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RESEARCH REPORT

Country material distribution and adolescents' perceived health: multilevel study of adolescents in 27 countries

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Objective: To assess the impact of country material distribution on adolescents' perceptions of health.

Design: Cross sectional multilevel study.

Setting: Data were collected from the school based health behaviour in school aged children: WHO cross national study 1997/98, which includes students from 27 European and North American countries.

Participants: 12 0381 students in year 6, 8, and 10 who were attending school classes on the day of data collection.

Main result: Adolescents in countries with a high dispersion of family affluence were more likely to have self rated poor health even after controlling for individual family level of affluence and family social resources.

Conclusion: There are substantial inequalities in subjective health across European and North American countries related to the distribution of family material resources in these countries.

The potentially harmful effects of unequal income distribution on individual self rated health and mortality has been the topic of multilevel studies of adult populations,^{1–4} but such effects are largely unexplored in younger populations. In a life course perspective on health inequalities it is essential to discover if health inequalities found in adult populations are present in younger age groups, or if the effects of material distribution manifests in a qualitatively different way during childhood and adolescence.

Adolescence has been described as a period of equalisation,⁵ during which socioeconomic hierarchies have little impact on health. Although the evidence in favour of equalisation is mixed,^{6–9} studies in this area highlight the fact that social stratification during adolescence may be mediated differently than during adulthood. A key assumption in psychosocial models of income inequality¹⁰ is that persons compare their wealth with that of others in the community, and such comparison is an important source of information for them about social status and power. Unlike adults with independent personal income, social stratification during adolescence is highly dependent on the family or household economic position. Indicators of general income distribution that are based on income statistics such as the Gini coefficient of income, may be a highly relevant reference for the working age population, but may be less relevant as a marker for adolescents without such income. This calls for the development of indicators that are specifically tailored to the social circumstances in younger populations. Following the argument that the impact of material inequalities is developmentally segmented, this study highlights the distribution of material resources across families of young people.

We studied the effects of material distribution on self rated health in young people from 27 European and North American countries. Starting from a comparatively equal distribution of standard of living and access to life chances in the former communist countries, the 1990s saw a widening gap between poor and rich families.¹¹ A similar trend occurred in Organisation for Economic Cooperation and Development (OECD) countries, in which income inequality increased for most of the countries from 1985 to 1995.¹² As

measured by child poverty sensitive indicators of inequality, OECD and Central-Eastern European countries show substantial cross national differences.¹³

To overcome well known methodological problems of aggregate level analysis of income distribution,^{14–16} we adopted a multilevel design.¹⁶ The impact of material distribution on individual self rated health clearly reflects phenomena at multiple levels. Whereas self rated health is an individual level characteristic, the distribution of material resources by definition characterises a group of persons. A key advantage of multilevel modelling is that the effects of material distribution on individual health can be modelled with simultaneous adjustment for individual compositional effects.¹⁷ If relations between material distribution and individual health remain after adjustment for individual level of wealth and other covariates, there is stronger evidence that the relation reflects a truly contextual effect on individual health. The most relevant compositional effects to consider in this study are factors proximal to the family situation, including family material conditions,^{7 18} family structure,¹⁸ and the level of support resources.^{18 19}

The aim of the study was to test if youth living in a country with unequal material distribution of material resources were at increased individual risk of poor self rated health, as compared with youth living in a country with a more egalitarian distribution of material resources.

METHODS

Sample

Data were obtained from the WHO collaborative health behaviour in school aged children 1997/98 study.²⁰ The sample was obtained through a complex multistage sampling procedure. The primary sampling unit was the school class, with a self selection of students. However, because of differences in school systems across countries, national adaptations had to be made. For most countries, the desired age group coincided with age of school entry, resulting in a homogeneous age composition of school classes. In a small

Abbreviations: FAS, family affluence scale; VPC, variance partitioning coefficient

number of samples (Flemish Belgium, French Belgium, England, Republic of Ireland, Switzerland, and USA), the age composition of school classes was more heterogeneous, because of students repeating grades, and different ages of school entry. In this group of countries, a larger sample of school classes was sampled, and students matching the desired age range within these classes were selected. More detailed information about the sample and the sampling frame for each country can be obtained elsewhere.²¹ The available documentation provides detailed information on non-response at the level of school and student. The response rate at the level of school class was in general high, with most countries reporting above 80%. In the 1997–98 survey, the Czech Republic, one of the participating countries, did not include the indicators of family affluence in its survey. Thus, the available study sample for this analysis consisted of 12 0381 adolescents from 27 countries or regions in Europe and North America. Data collection in each country was done in accordance with a standardised protocol.²² Necessary ethics approval of this protocol was secured on a national basis. In some countries ethics approval of the protocol was obtained through a regional or national ethics committee. In other countries, such approval was defined as not necessary according to the national regulations and practice at the time of data collection.

