

Family Affluence and Inequality in Adolescent Health and Life Satisfaction: Evidence from the HBSC study 2002-2014

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FAMILY AFFLUENCE AND INEQUALITY IN ADOLESCENT HEALTH AND LIFE SATISFACTION: EVIDENCE FROM THE HBSC STUDY 2002-2014

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Abstract: A large body of literature has established socio-economic gradients in adolescent health, but few studies have investigated the extent to which these gradients are associated with very poor health outcomes. The current analysis examined the extent to which the socio-economic background of adolescents relates to very poor self-reported health and well-being (the so-called 'bottom end'). For this analysis, we use data from the last four cycles of the Health Behaviour in School-aged Children study (2001/02, 2005/06, 2009/10, and 2013/14) for 32 European and North American countries in the EU and/or OECD. We examined the following as indicators of adolescent health: psychosomatic health complaints; physical activity; healthy eating; unhealthy eating; and life satisfaction. Adolescents who scored below the mean of the lower half of the distribution of a given indicator fall in the "bottom group" on this indicator. Family affluence is used as a measure of adolescents' socio-economic background (transformed to ridit score). In the vast majority of the countries studied, adolescents from families with a relatively low socio-economic status had a greater likelihood of reporting poor health. The largest, most persistent and widespread socio-economic gradients are in life satisfaction, physical activity and healthy eating, while the findings are mixed for unhealthy eating and psychosomatic health. Socio-economic inequalities were largely stable, but in a sizeable minority of the countries, socio-economic inequalities in physical activity and healthy eating have widened between 2001/02 and 2013/14, while inequalities in unhealthy eating and life satisfaction have narrowed in several countries.

Keywords: adolescents; socio-economic gradient; health; physical activity; balanced diet; life satisfaction; Health Behaviour in School-aged Children.

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1. INTRODUCTION

The health and well-being of European and North American adolescents has improved in many respects over the last decade. Findings from multiple cycles of the Health Behaviour in School-aged Children (HBSC) study between 2002 and 2010 indicate positive trends in adolescents reporting: (1) their health as “good” or “excellent” (Cavallo et al. 2015a); (2) healthy dietary practices in terms of fruit and vegetable consumption (Vereecken et al. 2015); (3) positive relationship(s) with their parent(s) (Brooks et al. 2015); (4) engagement in physical activity in a majority of countries (Kalman et al. 2015); and (5) abstinence from smoking and misuse of alcohol (Currie et al. 2012; de Looze et al. 2015; Hublet et al. 2015). While such trends are encouraging, inequalities in health still exist, as young people with lower socio-economic backgrounds have fewer life opportunities and poorer health (Kuntsche and Ravens-Sieberer 2015). Indeed, socio-economic position remains one of the leading contextual determinants of adolescent health (Currie et al. 2012; Viner et al. 2012).

A large evidence base describes steep socio-economic gradients in adolescent health that favour better-off groups (Elgar et al. 2015; Frederick et al. 2014; Geckova et al. 2004; Hanson and Chen 2007; Holstein et al. 2009; Levin et al. 2011; Moor et al. 2015; Piko and Fitzpatrick 2007; Reiss 2013; Stalsberg and Pedersen 2010; Starfield et al. 2002; UNICEF 2012), except for physical injuries that are more prevalent among adolescents from more affluent families (Currie et al. 2012). These gradients are reported in almost all countries and have persisted over recent decades (Currie et al. 2012; Elgar et al. 2015; Moor et al. 2015). Health outcomes that have been studied include self-rated health, psychological health, and academic performance (Magklara et al. 2010), mental health problems (Reiss 2013), life satisfaction (Cavallo et al. 2015b; Levin et al. 2011; Moor et al. 2014), overweight and obesity and its behavioural determinant of physical inactivity (Frederick et al. 2014; Hanson and Chen 2007; Stalsberg and Pedersen 2010). Moreover, there is some evidence indicating an increasing socio-economic gap in health in the last decade (Elgar et al. 2015; Moor et al. 2015), although the available research base is still scant. Such inequalities and their potential impacts on health among children and adolescents remain priorities for health policy at national and international levels (Catalano et al. 2012; Patton et al. 2012; Sawyer et al. 2012; Viner et al. 2012).

The current study examines the extent to which the socio-economic backgrounds of adolescents, relative to their peers in the same country, correspond to being in the ‘bottom end’ of health and well-being, defined as scoring below the mean of the lower half of the distribution given the country and survey year (see Currie et al. 2011; UNICEF 2010, 2016). We explored such relationships across 32 European and North American countries and also across time (cross-national surveys conducted in 2001/02, 2005/06, 2009/10, and 2013/14). The main research questions are two-fold: 1) what is the magnitude of the association between family socio-economic status (SES) and poor adolescent health, health-related behaviours and life satisfaction across countries and 2) how has the magnitude of this socio-economic gradient changed over time?

This analysis is important for at least two reasons. First, relatively few existing studies have examined trends in social inequalities in adolescent health across large numbers of countries and

cultures (Elgar et al. 2015; Moor et al. 2015). Second, there is a related lack of cross-national research that has investigated the health experiences and economic position of adolescents who report substantially worse health and well-being outcomes (the so-called 'bottom end') relative to peers in the middle of the distribution. Finally, rather than estimating a common trend across all countries, this study analyses predictors of poor adolescent health separately by country, identifying substantial heterogeneity in the effects of socio-economic status on adolescent health.

Identifying adolescents at risk of poor health is important because inequalities in health and health-related behaviours at this life stage tend to perpetuate into adulthood (Viner et al. 2012). Although early childhood years are a key foundational period for health and development, and economists insist that investing in the early years of disadvantaged children is the most efficient strategy to build a productive future workforce (Heckman 2006; Knudsen et al. 2006), adolescence is a crucial period for a healthy transition to adulthood. Thus socio-economic gradients in adolescent health are of direct importance to national economic development and social cohesion. Moreover, there is evidence that interventions during adolescence can mitigate adverse effects of poor well-being during earlier childhood (McDaid et al. 2014).

2. DATA AND MEASUREMENT

2.1 Data

The 'Health Behaviour in School-aged Children' (HBSC) study is a cross-sectional survey that has been carried out every four years since 1982 in a growing number of countries. The study aims to increase our understanding of adolescent health and well-being and the health behaviours and social environments that contribute to such outcomes.

As a school-based survey, HBSC teams in 43 countries collect data from 11- to 15- year-old schoolchildren according to a common international protocol. A core strength of the HBSC study is its repeat cross-section nature and its common methodology. A detailed description of its aims and theoretical framework can be found elsewhere (Currie et al. 2012).

The current analysis used data from the last four HBSC cycles in 2001/02, 2005/06, 2009/10 and 2013/14, and focuses on countries of the European Union (EU) and/or the Organisation for Economic Co-operation and Development (OECD). There are 31 such countries in the latest cycle and 26 countries are present in all four cycles. Countries where 10% or more of the students had missing information on key indicators were excluded from the analysis.

2.2 Socio-economic status (SES)

The Family Affluence Scale (FAS) is a measure of material family wealth developed as an indicator of absolute level of socio-economic position (Currie et al. 2008, 2014). Between 2001/02 and 2009/10, the FAS scale was comprised of reports for the following items: ownership of a family car (0, 1, 2 or more), own bedroom (no=0, yes=1), family holidays during the past 12 months (0, 1, 2, 3 or more), and family computer(s) (0, 1, 2, 3 or more). These items are combined to produce a composite score ranging from 0 (low affluence) to 9 (high affluence). In 2013/14, two more items were introduced to this scale, numbers of bathrooms and ownership of a dishwasher (Currie et al. 2014).

Cycle-specific measures were transformed into a continuous proportional rank score ranging from 0 to 1, separately by country, with the country sample means set at 0.5 (see Torsheim et al. 2004).¹ This was done in order to use a consistent measure of FAS across the last four HBSC cycles and to analyse relative socio-economic position, as indicated by FAS, rather than absolute levels of affluence. The transformed country-specific ridit score reflects the proportion of respondents with lower family affluence, with higher values reflecting higher levels of socio-economic status relative to others within the country. A ridit score is essentially a percentile rank, assuming that “the scores of the [FAS] scale can be used to rank individuals and groups along a latent continuum of material wealth” (Torsheim et al. 2004, p. 5). In regression models of health, one unit on the ridit scale refers to the difference between the least affluent and most affluent adolescents in the country (Elgar et al. 2015).

2.3 Bottom-end inequality in health and well-being

To identify children who have substantially poorer health and subjective well-being relative to their peers (i.e. the so-called ‘bottom group’), we estimated the mean in the lower half of the distribution for each indicator separately, by country and year. Children who fall below this threshold are thought to be left so far behind that *they do worse than an average child among the least well-off half of their population*. Thus, it is a relative measure of poor health and well-being, with thresholds varying across countries and years. This is consistent with the measure of bottom-end inequality in children’s health and well-being proposed in Currie et al. (2011) and used in UNICEF (2010, 2016) and Chzhen et al (2016): the relative distance between the mean below the median and the median, as a share of the median. However, the present study focuses on the individual determinants of scoring in the bottom group (separately by indicator, country and year) rather than on the country-level dispersion of health scores in the lower half of the distribution (see Chzhen et al. 2016).

2.4 Health indicators

We examine the following as indicators of adolescent health (detailed below): (1) psychosomatic health complaints; (2) physical activity; (3) healthy eating; (4) unhealthy eating; and (5) life satisfaction, as a proxy for subjective well-being. These indicators give a broad picture of adolescent physical and mental health as well as health-related behaviours. Mental health is a growing share of the global burden of disease (Whiteford et al. 2013), while physical activity and a balanced diet are crucial in the context of increasing childhood obesity (Ebbeling et al. 2002; Nishtar et al. 2016).

