



Socioeconomic inequalities in adolescent health 2002–2010: a time-series analysis of 34 countries participating in the Health Behaviour in School-aged Children study

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Summary

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Background Information about trends in adolescent health inequalities is scarce, especially at an international level. We examined secular trends in socioeconomic inequality in five domains of adolescent health and the association of socioeconomic inequality with national wealth and income inequality.

Methods We undertook a time-series analysis of data from the Health Behaviour in School-aged Children study, in which cross-sectional surveys were done in 34 North American and European countries in 2002, 2006, and 2010 (pooled n 492788). We used individual data for socioeconomic status (Health Behaviour in School-aged Children Family Affluence Scale) and health (days of physical activity per week, body-mass index Z score [zBMI], frequency of psychological and physical symptoms on 0–5 scale, and life satisfaction scored 0–10 on the Cantril ladder) to examine trends in health and socioeconomic inequalities in health. We also investigated whether international differences in health and health inequalities were associated with per person income and income inequality.

Findings From 2002 to 2010, average levels of physical activity (3.90 to 4.08 days per week; $p < 0.0001$), body mass (zBMI -0.08 to 0.03 ; $p < 0.0001$), and physical symptoms (3.06 to 3.20, $p < 0.0001$), and life satisfaction (7.58 to 7.61; $p = 0.0034$) slightly increased. Inequalities between socioeconomic groups increased in physical activity (-0.79 to -0.83 days per week difference between most and least affluent groups; $p = 0.0008$), zBMI (0.15 to 0.18 ; $p < 0.0001$), and psychological (0.58 to 0.67 ; $p = 0.0360$) and physical (0.21 to 0.26 ; $p = 0.0018$) symptoms. Only in life satisfaction did health inequality fall during this period (-0.98 to -0.95 ; $p = 0.0198$). Internationally, the higher the per person income, the better and more equal health was in terms of physical activity (0.06 days per SD increase in income; $p < 0.0001$), psychological symptoms (-0.09 ; $p < 0.0001$), and life satisfaction (0.08 ; $p < 0.0001$). However, higher income inequality uniquely related to fewer days of physical activity (-0.05 days; $p = 0.0295$), higher zBMI (0.06 ; $p < 0.0001$), more psychological (0.18 ; $p < 0.0001$) and physical (0.16 ; $p < 0.0001$) symptoms, and larger health inequalities between socioeconomic groups in psychological (0.13 ; $p = 0.0080$) and physical (0.07 ; $p = 0.0022$) symptoms, and life satisfaction (-0.10 ; $p = 0.0092$).

Interpretation Socioeconomic inequality has increased in many domains of adolescent health. These trends coincide with unequal distribution of income between rich and poor people. Widening gaps in adolescent health could predict future inequalities in adult health and need urgent policy action.

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Introduction

Adolescence is a formative life stage for adult health, but is often neglected in health policy.¹ Health and health behaviours track strongly from early adolescence to adulthood, and inequalities in health are typically established early in life.² Socioeconomic status (SES) is a major determinant of these inequalities.² To grow up in impoverished and marginalised socioeconomic conditions shortens the lifespan and contributes to poor mental and physical health.^{3,4} Some research has suggested that socioeconomic differences in health emerge in early childhood and then diminish in early adolescence, only to re-emerge in adulthood.⁵ However, most of the evidence in this area shows social class gradients in health at every stage of the life course, including adolescence.^{4,6,7}

An understanding of trends in health inequalities and their social determinants is crucial so that policy can be developed to redress them.^{2,8} The available evidence in this area relies heavily on local and national samples of young children.^{6,7,9} International studies of social inequalities in adolescent health are scarce and, as a result, predictions about future inequalities in adult health are not based on robust information. Findings from the Health Behaviour in School-aged Children (HBSC) study,^{4,8,10} which surveys the health of adolescents in North America and Europe, have shown SES differences in health in most countries and health domains, including self-rated health, psychological and physical symptoms, and life satisfaction. However, this research has not focused on trends in health inequalities in adolescence, nor on structural

For more on the HBSC study see <http://www.hbsc.org>

determinants of adolescent health, such as national wealth or income inequality.^{1,11,12}

Income inequality is rising¹³ and health inequalities are widening^{14,15} in adults, suggesting that socioeconomic differences in adolescent health might have increased in recent years. Since the 1970s, real wages for the bottom half of the workforce have fallen in many countries, while incomes of the top 1% have quadrupled.¹² Income inequality has risen steadily during the past four decades, thus increasing relative deprivation, depleting the social capacity of nations to support health, and contributing to poor health in terms of mental illness, obesity, mortality, and reduced child wellbeing.¹⁶ Thus, rising income inequality might have both worsened adolescent health in general and widened social inequality in adolescent health over time.¹² In a Series on adolescent health, Viner and colleagues¹ concluded that the strongest determinants of adolescent health worldwide are structural factors, such as national wealth, access to education, and income inequality.