Variables used in the analysis

In this study, conventional income based indicators were supplemented by an aggregate indicator of family material distribution, derived from individual scores on the family affluence scale.²³ The family affluence scale I (FAS I) is a linear composite of three items that adolescents can readily

answer: number of holidays during the past year, family car ownership, and having one's own bedroom. As a proxy for the country distribution of family material resources, we calculated the standard deviation of FAS for 27 countries, based on the simple assumption that in countries with a high standard deviation of FAS, family material resources are unevenly distributed across families.

Parental emotional support was a composite of two items: "How easy is it for you to talk to the following persons about things that really bother you?" (a) Father; (b) mother. Response options were: very easy (1), easy (2), difficult (3), and very difficult (4). Parental involvement was measured by a composite of three items: "If I have problems at school, my parents are ready to help", "My parents are willing to come to school to talk to teachers", and "My parents encourage me to do well at school". The response options were: always (1), often (2), sometimes (3), rarely (4), and never (5). Family structure was derived from responses to the items "I live with (a) mother, (b) father, (c) stepmother, (d) stepfather". Response options were yes (1) and no (2). Self rated health was measured by the single item: "How healthy do you think you are?" (very healthy (1); quite healthy (2); not very healthy (3)). Responses were dichotomised at the response option "not very healthy" (coded 1).

In collecting secondary information (Gini of income), attempts were made to collect information as close as possible to the time of data collection in 1997/98. The most important source of data was the Luxembourg income study.²⁴ For Eastern European countries that were not included in the LIS database, we used harmonised data published by Unicef.²⁵ For Portugal and Greece we used information from the World Development Indicators.²⁶ As an indicator of the average income in a country, we used data on average household income per capita from the World Development Indicators.²⁶

Table 1 Sample details and descriptive statistics, with countries grouped according to quartiles of the standard deviation of family affluence scale (FAS)

Material distribution subgroup	Number	Mean FAS (range 0–6)	SD FAS
Low inequality			
Norway	5026	4.56	1.21
Denmark	5066	3.59	1.28
Belgium–Flemish	4824	3.6	1.32
Switzerland	5520	3.95	1.32
Sweden	3802	4.05	1.33
Germany*	4792	3.82	1.34
Austria	4316	3.72	1.34
Medium low inequality			
Wales	4537	3.69	1.35
Northern Ireland	3346	3.4	1.36
Finland	4864	3.63	1.37
Canada	6567	4.07	1.38
England	6373	3.61	1.38
France*	4133	4.29	1.38
Medium high inequality			
Belgium–French	2505	3.52	1.41
USA	5169	4.26	1.41
Greece	4299	3.63	1.42
Republic of Ireland	4394	3.4	1.44
Scotland	5632	3.58	1.44
Portugal	3721	3.64	1.49
Slovak Republic	3789	3.04	1.49
High inequality			
Hungary	3609	2.83	1.52
Russia*	3997	2.43	1.57
Estonia	1897	3.29	1.59
Poland	4861	3.26	1.61
Latvia	3775	2.71	1.62
Lithuania	4513	3.21	1.66
Israel	5054	3.31	1.68
Total	120381	3.6	1.51

*Regional sample.

Statistical analyses

The multistage sampling indicates that a hierarchical three level model including separate variances for students, schools, and countries may adequately reflect the data structure. However, for five of the 27 countries, proper identification for school memberships was not available. To carry out a three level model, the samples without school identification codes would need to be excluded from the analysis. Rather than excluding valuable data from these countries, a decision was made to model a two level variance structure, including students within countries. The decision was supported by results obtained in a previous study of school level area deprivation on the same dataset, showing that as little as 3% to 6% of the random effects on self rated health were attributable to the class level.⁶ Given that the present research question focuses on the national level, omitting the random school level intercept variance should thus not result in significant loss of information.