2.5 Psychosomatic health complaints

High prevalence of multiple health symptoms among adolescents is an important indicator because these symptoms may persist into adulthood and can be related to other health issues (Dunn and Goodyer 2006; Gregory et al. 2008). An eight-item checklist of symptoms measuring psychosomatic health complaints has been used in the HBSC since 1993/94: headache; stomach ache; backache; feeling low; irritability or bad temper; feeling nervous; difficulties in getting to sleep; and feeling dizzy (Haugland et al. 2001; Haugland and Wold 2001). Respondents indicate the frequency of experiencing

¹ However, Torsheim et al (2004) used a reverse ridit scale, with 1 denoting the least affluent respondents.

each of these symptoms during the past six months: “about every day”, “more than once a week”, “about every week”, “about every month”, “rarely or never”. Following the measurement procedures described by Currie et al (2011) and Chzhen et al (2016), responses are summed up to produce a composite scale ranging from 0 to 32. A zero score corresponds to frequent occurrence of each of the eight complaints, and a score of 32 corresponds to no experiences with these health complaints. Previous internationally comparative research has demonstrated strong psychometric properties for this instrument, as indicated by confirmatory factor analyses (Haugland et al. 2001; Ravens-Sieberer et al. 2008) and test-retest reliability (Haugland and Wold 2001). Additionally, factor loadings, reliabilities and age and gender differences in patterns of reporting were found to be consistent for different European countries (Haugland et al. 2001).

2.6 Physical activity

Moderate-to-vigorous physical activity was measured by a one-item scale (Prochaska et al. 2001). Respondents were asked on how many days over the past seven they were physically active for at least 60 minutes. The survey item defines physical activity as “any activity that increases your heart rate and makes you get out of breath some of the time” and includes examples such as running and brisk walking (Currie et al. 2014, p. 72). The scale ranges from 0 days to 7 days. The item has been used in the HBSC since 2001/02 and has been found to correlate highly with a general question about physical activities (Kalman et al. 2015). The measure reflects current policy recommendations for children’s physical activity (WHO 2011).

2.7 Healthy eating

Sugar-enriched foods can have a detrimental effect on children’s health, while consumption of fruit and vegetables is associated with more positive health outcomes (Vereecken et al. 2015). Consumption of fruit and vegetables corresponds to a lower risk of major diseases, such as cancer (Vainio and Weiderpass 2006), coronary heart disease (He et al. 2007) and stroke (He et al. 2006), so their consumption is commonly used as an indicator of healthy eating (see Chzhen et al. 2016).

An abbreviated food frequency questionnaire has been used in the HBSC since 1986, with four mandatory items retained since 2001/02: fruit, vegetables, sweets, and sugary soft drinks. Following precedents (Vereecken et al. 2008), these two items were combined into a “Fruit and Vegetables Index” ranging from 0 to 14, with 0 corresponding to never eating fruit or vegetables and 14 to eating both fruit and vegetables at least once a day. The fruit and vegetables items are re-coded and summed as follows: “never” = 0, “less than once a week” = 0.25, “once a week” = 1, “2–4 days a week” = 3, “5-6 days a week” = 5.5 and “once a day, every day” and “more than once a day, every day” = 7.

2.8 Unhealthy eating

Items on sweets and sugar-added soft drinks consumption were used as indicators of unhealthy eating. There is consistent evidence of sugar snacks and sugar-sweetened beverages being major risk factors for dental caries among children and youth (Armfield et al. 2013; Kalsbeek and Verrips 1994; Marshall et al. 2003; Sheiham and James 2014). Moreover, consumption of beverages that contain

sugar is associated with weight gain in children (de Ruyter et al. 2012; Malik et al. 2006, 2013), while the intake of added sugars is linked to multiple indicators of cardiovascular disease risk (Welsh et al. 2011). For consistency with other indicators used in this paper, where higher values denote more positive outcomes, the items are reverse-coded as follows: “never” =7, “less than once a week” =5.5, “once a week” =3, “2-4 times/week” =1, “5-6 days a week” =0.25 and “once a day, every day” and “more than once a day, every day” = 0. In the composite 0-14 scale, 0 denotes consuming both sweets and sugared drinks at least once a day and 14 refers to never consuming sweets or sugary drinks.

2.9 Life satisfaction

Life satisfaction, a global assessment of one’s life, refers to the evaluative aspect of subjective well-being (see Currie et al. 2014). Higher life satisfaction is associated with physical activities (Valois et al. 2004), social support (Vieno et al. 2007), and higher family affluence, particularly in countries with large social inequalities (Levin et al. 2011). The Cantril ladder is used here as a general indicator of life satisfaction (Cantril 1965). This indicator has been used in the HBSC since 2001/02. Respondents are given a picture of an 11-step ladder that goes from 0 “worst possible life” to 10 “best possible life”. They are then asked to indicate where on the ladder they rate their life. Levin and Currie (2014) validated the Cantril Ladder for studying adolescent life satisfaction using data from seven samples of schoolchildren in Scotland between 2008 and 2010. They showed that the Cantril Ladder had good reliability and good convergent validity with other well-being measures.

2.10 Statistical analyses

The analysis focused on the strength of associations between the country-specific riddit-transformed FAS score and bottom-end health outcomes (i.e. scoring below the mean in the lower half of the distribution), reported across countries and years. To study these associations, we used linear probability models (i.e., ordinary least squares (OLS) regressions with binary dependent variables) separately for each indicator, country and survey year.² All analyses controlled for age and gender, while accounting for the complex sampling structure of the survey (participants nested within schools, then countries).³ We report on the effects of a one-unit difference in the riddit score for family affluence (the difference between the least and most affluent adolescents) on the probability of being in the bottom-end group for each indicator. To investigate if the effects of family affluence have changed significantly over the last four survey cycles, i.e., between 2001/02 and 2013/14, we included a trend variable (with 2001/02 cycle as referent) and interaction terms between the trend variable and each of the three other predictors (i.e. family affluence, age and gender). Cases with missing values on at least one of the predictors were excluded from the analysis.

² All analyses were replicated using logistic regression with qualitatively identical results (estimates available upon request). Linear probability models were used because they produce robust and easily-interpretable results.

³ Analyses were done separately by country, using sample weights, with schools identified as primary sampling units and regions as strata (where relevant, i.e. in Belgium and the United Kingdom).

3. RESULTS

Table 1 (page 12) shows the proportion of adolescents falling in the bottom group for the health behaviour indicators and life satisfaction across 31 countries in 2013-2014. With higher scores denoting better outcomes, adolescents in the bottom group score below the mean of the lower half of the distribution in their country. The bottom group can be sizeable: one in five adolescents (19%) have substantially poorer psychosomatic health than their peers, ranging from 17% at the bottom end in Belgium, Norway, and Portugal to 22% in Sweden. Around the same proportion of adolescents (21%) fall behind on consumption of fruit and vegetables, but there is more variation between countries: from 16% in Belgium and Switzerland to 26% in Hungary and Spain. One in four adolescents (25%) score poorly on abstinence from sweets and sugary drinks, but this varies from just 12% in Sweden to 33% in Norway. Meanwhile, one in five adolescents (20%) falls behind on physical activity, ranging from 10% in Portugal to 27% in Belgium. Finally, the share of adolescents reporting very low life satisfaction scores varies from 9% in the Czech Republic to 19% in Poland and Slovakia, with 15% across all 31 countries.

Table 2 (page 13) shows the marginal effects of a one unit difference in FAS (i.e. between those from the least and the most affluent families) on the probability of scoring in the bottom group in a given indicator, controlling for age and gender, estimated via OLS using data from the HBSC 2013/14. The largest and most widespread socio-economic inequalities (i.e. as indicated by the estimated FAS gradients or marginal effects) are in physical activity, fruit and vegetables consumption (healthy eating) and life satisfaction, while the results for psychosomatic health and sweets and sugary drinks consumption are mixed. In all 31 countries in the analysis, adolescents from more affluent households are significantly less likely to fall behind in physical activity, with the FAS gradient ranging from -8.3 percentage points (ppt) in Finland to -21.9ppt in Luxembourg. Thus, adolescents from the least affluent families are 21.9 points more likely to score in the bottom group in physical activity in Luxembourg than their peers from the most affluent families, controlling for age and gender. Similarly, adolescents from more affluent households are significantly less likely to fall behind in life satisfaction in all 31 countries, ranging from -7.6ppt in Greece to -24ppt in Hungary. Also, adolescents from more affluent households are significantly less likely to fall behind on fruit and vegetables consumption in 29 countries: everywhere except in Malta and Romania. The statistically significant FAS gradient ranged from -5.3ppt in Slovenia to -21.3ppt in the UK.

Socio-economic inequalities in psychosomatic health are statistically significant in just over half of the countries. In 15 countries adolescents from higher affluence families are less likely to be in the bottom group in terms of reported psychosomatic health, with the FAS gradient ranging from -5.1ppt in Romania to -8.4 in Canada. In two other countries, the Czech Republic and Switzerland, the gradient is positive, suggesting that adolescents from more affluent backgrounds are more likely to report more frequent psychosomatic health complaints. Socio-economic inequalities in psychosomatic health are not as large, widespread or persistent as are observed

⁴There would be 32 countries, but Israel was excluded due to high prevalence of missing values on the key health indicators.

gender differences. Girls are significantly more likely to report poorer psychosomatic health than boys in any given year between 2001/02 and 2013/14 in every country studied. The gender gap has widened over time in 10 countries: Belgium, Canada, the Czech Republic, Estonia, Ireland, Italy, Slovenia, Sweden, the UK and the US (see Figure A1 in the Annex).