We had two goals for this study. Our first objective was to examine secular trends in health inequalities in different domains of adolescent health: physical activity, bodyweight, psychological and physical symptoms, and life satisfaction. We chose these domains to broadly represent mental and physical health and wellbeing. Because adolescent health relates to SES, and SES differences might have widened because of increasing income inequality, we hypothesised that adolescent health inequalities in all health domains grew from 2002 to 2010. Our second objective was to explore whether national wealth and income inequality relate to international differences in adolescent health and health inequalities between SES groups.

Methods

Study design and participants

Data for SES and health used in this time-series analysis were collected in a series of cross-sectional surveys of adolescents in 34 North American and European countries or regions in the 2002, 2006, and 2010 cycles of the HBSC study: Austria, Belgium (French region), Belgium (Flanders region), Canada, Croatia, Czech Republic, Denmark, England, Estonia, Finland, France, Germany, Greece, Greenland, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Macedonia, Netherlands, Norway, Poland, Portugal, Russia, Scotland, Slovenia, Spain, Sweden, Switzerland, Ukraine, USA, and Wales. The HBSC study included nationally representative samples of participants aged 11 years, 13 years, and 15 years.⁴ Stratified samples of schools representing the regional, economic, and public-private distribution of schools in each country were recruited according to a common protocol.⁴ We sampled schools with replacement as needed within each strata to ensure consistency between countries

and survey cycles in terms of sample composition. The protocol stipulated a standard questionnaire format, item order, and testing conditions. Teachers or trained interviewers distributed the questionnaires in classroom settings.⁴

This research was approved on March 13, 2014, by the Institutional Review Board of the Faculty of Medicine, McGill University (Montreal, QC, Canada). Each member country obtained ethics clearance to conduct the survey from a university-based review board or

Panel 1: Measures of health inequality

We measured absolute health inequality using the slope index of inequality (SII) and relative health inequality using the relative index of inequality (RII).²⁶ Both absolute and relative measures are useful because they can lead to different conclusions about the size of and changes in inequalities.²⁷ The SII represents an absolute difference in health between the most and least affluent groups. The RII represents relative inequality in terms of the percentage of population health that differs between the most and least affluent groups. These regression-based indices are calculated by transformation of socioeconomic status (SES) to cumulative rank probabilities (ridit scores) ranging from 0 (highest) to 1 (lowest). The RII is calculated by division of health scores by the population mean and multiplication of the resulting fraction by 100, thus representing the percentage of population health that differs between the highest and lowest SES groups. Unlike other measures of health inequality that compare extreme SES groups (eg, rate ratios), the SII and RII estimate health across the full distribution of SES and are thus better suited to continuous measures of health that have no predefined cut-point and are not affected by differences in the size of socioeconomic groups between countries or over time.^{26,27}

	2002 (n=156 696)	2006 (n=165 514)	2010 (n=170 578)
Individual characteristics			
Sex			
Female	80 745 (52%)	85 003 (51%)	87 497 (51%)
Male	75 951 (49%)	80 511 (49%)	83 081 (49%)
Age (years)			
11	52 604 (34%)	52 222 (32%)	54 414 (32%)
13	54 921 (35%)	56 813 (34%)	58 526 (34%)
15	49 171 (31%)	56 479 (34%)	57 638 (34%)
Mean age (years)	13.55 (1.66)	13.63 (1.65)	13.57 (1.63)
Mean affluence	4.85 (1.98)	5.25 (1.98)	5.84 (1.92)
Mean physical activity	3.84 (2.09)	4.05 (2.09)	4.06 (2.05)
Mean body-mass index*	-0.11 (1.16)	-0.02 (1.15)	0.04 (1.17)
Mean psychological symptoms	4.74 (3.82)	4.67 (3.87)	4.63 (3.87)
Mean physical symptoms	3.12 (3.22)	3.12 (3.28)	3.24 (3.34)
Mean life satisfaction	7.55 (1.92)	7.58 (1.91)	7.58 (1.89)
Country characteristics			
Mean income per person (US\$)	17 165 (11 432)	29 010 (17 729)	32 593 (19 613)
Mean income inequality	0.30 (0.05)	0.30 (0.05)	0.31 (0.05)
Countries	34	34	34
Schools	5930	6659	7339

Data are n (%) or mean (SD). *Deviation (in SD units) from WHO international age-adjusted and gender-adjusted norms.²⁹

Table 1: Sample characteristics by survey cycle

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