Multilevel multivariate logistic regression analysis on poor self rated health was performed using the software GLLAMM,²⁷ which runs as a separate module in Stata (release 8.0, StataCorp, College Station, TX). Adaptive quadrature²⁸ was used for estimation, using a logit link function. To examine the scope for multilevel modelling, the magnitude of between country variation in health related outcomes was examined in a two level random intercepts model. Assuming a latent underlying continuum of health, the variance partitioning coefficient (VPC) was computed using a formula for logistic models.²⁹ In this formula, residuals are assumed to have a standard logistic variance structure at the level 1 ($\pi^2/3 = 3.29$), and a normal distributed variance structure (U_{0j}) at level 2 (that is, country). The VPC is calculated as the ratio of the random country variance to the total variance:

Table 2 Macro-level characteristics by country material distribution subgroup (n = 27)

Criterion	SD family affluence scale							
	Low quartile		Medium low quartile		Medium high quartile		High quartile	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Average household income per capita*	18.09	4.09	13.49	1.07	11.05	5.72	3.09	3.13
Gini of income	0.26	0.03	0.30	0.05	0.32	0.06	0.33	0.04
Life expectancy at birth, men (1997)	74.5	1.2	74.5	1.0	73.1	2.1	65.9	5.0
Life expectancy at birth, women (1997)	80.4	1.1	80.6	1.0	79.4	1.4	75.5	2.2

*In thousand US\$.

VPC = $U_{0j}/(U_{0j}+3.29)$. To ease interpretation, estimates on a logit scale were transformed to percentages or odds ratios.

Because of the comparatively small number of countries (n = 27), material distribution was modelled as a group variable rather than a continuous score. Four subgroups of material distribution were constructed based on the quartiles of the estimated standard deviations on the family affluence scale: (1) the low inequality group consisted of young people from Austria, Belgium Flemish, Denmark, Germany, Norway, Sweden, and Switzerland; (2) the medium low inequality group consisted of students from Canada, England, Finland, France, Northern Ireland, and Wales; (3) the medium high inequality group consisted of students from Belgium-French, Greece, Portugal, Republic of Ireland, Scotland, Slovak Republic, and USA; and (4) the high inequality group consisted of young people from Estonia, Hungary, Israel, Latvia, Lithuania, Poland, and Russia.

In the multilevel logistic regression model, simple contrasts of group membership were entered using the least disadvantaged group as the reference. To examine the impact of material distribution on individual health, two logistic random intercepts models were tested: model 1 (M1) specified the bivariate unadjusted relations between country level indicators of inequality and self rated health. Model 2 (M2) specified the relation between material distribution and self rated health country level indicators of family affluence on health outcomes, after adjusting for individual compositional effects. The adjustment was motivated by the argument that between community inequalities in health to some extent reflect non-linear effects of individual wealth.^{4 15} As the four groups were created using a newly developed indicator of material distribution, we also conducted analysis on subgroups defined by conventional indicators of income distribution and wealth. In this set of analysis simple contrast of groups defined by the quartile ranks for Gini of income and quartiles for household income were entered, again treating the least disadvantaged group as the reference for comparison.

RESULTS

Table 1 shows the participating countries sorted by standard deviations of FAS by country. The SD ranged from 1.21 to 1.68. The highest dispersion was shown in Israel (SD = 1.68), Lithuania (SD = 1.66), and in Latvia (SD = 1.62). Low standard deviations were shown in Norway (SD = 1.21), Denmark (SD = 1.28) and in Sweden (1.33).

Subgroup characteristics

Table 2 shows selected macro-level characteristics of the four subgroups. It can be seen that countries in the high quartile of SD FAS had a higher income inequality (Gini), a lower average household income, and lower life expectancy at birth for men and for women, compared to the other groups.

It can be seen from table 3 that students in countries in the high quartile of SD FAS, also had lower mean levels of family affluence, and lower level of parental emotional support.

Between country differences in adolescent self rated health

Table 4 shows the results of a random intercepts "null model". In an "average" country, 4.6% of boys and 8.2% of girls reported not being healthy. For boys and for girls, about 11% of the total variation in self rated health was at the between country level (VPC boys: $(0.40)/(0.40+3.29) = 0.11$; VPC girls: $0.39/(0.39+3.29) = 0.11$). For the population of countries the expectation would be that for 95% of the countries, the percentage of young people reporting "not being healthy" would fall between 1.4% and 14.4% for boys, and between 2.5% to 23.2% for girls. This magnitude of country variation shows scope for modelling country level predictors and self rated health.