Table 1 – Share of adolescents (%) below the mean of the lower half of the distribution (HBSC 2013/14)

| Country | Psycho-somatic health | Physical activity | Fruit and vegetables | Sweets and soft drinks | Life satisfaction |
|--------------------|-----------------------|-------------------|----------------------|------------------------|-------------------|
| Austria | 18.7 | 22.2 | 21.5 | 28.4 | 10.7 |
| Belgium | 17.2 | 26.7 | 15.9 | 25.2 | 16.5 |
| Bulgaria | 19.2 | 22.9 | 18.1 | 32.2 | 13.7 |
| Canada | 17.9 | 15.8 | 22.7 | 27.1 | 16.5 |
| Croatia | 18.7 | 20.4 | 24.4 | 23.8 | 13.5 |
| Czech Republic | 20.4 | 19.9 | 19.9 | 28.7 | 8.6 |
| Denmark | 19.7 | 14.4 | 24.0 | 29.0 | 11.4 |
| Estonia | 19.7 | 24.7 | 21.4 | 23.4 | 12.2 |
| Finland | 17.9 | 13.1 | 23.1 | 27.5 | 11.1 |
| France | 20.0 | 14.9 | 22.0 | 29.2 | 17.5 |
| Germany | 17.7 | 26.3 | 24.9 | 31.6 | 17.3 |
| Greece | 18.1 | 14.4 | 20.2 | 21.1 | 12.2 |
| Hungary | 20.3 | 12.9 | 25.9 | 29.2 | 15.9 |
| Iceland | 19.5 | 18.5 | 18.8 | 19.9 | 12.2 |
| Ireland | 19.5 | 17.6 | 17.6 | 26.3 | 14.1 |
| Italy | 19.8 | 17.8 | 25.3 | 31.4 | 15.5 |
| Latvia | 19.2 | 23.9 | 22.6 | 23.9 | 15.1 |
| Lithuania | 18.8 | 23.0 | 19.5 | 23.9 | 13.1 |
| Luxembourg | 19.4 | 22.7 | 23.0 | 29.2 | 17.2 |
| Malta | 20.1 | 18.5 | 23.8 | 16.3 | 13.4 |
| Netherlands | 19.6 | 18.5 | 18.2 | 22.0 | 16.6 |
| Norway | 17.2 | 19.4 | 17.3 | 32.7 | 11.2 |
| Poland | 20.6 | 20.5 | 22.2 | 21.8 | 19.4 |
| Portugal | 16.6 | 9.6 | 24.5 | 25.4 | 17.0 |
| Romania | 20.1 | 20.8 | 21.8 | 25.2 | 16.4 |
| Slovakia | 18.9 | 21.1 | 24.4 | 23.0 | 18.5 |
| Slovenia | 17.8 | 23.2 | 17.5 | 24.7 | 12.2 |
| Spain | 18.5 | 18.0 | 25.8 | 24.3 | 12.5 |
| Sweden | 22.4 | 23.8 | 18.0 | 11.7 | 16.1 |
| Switzerland | 20.7 | 20.5 | 15.7 | 22.4 | 11.5 |
| United Kingdom | 19.6 | 21.8 | 22.0 | 28.4 | 15.3 |
| Weighted average | 19.1 | 19.8 | 21.3 | 25.3 | 14.5 |
| Unweighted average | 19.2 | 19.6 | 21.4 | 25.5 | 14.3 |

Source: HBSC 2013-14

Table 2 – Effect of family affluence on the probability of falling into the bottom-end group, controlling for age and gender (HBSC 2013/14)

| Country | Psychosomatic health | | Physical activity | | Fruit and vegetables | | Sweets and soft drinks | | Life satisfaction | |
|----------------|----------------------|-------------------|-------------------|-------------------|----------------------|-------------------|------------------------|-------------------|-------------------|-------------------|
| | B | 95% CI | B | 95% CI | B | 95% CI | B | 95% CI | B | 95% CI |
| Austria | -0.007 | (-0.051 – 0.037) | -0.111 | (-0.158 – -0.063) | -0.106 | (-0.158 – -0.054) | 0.043 | (-0.014 – 0.100) | -0.126 | (-0.165 – -0.087) |
| Belgium | -0.052 | (-0.084 – -0.020) | -0.210 | (-0.244 – -0.177) | -0.132 | (-0.159 – -0.104) | -0.109 | (-0.143 – -0.075) | -0.097 | (-0.128 – -0.065) |
| Bulgaria | 0.008 | (-0.036 – 0.052) | -0.151 | (-0.203 – -0.100) | -0.144 | (-0.188 – -0.100) | 0.009 | (-0.044 – 0.062) | -0.136 | (-0.179 – -0.094) |
| Canada | -0.084 | (-0.119 – -0.048) | -0.134 | (-0.174 – -0.094) | -0.203 | (-0.248 – -0.157) | -0.027 | (-0.068 – 0.014) | -0.160 | (-0.205 – -0.115) |
| Croatia | -0.002 | (-0.047 – 0.043) | -0.097 | (-0.135 – -0.060) | -0.092 | (-0.135 – -0.049) | 0.030 | (-0.015 – 0.074) | -0.084 | (-0.120 – -0.048) |
| Czech Republic | 0.063 | (0.022 – 0.103) | -0.123 | (-0.160 – -0.085) | -0.130 | (-0.173 – -0.087) | 0.003 | (-0.045 – 0.051) | -0.038 | (-0.070 – -0.006) |
| Denmark | -0.020 | (-0.066 – 0.026) | -0.150 | (-0.197 – -0.102) | -0.173 | (-0.224 – -0.123) | -0.053 | (-0.102 – -0.004) | -0.103 | (-0.138 – -0.068) |
| Estonia | -0.025 | (-0.073 – 0.023) | -0.188 | (-0.237 – -0.139) | -0.189 | (-0.236 – -0.142) | 0.071 | (0.024 – 0.118) | -0.160 | (-0.197 – -0.122) |
| Finland | -0.023 | (-0.062 – 0.016) | -0.083 | (-0.113 – -0.053) | -0.145 | (-0.184 – -0.106) | 0.027 | (-0.014 – 0.068) | -0.074 | (-0.104 – -0.044) |
| France | 0.004 | (-0.039 – 0.047) | -0.136 | (-0.177 – -0.095) | -0.143 | (-0.187 – -0.099) | -0.072 | (-0.124 – -0.019) | -0.134 | (-0.176 – -0.092) |
| Germany | -0.019 | (-0.056 – 0.017) | -0.151 | (-0.192 – -0.110) | -0.100 | (-0.141 – -0.060) | -0.038 | (-0.079 – 0.004) | -0.117 | (-0.156 – -0.078) |
| Greece | 0.012 | (-0.036 – 0.059) | -0.086 | (-0.129 – -0.044) | -0.124 | (-0.167 – -0.081) | -0.021 | (-0.063 – 0.022) | -0.076 | (-0.111 – -0.041) |
| Hungary | -0.033 | (-0.079 – 0.012) | -0.119 | (-0.156 – -0.083) | -0.176 | (-0.226 – -0.125) | -0.161 | (-0.221 – -0.101) | -0.240 | (-0.292 – -0.188) |
| Iceland | -0.057 | (-0.082 – -0.033) | -0.135 | (-0.166 – -0.104) | -0.128 | (-0.159 – -0.098) | -0.037 | (-0.067 – -0.007) | -0.106 | (-0.128 – -0.083) |
| Ireland | -0.082 | (-0.128 – -0.037) | -0.099 | (-0.143 – -0.054) | -0.152 | (-0.202 – -0.102) | -0.108 | (-0.167 – -0.048) | -0.142 | (-0.180 – -0.105) |
| Italy | -0.011 | (-0.058 – 0.036) | -0.158 | (-0.207 – -0.109) | -0.155 | (-0.203 – -0.107) | -0.034 | (-0.091 – 0.023) | -0.098 | (-0.137 – -0.059) |
| Latvia | -0.052 | (-0.086 – -0.018) | -0.216 | (-0.254 – -0.178) | -0.150 | (-0.190 – -0.110) | 0.057 | (0.016 – 0.099) | -0.154 | (-0.189 – -0.119) |
| Lithuania | -0.068 | (-0.106 – -0.029) | -0.163 | (-0.209 – -0.118) | -0.182 | (-0.218 – -0.146) | -0.003 | (-0.051 – 0.046) | -0.157 | (-0.186 – -0.127) |
| Luxembourg | -0.060 | (-0.116 – -0.005) | -0.219 | (-0.271 – -0.167) | -0.203 | (-0.254 – -0.151) | 0.000 | (-0.055 – 0.056) | -0.175 | (-0.222 – -0.127) |
| Malta | -0.054 | (-0.113 – 0.006) | -0.087 | (-0.164 – -0.010) | -0.041 | (-0.100 – 0.017) | 0.024 | (-0.021 – 0.070) | -0.096 | (-0.162 – -0.030) |
| Netherlands | -0.052 | (-0.096 – -0.009) | -0.201 | (-0.242 – -0.161) | -0.164 | (-0.210 – -0.117) | 0.057 | (0.009 – 0.104) | -0.127 | (-0.171 – -0.083) |
| Norway | -0.016 | (-0.061 – 0.029) | -0.132 | (-0.178 – -0.087) | -0.068 | (-0.120 – -0.016) | 0.039 | (-0.016 – 0.094) | -0.145 | (-0.188 – -0.103) |
| Poland | -0.049 | (-0.093 – -0.005) | -0.116 | (-0.158 – -0.074) | -0.149 | (-0.197 – -0.100) | -0.018 | (-0.059 – 0.023) | -0.185 | (-0.227 – -0.143) |
| Portugal | -0.079 | (-0.121 – -0.037) | -0.063 | (-0.096 – -0.030) | -0.116 | (-0.166 – -0.067) | -0.020 | (-0.076 – 0.037) | -0.196 | (-0.237 – -0.155) |
| Romania | -0.051 | (-0.099 – -0.004) | -0.129 | (-0.173 – -0.085) | -0.030 | (-0.082 – 0.022) | 0.039 | (-0.027 – 0.104) | -0.141 | (-0.191 – -0.090) |
| Slovakia | -0.042 | (-0.081 – -0.003) | -0.170 | (-0.208 – -0.132) | -0.128 | (-0.164 – -0.092) | -0.042 | (-0.085 – 0.001) | -0.145 | (-0.188 – -0.101) |
| Slovenia | 0.015 | (-0.019 – 0.048) | -0.116 | (-0.156 – -0.076) | -0.053 | (-0.088 – -0.017) | 0.012 | (-0.035 – 0.058) | -0.081 | (-0.114 – -0.048) |
| Spain | -0.045 | (-0.078 – -0.011) | -0.092 | (-0.127 – -0.057) | -0.126 | (-0.165 – -0.087) | -0.056 | (-0.096 – -0.017) | -0.121 | (-0.148 – -0.093) |
| Sweden | -0.052 | (-0.089 – -0.016) | -0.203 | (-0.238 – -0.168) | -0.104 | (-0.135 – -0.073) | -0.024 | (-0.051 – 0.004) | -0.125 | (-0.155 – -0.094) |
| Switzerland | 0.038 | (0.000 – 0.076) | -0.108 | (-0.145 – -0.070) | -0.054 | (-0.088 – -0.019) | 0.036 | (-0.002 – 0.074) | -0.114 | (-0.145 – -0.084) |
| United Kingdom | -0.064 | (-0.090 – -0.038) | -0.192 | (-0.218 – -0.166) | -0.213 | (-0.240 – -0.186) | -0.067 | (-0.096 – -0.037) | -0.135 | (-0.158 – -0.113) |

