1	0.0013	23.6	0.0013	24.2	0.0009	48.3	0.0010	49.2

Abbreviations: Est, estimates; s.e., standard error.

[a] As classified according to the World Development Indicators Database, World Bank 2003, www.worldbank.org.

[b] GNI and Gini mutually adjusted.

Table 4

Estimates, standard error and R-square of the association between GNI, Gini, and absolute socioeconomic inequality (SII) in overweight among adolescents in all 33 countries, and stratified into 23 high-income and 10 low-income countries[a]

Slope index of inequality	All 33 countries				23 high-income countries[a]				10 middle-income countries[a]			
	Crude	R^2	Adjusted[b]	R^2	Crude	R^2	Adjusted[b]	R^2	Crude	R^2	Adjusted[b]	R^2
Boys												
GNI												
Est	0.0032		0.0030		0.0012		0.0014		0.0100		0.0105	
s.e.	0.0008	32.7	0.0009		0.0014	3.1	0.0014		0.0109	9.4	0.0124	
Gini												
Est	0.0013		0.0015		0.0033		0.0044		−0.0022		−0.0037	
s.e.	0.0020	1.3	0.0017		0.0020	11.5	0.0024		0.0028	7.2	0.0038	
Country prevalence: overweight for boys												
Est	0.3510		0.1276		0.0498		−0.1353		−0.0758		−0.6139	
s.e.	0.1888	10.0	0.1785	36.1	0.2049	0.3	0.2337	18.2	0.4589	0.3	0.6116	25.1
Girls												
GNI												
Est	0.0017		0.0010		0.0006		0.0009		0.0077		0.0054	
s.e.	0.0006	22.7	0.0006		0.0011	1.8	0.0010		0.0060	17.3	0.0065	
Gini												
Est	0.0006		0.0004		0.0025		0.0021		−0.0024		−0.0025	
s.e.	0.0013	0.8	0.0011		0.0015	12.2	0.0017		0.0014	27.4	0.0021	
Country prevalence: overweight for girls												
Est	0.5138		0.3566		0.3370		0.1875		0.3985		−0.2289	
s.e.	0.1507	27.3	0.1800	33.2	0.2194	10.1	0.2526	18.2	0.4475	9.0	0.6100	35.6

Abbreviations: Est, estimates; s.e., standard error; SII, slope index of inequality.

[a] As classified according to the World Development Indicators Database, World Bank 2003, www.worldbank.org.

[b] GNI and Gini mutually adjusted.

Table 5

Estimates, standard error and R-square of the association between GNI, Gini, and relative socioeconomic inequality (RII) in overweight among adolescents in all 33 countries participating in the HBSC study 2001–2002, and stratified into 23 high-income and 10 low-income countries[a]

Relative index of inequality	All 33 countries				23 high-income countries[a]				10 middle-income countries[a]			
	Crude	R^2	Adjusted[b]	R^2	Crude	R^2	Adjusted[b]	R^2	Crude	R^2	Adjusted[b]	R^2
Boys												
GNI												
Est	0.0324		0.0325		0.0212		0.0229		0.0269		−0.0075	
s.e.	0.0094	27.7	0.0096		0.0184	5.9	0.0190		0.0954	1.0	0.1005	
Gini												
Est	−0.0021		0.0023		0.109		0.0162		−0.0253		−0.0259	
s.e.	0.0228	0.0	0.0197	27.8	0.0283	0.7	0.0283	7.5	0.0220	14.1	0.0250	14.2
Girls												
GNI												
Est	0.0169		0.0166		0.0167		0.0203		0.2893		0.2100	
s.e.	0.0143	4.3	0.0145		0.0222	2.6	0.0224		0.2390	15.5	0.2549	
Gini												
Est	−0.0124		−0.0102		0.0293		0.0340		−0.0769		−0.0597	
s.e.	0.0300	0.6	0.0299	4.7	0.0329	3.6	0.0335	7.4	0.0585	17.8	0.0633	25.0

Abbreviations: Est, estimates; RII, relative index of inequality; s.e., standard error.

[a] As classified according to the World Development Indicators Database, World Bank 2003, www.worldbank.org.

[b] GNI and Gini mutually adjusted.

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