Country material distribution and individual health

Table 5 (M1) shows that young people in the group of countries with the strongest level of material inequalities had almost threefold higher odds of reporting "not being healthy" compared with young people from the reference

Table 3 Family related characteristics by country material distribution

Family characteristics*	SD family affluence scale							
	Low quartile		Medium low quartile		Medium high quartile		High quartile	
	(95% CI)	(95%CI)	(95%CI)	(95% CI)	(95% CI)	(95%CI)	(95%CI)	
Family affluence								
Boys	0.24	(0.15,0.32)	0.16	(0.06,0.25)	-0.01	(-0.10,0.09)	-0.30	(-0.40,-0.20)
Girls	0.16	(0.06,0.27)	0.10	(0.00,0.21)	-0.06	(-0.16,0.04)	-0.47	(-0.58,-0.36)
Parental involvement								
Boys	0.08	(-0.02,0.19)	0.12	(0.01,0.23)	0.05	(-0.05,0.15)	0.15	(0.04, 0.25)
Girls	-0.11	(-0.22, 0.00)	-0.09	(-0.20,0.02)	-0.15	(-0.25,0.05)	-0.07	(-0.19,0.05)
Parental emotional support								
Boys	0.11	(0.05,0.17)	0.14	(0.01,0.26)	-0.03	(-0.18,0.12)	-0.33	(-0.44,-0.21)
Girls	0.10	(0.04, 0.17)	0.17	(0.05,0.29)	-0.01	(-0.16,0.14)	-0.35	(-0.50,-0.20)

*All variables are Z standardised.

Table 4 Random intercepts null model for self rated health. Logit scale transformed to percentages

	Point estimate (%) "not healthy"	95%CI (%)	95% Population variation (%)	Variance partitioning coefficient
Boys	4.6	(3.7, 5.8)	(1.4–14.4)	0.110
Girls	8.2	(6.6, 10.1)	(2.5–23.2)	0.106

group of low inequality. After adjusting for differences in family affluence, family structure, parental involvement, and parental emotional support groups of increasing material inequalities were more than twice as likely to report poor health.

Table 5 also shows that young people from countries with medium high and high Gini of income had more than 2:1 odds of reporting poor health, compared with young people in countries with lower Gini of income. Using young people from countries with high average household income as the reference group, young people from low household income countries had odds of more than 2:1 for reporting poor health. For the two other subgroups of household income, differences with the reference group were only marginal.

DISCUSSION

This study showed a consistent pattern of poorer self rated health among young people from countries in which families' material resources were distributed less evenly. Overall, adolescents living in the group of countries with highest inequalities had more than 2:1 odds of reporting poor health even when their individual levels of family affluence, and their social relationships within the family were accounted for.

Several methodological issues need to be considered when interpreting the results. Although this study included more than 120 000 students, the fact that these represented only 27 countries limits the power for testing the impact of material distribution on young people's health. Still, it is

assuring that the results were highly consistent across subsamples split by sex.

A second limitation relates to the cross national comparability of macro-level indicators. Attempts were made to harmonise data collection as much as possible, but there are inevitably variations, both for the primary source of data and the collection of data from secondary sources. Such non-equivalence is hard to rule out as source of error. It remains a fact that the SD of FAS and the Gini of income showed a fairly similar association with self rated health.

It is well known that subjective health reports are affected by response styles, including negative affectivity.³¹ Such response style represents a systematic source of error in adolescents' ratings of health, making some adolescents prone to exaggerate their health problems. Such error would not systematically bias relations between country level conditions and individual health, as there is little evidence to suggest that response styles differs systematically between countries. As such, the limitations of self reported health should not be seen as a major threat to the validity of the study.

What this paper adds

This paper shows that the distribution of material resources in a country is systematically related to young peoples risk of poor self rated health.

Table 5 Crude and adjusted odds ratio (95% CI) of "not being healthy" according to country subgroup