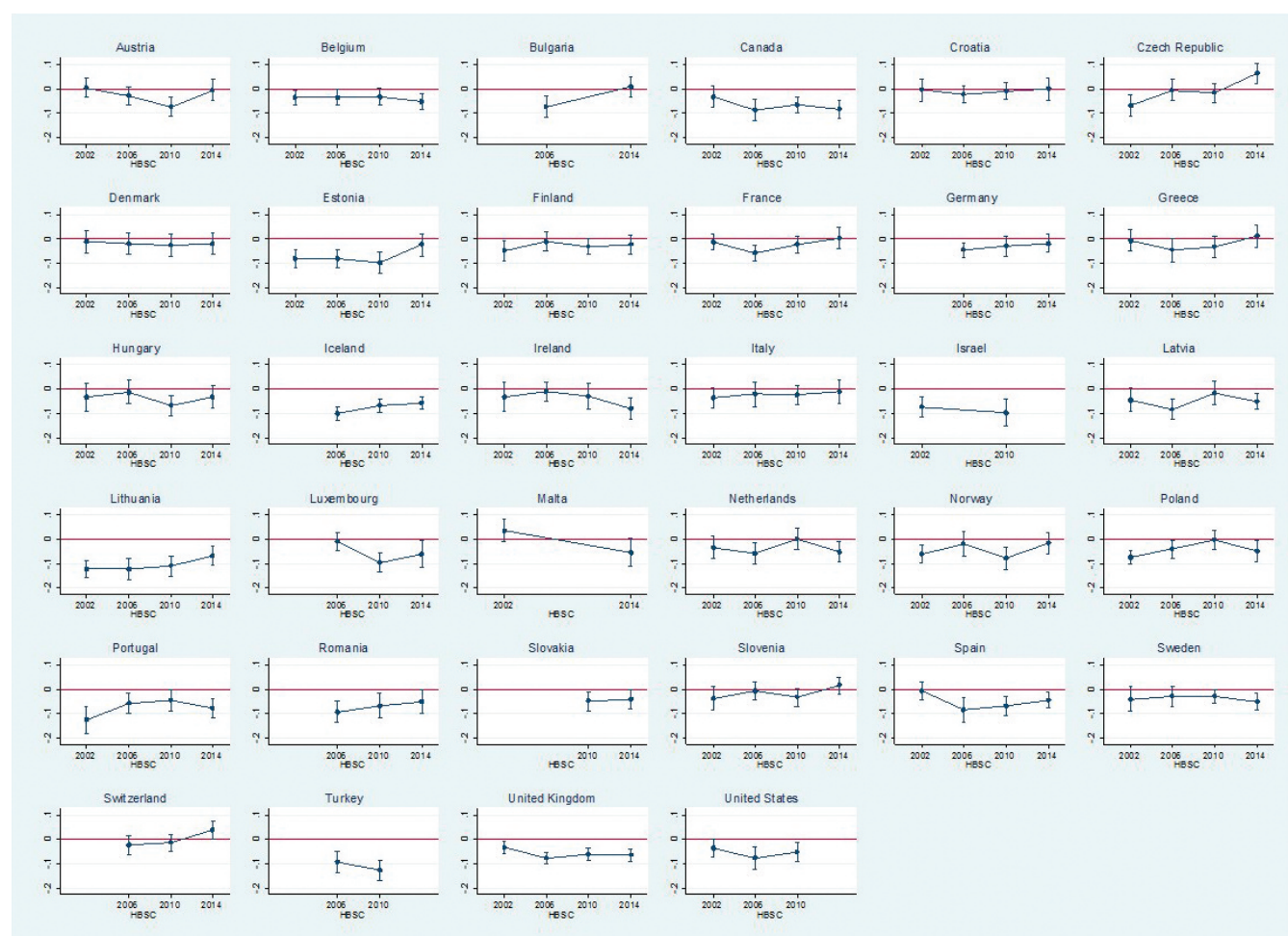
Standard errors adjusted for clustering at the school level and stratification by region (Belgium and the United Kingdom). Statistically significant effects ($p < 0.05$) in bold.

Meanwhile, in the majority of the countries analyzed, there are no significant socio-economic inequalities in unhealthy eating in 2013/14. In eight countries adolescents from more affluent households are less likely to report frequent consumption of sweets and sugary drinks, while in three others (Estonia, Latvia and the Netherlands), they are more likely to do so.

Inequalities in health between socio-economic groups have also been assessed for all countries in 2001/02, 2005/06 and 2009/10. Table 3 shows highly comparable results to those described for 2013/14. In virtually all countries, lower reported family affluence was associated with a higher likelihood of being in the bottom end of physical activity, life satisfaction and healthy eating. Again, for psychosomatic health, in about half of the countries adolescents with lower family affluence were more likely to be in the bottom end, while in other countries no association was revealed. For unhealthy eating, a more mixed pattern of associations emerged, with higher family affluence being associated with a higher, lower, or equal likelihood of being in the bottom end.

Figures 1-5 describe the strength of the association between FAS and the health indicators across the four survey cycles separately by indicator and country. Socio-economic inequalities in psychosomatic health symptoms tend to be stable, with no significant differences over time, except in the Czech Republic, where the gradient has changed from being negative (-0.07 , $p < 0.01$) in 2001/02 to positive (0.06 , $p < 0.01$) in 2013/14 (Figure 1). In eight countries, statistically significant

Figure 1 – FAS gradient in bottom-end psychosomatic symptoms between 2002 and 2014



socio-economic inequalities in psychosomatic health have persisted over time: Belgium, Canada, Iceland, Israel, Lithuania, Portugal, the UK and the US. There was a large and significant FAS gradient in Estonia between 2001/02 and 2009/10, but it is no longer significant in 2013/14.

Figure 2 shows that in the vast majority of the countries studied, the sizeable and statistically significant socio-economic gradient in physical activity has remained stable over time.

In six countries it has become significantly larger in absolute terms between 2001/02 and 2013/14: Belgium, Italy, Latvia, the Netherlands, Sweden, and the UK (Figure 2). In these countries, adolescents from lower socio-economic backgrounds are increasingly less likely to engage in physical activity of at least 60 minutes a day.

The FAS gradient in healthy eating has also remained stable in most of the countries studied (Figure 3, page 16). However, in Canada and the UK it increased, suggesting that adolescents from lower socio-economic backgrounds are increasingly less likely to consume fruit and vegetables when compared with their peers. In three other countries – Latvia, Lithuania, and Romania – the FAS gradient has decreased. Although in Latvia and Lithuania adolescents from lower-affluence families are still significantly less likely to eat healthily, in Romania socio-economic inequalities are no longer significant in 2013/14.

Figure 2 – FAS gradient in bottom-end physical activity between 2002 and 2014

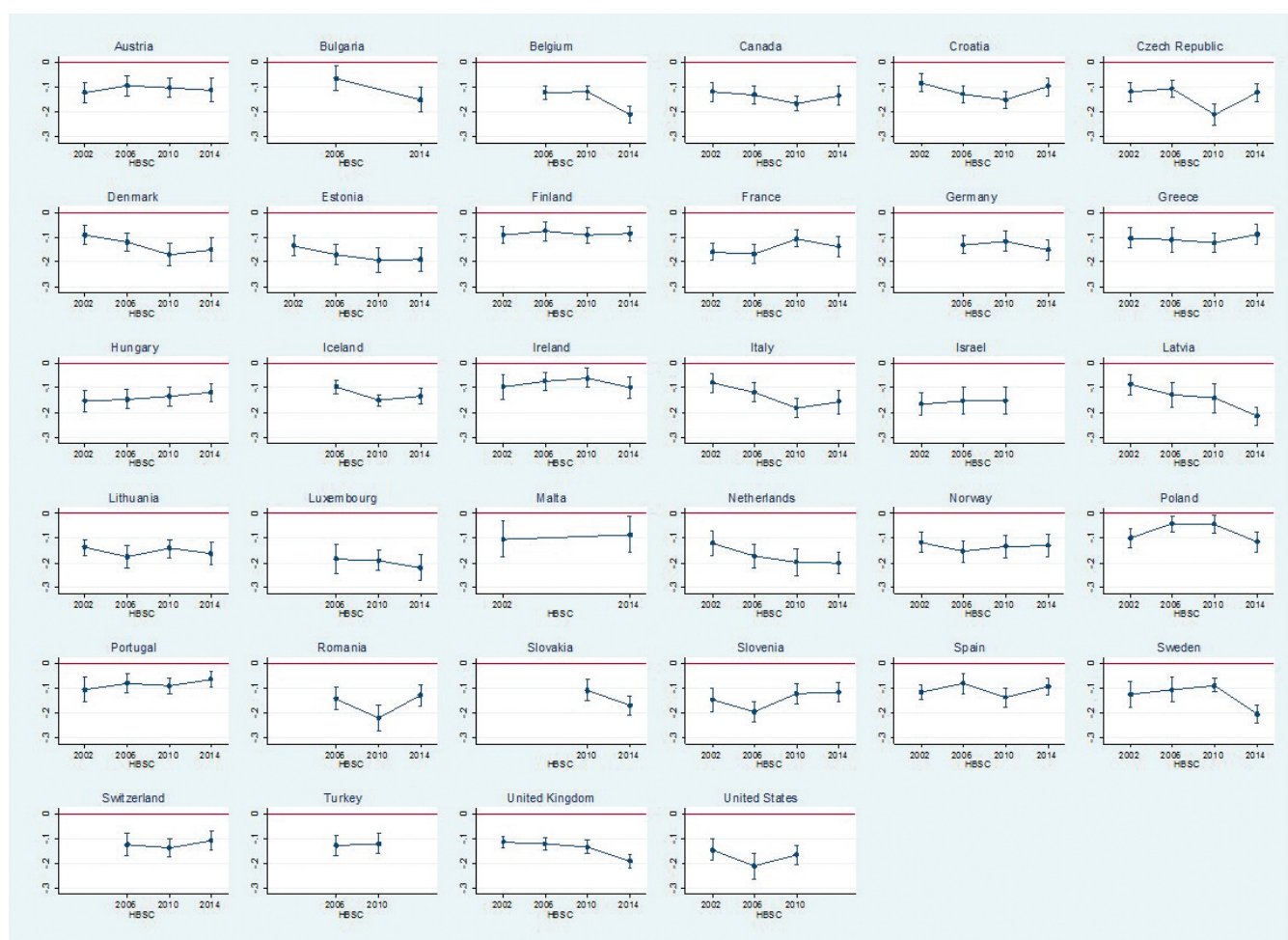
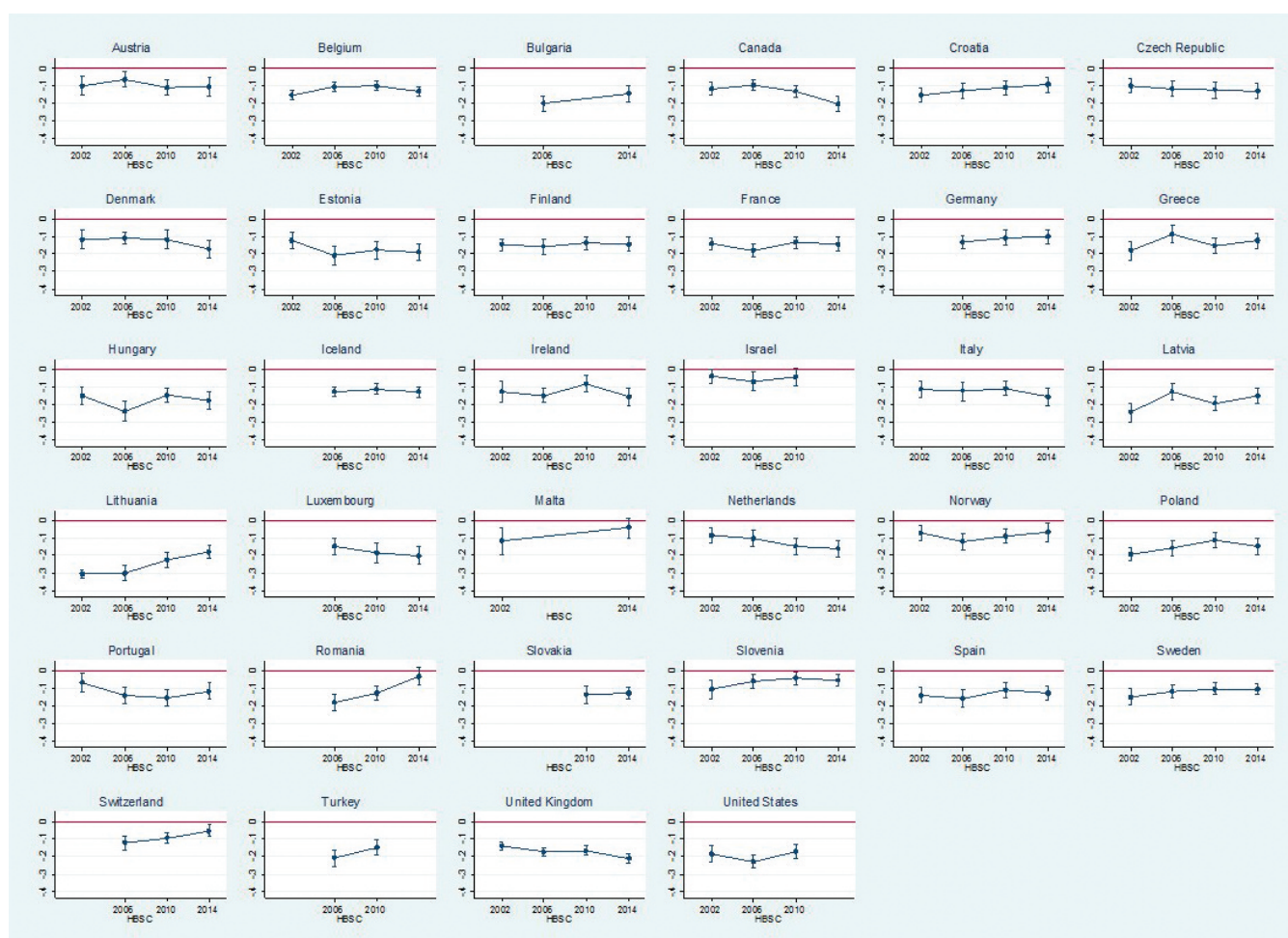
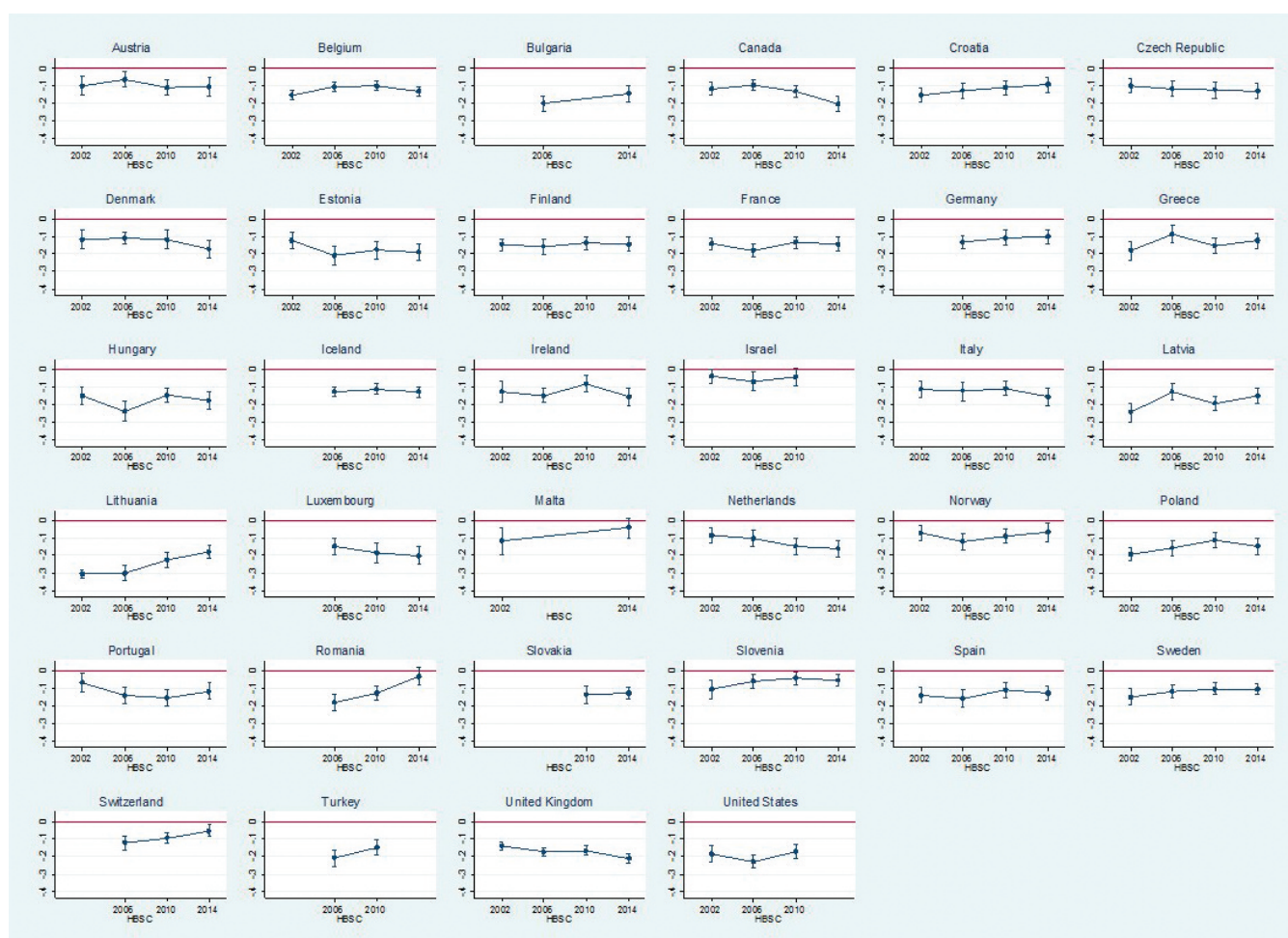