Model	Country subgroup				Most disadvantaged quartile	p linear effect
	Least disadvantaged quartile	Medium low quartile	Medium high quartile			
SD of family affluence scale						
M1 unadjusted						
Boys	1.00	–	1.32 (0.75–2.29)	1.58 (0.93–2.69)	2.68 (1.61–4.47)	0.0016
Girls	1.00	–	1.28 (0.75–2.17)	1.63 (0.98–2.72)	2.90 (1.75–4.83)	0.0003
M2 adjusting for compositional effects*						
Boys	1.00	–	1.33 (0.74–2.38)	1.49 (0.85–2.60)	2.35 (1.35–4.12)	0.0063
Girls	1.00	–	1.28 (0.74–2.23)	1.52 (0.90–2.59)	2.46 (1.45–4.17)	0.0024
Gini of income						
M1 unadjusted						
Boys	1.00	–	1.05 (0.59–1.85)	2.29 (1.37–3.82)	2.05 (1.13–3.72)	0.0038
Girls	1.00	–	1.10 (0.64–1.92)	2.31 (1.41–3.81)	2.08 (1.17–3.71)	0.0029
M2 adjusting for compositional effects						
Boys	1.00	–	1.08 (0.63–1.86)	2.32 (1.42–3.79)	1.96 (1.11–3.46)	0.0037
Girls	1.00	–	1.13 (0.69–1.84)	2.43 (1.61–3.66)	1.89 (1.19–3.03)	0.0033
Average household income per capita						
M1 unadjusted						
Boys	1.00	–	1.02 (0.58–1.81)	1.18 (0.64–2.20)	2.35 (1.27–4.37)	0.0114
Girls	1.00	–	0.99 (0.61–1.61)	1.13 (0.65–1.94)	2.74 (1.59–4.70)	0.0021
M2 adjusting for compositional effects						
Boys	1.00	–	1.01 (0.57–1.79)	1.16 (0.62–2.17)	2.02 (1.08–3.78)	0.0324
Girls	1.00	–	0.97 (0.58–1.64)	1.10 (0.62–1.94)	2.25 (1.28–3.98)	0.0108

*Adjusted for age, linear and quadratic family affluence, parental emotional support, parental school involvement, and family structure.

Cross sectional studies such as this one can only provide a snapshot picture of changing relations. The data were collected in a time period with profound societal changes, in particular within Eastern European countries. Clearly, the daily life circumstances of adolescents in these groups differed in a number of respects other than material distribution, including differences in infrastructure, consumer demands, schooling and access to higher education, access to health care, and social security. These differences imply that material inequality could work as a proxy for exposure to a range of coinciding stressful conditions that correlate with, but are causally secondary to the effects of material distribution. Such stressful conditions include downsizing of social welfare, increased unemployment, crime, and poverty. This means that although the results may reflect a mechanism related to the distribution of material resources, a number of other explanations are also consistent with the findings.

Previous studies of national income distribution and health have primarily been based on aggregate level data, using aggregate indicators of inequality and health. Studies with such designs are vulnerable to a number of statistical artefacts,¹⁵ related to ignoring the correlation structure at the individual level. On the basis of the artefactual hypothesis,¹⁵ one would expect the effect of family material distribution to disappear or decrease when adjusting for individual level of family affluence but in contrast with this expectation, the effects of material distribution remained almost unaffected by the adjustment for individual family affluence.

The fact that relations between material distribution and individual health were only marginally affected by adjustment for individual family related factors shows that the graded relation cannot be attributable primarily to the level of social and economic resources in the family. Subgroups of increasing material inequality differed strongly in their level of self rated health, but differed modestly in terms of family affluence, social support, and parental school involvement. The strong effects of material distribution, in the presence of individual family factors, point to processes external to the family context.

A recent comprehensive review³¹ identified two multilevel studies on the relation between national income inequality and individual health. One of the few multilevel studies that permit for comparison with this study is a recent study of adults from seven post-communist countries.³² In partial agreement with our findings, that study reported a bivariate relation between income inequality and self rated poor health, but the relation was no longer present once controls were made for individual level of material deprivation, and for perceived control. The fact that relations remained strong after statistical control might reflect that statistical power of this study was higher than in the study by Bobak and colleagues, and that this study covered a wider range of countries, making this study less susceptible to restrictions of range. Importantly, the observed linear gradient showed that the impact of income inequality and material distribution was not restricted to the harmful effects of extremely high inequality in the Eastern European countries.

The finding of a linear gradient between the level of material inequality and self rated health contradicts the notion of equalisation in youth.⁵ According to the equalisation hypothesis, as young people earn growing independence, their main reference targets change from parents to peers, and their own families' socioeconomic position becomes of less importance to their lives. Based on this set of expectations the strong observed health inequalities may seem somewhat surprising. Rather than suggesting equalisation, this study shows strong health inequalities at the country

level, a finding that adds to the number of other studies that have reported health inequalities in youth at the individual level.⁶⁻⁹ Accumulating evidence now shows that the label "equalisation" is not descriptive of self rated health in young people, at least not for the self rated health of European and North American youth.

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