Figure 3 – FAS gradient in bottom-end fruit and vegetables consumption between 2002 and 2014

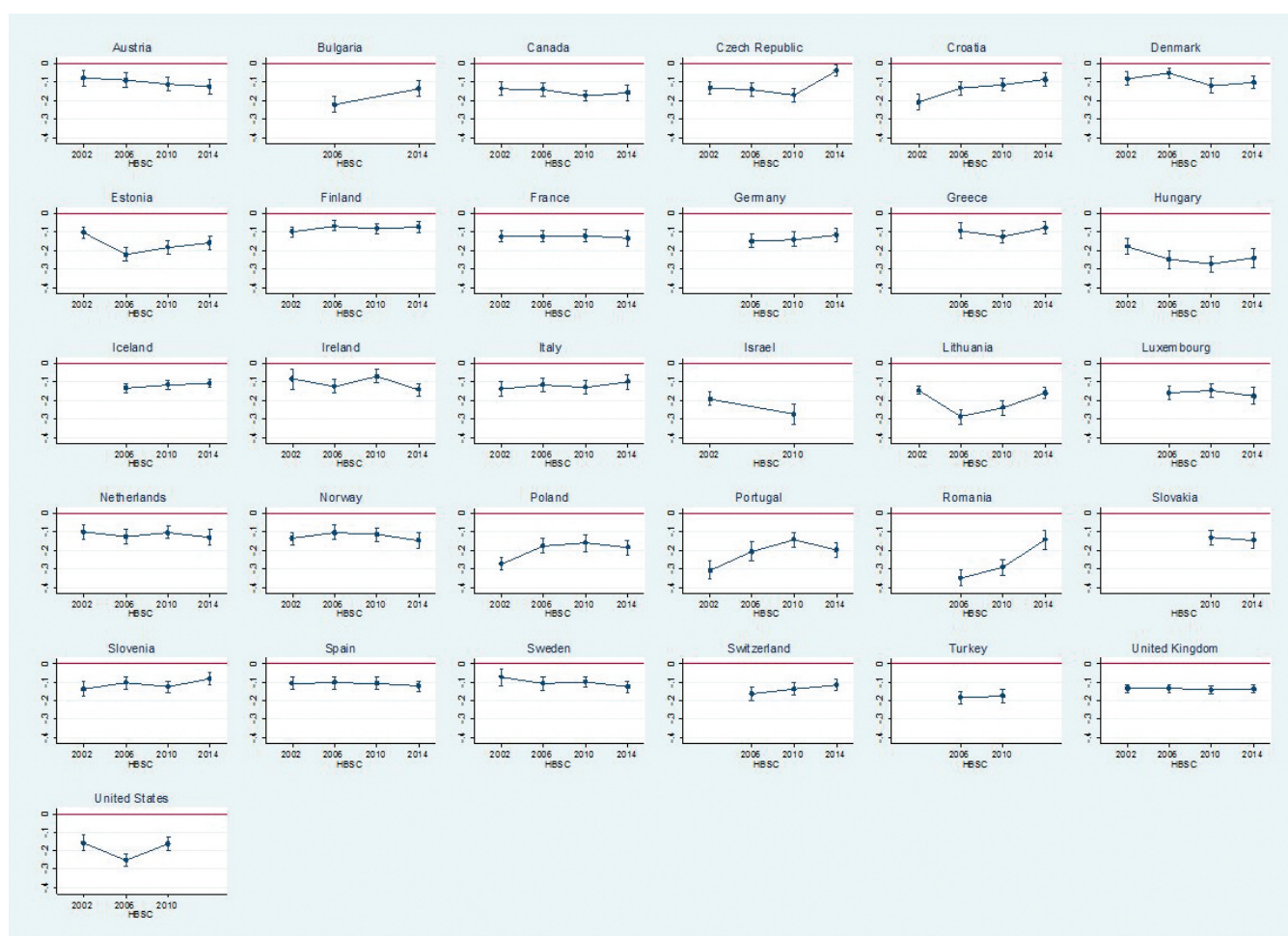
In most countries, socio-economic inequalities in the consumption of sweets and sugary drinks have remained stable between 2001/02 and 2013/14 (Figure 4, page 17). In many of these countries there has not been a significant FAS gradient in unhealthy eating, but in countries like France, Ireland, Turkey and the United Kingdom, substantial inequalities have persisted over time. The FAS gradient has changed significantly in eight countries. In six of these – Estonia, Latvia, Lithuania, Poland, Portugal and Romania – inequalities have narrowed or disappeared altogether, with children from more affluent backgrounds being increasingly less likely to report a higher frequency of sweets and sugary drinks consumption. An opposite trend is observed in the remaining two countries, Belgium and Hungary, where socio-economic inequalities are widening, with adolescents from less affluent backgrounds being increasingly more likely to report a higher frequency of unhealthy eating.

Adolescents from less affluent backgrounds have been significantly more likely to fall behind their peers in life satisfaction in any given year and in every single country studied (Tables 2 and 3). However, socio-economic inequalities in life satisfaction have narrowed over time in five countries: Croatia, the Czech Republic, Poland, Portugal and Romania (Figure 5, page 18).

Figure 4 – FAS gradient in bottom-end sweets and sugary drinks consumption between 2002 and 2014**Table 3 – Summary table describing relationships between FAS and indicators of bottom-end health**

| Bottom end group | Number of countries reporting Statistically significant association (at $p < 0.05$) between predictor and outcome | | | | | | | | | | | |
|---|--|-------|-------|------|-------|-------|------|-------|-------|------|-------|-------|
| | 2002 | | | 2006 | | | 2010 | | | 2014 | | |
| | + | = | - | + | = | - | + | = | - | + | = | - |
| Health symptoms | | | | | | | | | | | | |
| Psychosomatic health | | 16/26 | 10/26 | | 14/31 | 17/31 | | 15/32 | 17/32 | 2/31 | 14/31 | 15/31 |
| Physical activity | | | 25/25 | | | 31/32 | | | 31/32 | | | 31/31 |
| Fruit and vegetables | | 1/26 | 25/26 | | | 32/32 | | 1/32 | 31/32 | | 2/31 | 29/31 |
| Low frequency of consuming sweets and sugary drinks | 6/26 | 15/26 | 5/26 | 9/32 | 15/32 | 8/32 | 6/32 | 19/32 | 7/32 | 3/31 | 20/31 | 8/31 |
| Life satisfaction | | | 24/24 | | | 31/31 | | | 31/32 | | | 31/31 |

= no significant association at $p < 0.05$; + positive association; - negative association.

Figure 5 – FAS gradient in bottom-end life satisfaction between 2002 and 2014

4. DISCUSSION

The most important finding of this analysis of socio-economic inequalities in adolescent health is that such inequalities are high and stable in most countries as well as across time, in spite of absolute improvements in adolescent health in many countries. This suggests that structural inequalities can persist even in a context of overall absolute improvements. In the vast majority of EU and/or OECD countries at the four different points of time, adolescents from relatively low socio-economic status families had a greater likelihood of falling behind in health. The strength of the association between socio-economic status and the different indicators of adolescent health was similar across time within most countries.

Our findings are consistent with a large body of research that has examined socio-economic inequalities in adolescent health. However, given the cross-national and repeated time series design of our study, our analyses suggest that these insights are highly generalizable across countries and

cultures, as well as over time. Adolescents from relatively low socio-economic backgrounds are considerably more likely to be in the bottom end of adolescent health. This is a vitally important observation. Adolescence is a critical period of transition in the life course, characterised by biological, psychological and relational changes. Such transitions and associated changes are of fundamental importance to health and well-being (e.g., Viner et al., 2012), and set the stage for future patterns of adult inequalities (Patton et al. 2012, Richter 2010, Gore et al. 2011).

Our study findings also indicate that the influence of socio-economic factors on bottom-end health can vary considerably by the adolescent health and well-being indicator. For the physical health, healthy eating and life satisfaction indicators, socio-economic inequalities existed for virtually all countries and survey cycles between 2001/02 and 2013/14. For the psychosomatic health indicator, however, results were less straightforward: each year roughly half the countries showed a positive FAS gradient (i.e. privileging the better off), with the other half exhibiting no significant gradient. For unhealthy eating another pattern emerged, with no indication of an association with socio-economic status for more than half of the countries, and either a higher or lower likelihood of falling behind for adolescents from relatively less affluent households for the rest of the countries. Thus, when studying socio-economic inequalities in adolescent health, very different conclusions may be drawn depending upon the indicator under study.

These heterogeneous findings have a number of possible explanations. For psychosomatic health, it is possible that other individual factors, such as gender (Elgar et al. 2015) and proximal factors such as peer and family support (Matos et al. 2003) may be more important in the development of symptoms than an adolescent's socio-economic status. Moreover, unhealthy eating habits as indicated by sweets and soft drink consumption may be associated with knowledge about healthy diets, which is typically higher in more affluent socio-economic groups (Hulshof et al. 2003) and by parental occupation (Vereecken et al. 2005). This finding is corroborated in the current study, although the positive FAS gradient in sweets and soft drinks consumption in Eastern and Central European countries has decreased since 2001/02, remaining positive and significant only in 2013/14 in Estonia and Latvia.

Another notable finding in our analysis was that inequalities in adolescent health were widening in some of the countries studied, with adolescents from less affluent backgrounds being increasingly more likely to fall further behind their peers. For our indicator of physical activity, socio-economic inequalities increased in six countries during the 15-year study period (Belgium, Italy, Latvia, the Netherlands, Sweden, and the United Kingdom). In Canada and the United Kingdom, the association between socio-economic status and adolescent healthy eating became more pronounced over time, and the same applies to unhealthy eating in Belgium and Hungary. Widening national income inequalities tend to increase socio-economic differences in health, perpetuating the socio-economic divide (Elgar et al. 2015).

In contrast, in some (mostly Central or Eastern European) countries, inequalities in adolescent health decreased considerably between 2001/02 and 2013/14. Adolescents in Latvia and Lithuania from less affluent families were less likely to eat healthily, but this association weakened significantly between 2001/02 and 2013/04. For Romania, socio-economic inequalities in healthy

eating disappeared in the same period. In addition, it was found that for six countries in which adolescents from more affluent backgrounds were more likely to report a higher frequency of unhealthy eating in 2001, these inequalities narrowed or disappeared (Estonia Latvia, Lithuania, Poland, Portugal and Romania). Finally, socio-economic inequalities in life satisfaction narrowed over time in five countries: Croatia, the Czech Republic, Poland, Portugal and Romania. Although the deep cultural and socio-political reasons for these findings warrant further analysis, these results suggest that social gradients in health can evolve over time, either narrowing or widening.

This study has several potential limitations. First, the cross-sectional design of the HBSC study precludes the establishment of the temporal sequence of events, limiting claims on causality. Second, the indicators of adolescent health used here, although standardised and validated for cross-national comparison, come with their own inherent limitations. For example, the indicators of fruit, vegetables, sweets and sugary drinks consumption are all based on frequency of intake, rather than amounts consumed (Vereecken et al. 2015). Despite these challenges, the study advances our understanding of drivers of poor adolescent health across countries and over time by focusing on adolescents with substantially worse outcomes than their peers. Socio-economic status is a key predictor of falling in the bottom group in health on a range of indicators and, although socio-economic inequalities remain stable in many countries and increase in some, it is encouraging to find that they can also decrease over time in other countries.

6. CONCLUSION

This repeated cross-national analysis establishes that differences in socio-economic position in adolescent health and life satisfaction have remained large and stable in most EU and/or OECD countries over the last four HBSC cycles. In a sizeable minority of these countries, socio-economic inequalities in physical activity and healthy eating have widened over time. Inequalities in unhealthy eating and life satisfaction have narrowed in several countries. To sum up, the largest, most persistent and widespread socio-economic gradients were found for life satisfaction, physical activity and healthy eating, while the findings were mixed for unhealthy eating and psychosomatic health.

This analysis is unique to the adolescent health literature. Data were consistently collected via a common international protocol that has remained consistent across time, and the focus of the analysis remains of vital importance to populations of young people, providing foundational evidence to inform the creation of public health and social policies at international and national levels. While it is important to continue monitoring average levels of adolescent health, policy makers also need to pay attention to socio-economic inequalities in health and the concentration of poor health outcomes among the most economically disadvantaged groups.

7. REFERENCES

- Armfield, J. M., Spencer, A. J., Roberts-Thomson, K. F., & Plastow, K. (2013). Water fluoridation and the association of sugar-sweetened beverage consumption and dental caries in Australian children. *American journal of public health*, 103(3), 494–500.
- Brooks, F., Zaborskis, A., Tabak, I., Alcón, M. del C. G., Zemaitiene, N., de Roos, S., & Klemnera, E. (2015). Trends in adolescents' perceived parental communication across 32 countries in Europe and North America from 2002 to 2010. *The European Journal of Public Health*, 25(suppl 2), 46–50.
- Cantril, H. (1965). *Pattern of human concern*. Rutgers: Rutgers University Press.
- Catalano, R. F., Fagan, A. A., Gavin, L. E., Greenberg, M. T., Irwin, C. E., Ross, D. A., & Shek, D. T. (2012). Worldwide application of prevention science in adolescent health. *The Lancet*, 379(9826), 1653–1664.
- Cavallo, F., Dalmaso, P., Ottová-Jordan, V., Brooks, F., Mazur, J., Välimaa, R., et al. (2015a). Trends in self-rated health in European and North-American adolescents from 2002 to 2010 in 32 countries. *The European Journal of Public Health*, 25(suppl 2), 13–15.
- Cavallo, F., Dalmaso, P., Ottová-Jordan, V., Brooks, F., Mazur, J., Välimaa, R., et al. (2015b). Trends in life satisfaction in European and North-American adolescents from 2002 to 2010 in over 30 countries. *The European Journal of Public Health*, 25(suppl 2), 80–82.
- Chzhen, Y., Bruckauf, Z., Ng, K., Pavlova, D., Torsheim, T., & Matos, M. G. (2016). *Inequalities in adolescent health and life satisfaction: evidence from the Health Behaviour in School-Aged Children study*. (Innocenti Working Paper No. 2016-11). Florence: UNICEF Office of Research.
- Currie, C., Inchley, J., Molcho, M., Lenzi, M., Veselska, Z., & Wild, F. (Eds.). (2014). *Health Behaviour in School-aged Children (HBSC) study protocol: Background, methodology and mandatory items for the 2013/14 survey*. St Andrews: CAHRU.
- Currie, C., Menchini, L., Richardson, D., Currie, D., & Roberts, C. (2011). Comparing inequality in the well-being of children in economically advanced countries: a methodology. *Innocenti Working Paper*, IWP-2010-19.
- Currie, C., Molcho, M., Boyce, W., Holstein, B., Torsheim, T., & Richter, M. (2008). Researching health inequalities in adolescents: the development of the Health Behaviour in School-Aged Children (HBSC) family affluence scale. *Social science & medicine*, 66(6), 1429–1436.
- Currie, C., Zanotti, C., Morgan, A., Currie, D., de Looze, M., Roberts, C., et al. (2012). *Social determinants of health and well-being among young people*. Copenhagen: World Health Organization Regional Office for Europe.
- de Looze, M., Raaijmakers, Q., Ter Bogt, T., Bendtsen, P., Farhat, T., Ferreira, M., et al. (2015). Decreases in adolescent weekly alcohol use in Europe and North America: evidence from 28 countries from 2002 to 2010. *The European Journal of Public Health*, 25(suppl 2), 69–72.

- de Ruyter, J. C., Olthof, M. R., Seidell, J. C., & Katan, M. B. (2012). A trial of sugar-free or sugar-sweetened beverages and body weight in children. *New England Journal of Medicine*, 367(15), 1397–1406.
- Dunn, V., & Goodyer, I. M. (2006). Longitudinal investigation into childhood-and adolescence-onset depression: psychiatric outcome in early adulthood. *The British Journal of Psychiatry*, 188(3), 216–222.
- Ebbeling, C. B., Pawlak, D. B., & Ludwig, D. S. (2002). Childhood obesity: public-health crisis, common sense cure. *The Lancet*, 360(9331), 473–482.
- Elgar, F. J., Pfortner, T.-K., Moor, I., De Clercq, B., Stevens, G. W., & Currie, C. (2015). Socioeconomic inequalities in adolescent health 2002–2010: a time-series analysis of 34 countries participating in the Health Behaviour in School-aged Children study. *The Lancet*, 385(9982), 2088–2095.
- Frederick, C. B., Snellman, K., & Putnam, R. D. (2014). Increasing socioeconomic disparities in adolescent obesity. *Proceedings of the National Academy of Sciences*, 111(4), 1338–1342.
- Geckova, A. M., van Dijk, J. P., Zezula, I., Tunistra, J., Groothoff, J. W., & Post, D. (2004). Socio-economic differences in health among Slovak adolescents. *Sozial-und Präventivmedizin*, 49(1), 26–35.
- Gregory, A. M., Van der Ende, J., Willis, T. A., & Verhulst, F. C. (2008). Parent-reported sleep problems during development and self-reported anxiety/depression, attention problems, and aggressive behavior later in life. *Archives of pediatrics & adolescent medicine*, 162(4), 330–335.
- Hanson, M. D., & Chen, E. (2007). Socioeconomic status and health behaviors in adolescence: a review of the literature. *Journal of behavioral medicine*, 30(3), 263–285.
- Haugland, S., & Wold, B. (2001). Subjective health complaints in adolescence-reliability and validity of survey methods. *Journal of adolescence*, 24(5), 611–624.
- Haugland, S., Wold, B., Stevenson, J. I. M., Aaroe, L. E., & Woynarowska, B. (2001). Subjective health complaints in adolescence. *The European Journal of Public Health*, 11(1), 4–10.
- Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, 312(5782), 1900–1902.
- He, F. J., Nowson, C. A., Lucas, M., & MacGregor, G. A. (2007). Increased consumption of fruit and vegetables is related to a reduced risk of coronary heart disease: meta-analysis of cohort studies. *Journal of human hypertension*, 21(9), 717–728.
- He, F. J., Nowson, C. A., & MacGregor, G. A. (2006). Fruit and vegetable consumption and stroke: meta-analysis of cohort studies. *The Lancet*, 367(9507), 320–326.
- Holstein, B. E., Currie, C., Boyce, W., Damsgaard, M. T., Gobina, I., Kökönyei, G., et al. (2009). Socio-economic inequality in multiple health complaints among adolescents: international comparative study in 37 countries. *International Journal of Public Health*, 54(2), 260–270.

- Hublet, A., Bendtsen, P., de Looze, M. E., Fotiou, A., Donnelly, P., Vilhjalmsson, R., et al. (2015). Trends in the co-occurrence of tobacco and cannabis use in 15-year-olds from 2002 to 2010 in 28 countries of Europe and North America. *The European Journal of Public Health*, 25(suppl 2), 73–75.
- Hulshof, K., Brussaard, J. H., Kruizinga, A. G., Telman, J., & Löwik, M. R. H. (2003). Socio-economic status, dietary intake and 10 y trends: the Dutch National Food Consumption Survey. *European Journal of Clinical Nutrition*, 57(1), 128–137.
- Kalman, M., Inchley, J., Sigmundova, D., Iannotti, R. J., Tynjälä, J. A., Hamrik, Z., et al. (2015). Secular trends in moderate-to-vigorous physical activity in 32 countries from 2002 to 2010: a cross-national perspective. *The European Journal of Public Health*, 25(suppl 2), 37–40.
- Kalsbeek, H., & Verrips, G. H. (1994). Consumption of sweet snacks and caries experience of primary school children. *Caries Research*, 28(6), 477–483.
- Knudsen, E. I., Heckman, J. J., Cameron, J. L., & Shonkoff, J. P. (2006). Economic, neurobiological, and behavioral perspectives on building America's future workforce. *Proceedings of the National Academy of Sciences*, 103(27), 10155–10162.
- Kuntsche, E., & Ravens-Sieberer, U. (2015). Monitoring adolescent health behaviours and social determinants cross-nationally over more than a decade: introducing the Health Behaviour in School-aged Children (HBSC) study supplement on trends. *The European Journal of Public Health*, 25(suppl 2), 1–3.
- Levin, K. A., & Currie, C. (2014). Reliability and validity of an adapted version of the Cantril ladder for use with adolescent samples. *Social Indicators Research*, 119(2), 1047–1063.
- Levin, K. A., Torsheim, T., Vollebergh, W., Richter, M., Davies, C. A., Schnohr, C. W., et al. (2011). National income and income inequality, family affluence and life satisfaction among 13 year old boys and girls: A multilevel study in 35 countries. *Social indicators research*, 104(2), 179–194.
- Magklara, K., Skapinakis, P., Niakas, D., Bellos, S., Zissi, A., Stylianidis, S., et al. (2010). Socioeconomic inequalities in general and psychological health among adolescents: a cross-sectional study in senior high schools in Greece. *Int J Equity Health*, 9(3).
- Malik, V. S., Pan, A., Willett, W. C., & Hu, F. B. (2013). Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis. *The American journal of clinical nutrition*, 98(4), 1084–1102.
- Malik, V. S., Schulze, M. B., & Hu, F. B. (2006). Intake of sugar-sweetened beverages and weight gain: a systematic review. *The American journal of clinical nutrition*, 84(2), 274–288.
- Marshall, T. A., Levy, S. M., Broffitt, B., Warren, J. J., Eichenberger-Gilmore, J. M., Burns, T. L., & Stumbo, P. J. (2003). Dental caries and beverage consumption in young children. *Pediatrics*, 112(3), e184–e191.
- Matos, M. G., Barrett, P., Dadds, M., & Shortt, A. (2003). Anxiety, depression, and peer relationships during adolescence: Results from the Portuguese national health behaviour in school-aged children survey. *European Journal of Psychology of Education*, 18(1), 3–14.

- McDaid, D., Park, A.-L., Currie, C., & Zanotti, C. (2014). Investing in the wellbeing of young people: making the economic case. In D. McDaid & C. Cooper (Eds.), *Economics of wellbeing* (Vol. 5). Oxford: Wiley-Blackwell.
- Moor, I., Lampert, T., Rathmann, K., Kuntz, B., Kolip, P., Spallek, J., & Richter, M. (2014). Explaining educational inequalities in adolescent life satisfaction: do health behaviour and gender matter? *International journal of public health*, 59(2), 309–317.
- Moor, I., Rathmann, K., Lenzi, M., Pförtner, T.-K., Nagelhout, G. E., de Looze, M., et al. (2015). Socioeconomic inequalities in adolescent smoking across 35 countries: a multilevel analysis of the role of family, school and peers. *The European Journal of Public Health*, cku244.
- Nishtar, S., Gluckman, P., & Armstrong, T. (2016). Ending childhood obesity: a time for action. *The Lancet*, 387(10021), 825–827.
- Patton, G. C., Coffey, C., Cappa, C., Currie, D., Riley, L., Gore, F., et al. (2012). Health of the world's adolescents: a synthesis of internationally comparable data. *The Lancet*, 379(9826), 1665–1675.
- Piko, B. F., & Fitzpatrick, K. M. (2007). Socioeconomic status, psychosocial health and health behaviours among Hungarian adolescents. *The European Journal of Public Health*, 17(4), 353–360.
- Prochaska, J. J., Sallis, J. F., & Long, B. (2001). A physical activity screening measure for use with adolescents in primary care. *Archives of Pediatrics & Adolescent Medicine*, 155(5), 554–559.
- Ravens-Sieberer, U., Erhart, M., Torsheim, T., Hetland, J., Freeman, J., Danielson, M., et al. (2008). An international scoring system for self-reported health complaints in adolescents. *The European Journal of Public Health*, 18(3), 294–299.
- Reiss, F. (2013). Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. *Social science & medicine*, 90, 24–31.
- Sawyer, S. M., Afifi, R. A., Bearinger, L. H., Blakemore, S.-J., Dick, B., Ezech, A. C., & Patton, G. C. (2012). Adolescence: a foundation for future health. *The Lancet*, 379(9826), 1630–1640. doi:10.1016/S0140-6736(12)60072-5
- Sheiham, A., & James, W. P. T. (2014). A new understanding of the relationship between sugars, dental caries and fluoride use: implications for limits on sugars consumption. *Public health nutrition*, 17(10), 2176–2184.
- Stalsberg, R., & Pedersen, A. V. (2010). Effects of socioeconomic status on the physical activity in adolescents: a systematic review of the evidence. *Scandinavian journal of medicine & science in sports*, 20(3), 368–383.
- Starfield, B., Riley, A. W., Witt, W. P., & Robertson, J. (2002). Social class gradients in health during adolescence. *Journal of Epidemiology and Community Health*, 56(5), 354–361.
- Torsheim, T., Currie, C., Boyce, W., Kalnins, I., Overpeck, M., & Haugland, S. (2004). Material deprivation and self-rated health: a multilevel study of adolescents from 22 European and North American countries. *Social science & medicine*, 59(1), 1–12.

- UNICEF. (2010). *The Children Left Behind: A league table of inequality in child well-being in the world's rich countries*. Florence: UNICEF Innocenti Research Centre.
- UNICEF. (2012). *Progress for Children: A report card on adolescents*. New York: UNICEF.
- UNICEF. (2016). *Fairness for Children: A league table of inequality in child well-being in rich countries*, Innocenti Report Card 13. Florence: UNICEF Office of Research.
- Vainio, H., & Weiderpass, E. (2006). Fruit and vegetables in cancer prevention. *Nutrition and cancer*, 54(1), 111–142.
- Valois, R. F., Zullig, K. J., Huebner, E. S., & Drane, J. W. (2004). Physical activity behaviors and perceived life satisfaction among public high school adolescents. *The Journal of school health*, 74(2), 59.
- Vereecken, C., Inchley, J., Subramanian, S. V., Hublet, A., & Maes, L. (2005). The relative influence of individual and contextual socio-economic status on consumption of fruit and soft drinks among adolescents in Europe. *The European Journal of Public Health*, 15(3), 224–232.
- Vereecken, C., Pedersen, T. P., Ojala, K., Krølner, R., Dzielska, A., Ahluwalia, N., et al. (2015). Fruit and vegetable consumption trends among adolescents from 2002 to 2010 in 33 countries. *The European Journal of Public Health*, 25(suppl 2), 16–19.
- Vereecken, C., Rossi, S., Giacchi, M. V., & Maes, L. (2008). Comparison of a short food-frequency questionnaire and derived indices with a seven-day diet record in Belgian and Italian children. *International journal of public health*, 53(6), 297–305.
- Vieno, A., Santinello, M., Pastore, M., & Perkins, D. D. (2007). Social support, sense of community in school, and self-efficacy as resources during early adolescence: An integrative model. *American Journal of Community Psychology*, 39(1-2), 177–190.
- Viner, R. M., Ozer, E. M., Denny, S., Marmot, M., Resnick, M., Fatusi, A., & Currie, C. (2012). Adolescence and the social determinants of health. *The Lancet*, 379(9826), 1641–1652.
- Welsh, J. A., Sharma, A., Cunningham, S. A., & Vos, M. B. (2011). Consumption of added sugars and indicators of cardiovascular disease risk among US adolescents. *Circulation*, 123(3), 249–257.
- Whiteford, H. A., Degenhardt, L., Rehm, J., Baxter, A. J., Ferrari, A. J., Erskine, H. E., et al. (2013). Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *The Lancet*, 382(9904), 1575–1586.
- WHO. (2011). *Information sheet: global recommendations on physical activity for health 5 - 17 years old*. World Health Organization.
http://www.who.int/dietphysicalactivity/publications/recommendations5_17years/en/.
Accessed 11 March 2016

8. ANNEX

Figure 1A – Gender gradient (girl (1) vs. boy (0)) in bottom-end psychosomatic symptoms between 2002 and 2014

