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Socioeconomic inequalities in adolescent health behaviours across 32 different countries – The role of country-level social mobility

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ABSTRACT

Higher family affluence is associated with healthier behaviours in adolescents, but the strength of this association varies across countries. Differences in social mobility at the country-level, i.e. the extent to which adolescents develop a different socioeconomic status (SES) than their parents, may partially explain why the association between family affluence and adolescent health behaviours is stronger in some countries than in others. Using data from adolescents aged 11–15 years from 32 countries, participating in the 2017/2018 wave of the Health Behaviour in School-aged Children (HBSC) study (N = 185,086), we employed multilevel regression models with cross-level interactions to examine whether country-level social mobility moderates the association between family affluence and adolescent health behaviours (i.e. moderate-to-vigorous physical activity, vigorous physical activity, healthy and unhealthy foods consumption, having breakfast regularly, and weekly smoking). Higher family affluence was more strongly associated with higher levels of adolescent physical activity in countries characterized by high levels of social mobility. No cross-level interactions were found for any of the other health behaviours. Differences in social mobility at the country-level may contribute to cross-national variations in socioeconomic inequalities in adolescent physical activity. Further research can shed light on the mechanisms linking country-level social mobility to inequalities in adolescent physical activity to identify targets for policy and interventions.

1. Background

Health behaviours affect health and mortality over the life course, and are influenced by both individual dispositions and the social environment (Mackenbach, 2012; Marmot et al., 2008; Viner et al., 2012). Several important health behaviours deteriorate during the transition from childhood to adolescence. For example, average levels of physical activity (Farooq et al., 2018), fruit and vegetable consumption (Albani et al., 2017), and the frequency of having breakfast (Alexy et al., 2010) tend to decrease, while the consumption of some unhealthy foods, such as soft drinks, tends to increase (Inchley et al., 2020). Meanwhile, substance use, such as tobacco smoking, often has its onset in adolescence (Moor et al., 2015). Importantly, health behaviours established during adolescence frequently continue into adulthood (Wiium et al., 2015), increasing the significance of targeting unhealthy behaviours in this phase of life.

In most high-income countries, higher family socioeconomic status (SES) is associated with more favourable health behaviours in adolescents, but the strength of this association varies considerably across countries (Pförtner et al., 2015; Sigmundová et al., 2019; Zaborskis et al., 2021). In recent years, there have been substantial efforts to identify country-level macroeconomic (e.g. GDP, income inequality),

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policy (e.g. educational system stratification), and sociocultural factors (e.g. meritocratic attitudes) that could explain why socioeconomic inequalities in adolescent health and health behaviours are larger in some countries than in others (Currie and Morgan, 2020; Dierckens et al., 2020; Weinberg et al., 2021). Most of these studies primarily focussed on inequalities in well-being and physical and mental health (Dierckens et al., 2020; Elgar et al., 2015; Högberg et al., 2019; Weinberg et al., 2021), whilst a smaller number examined the social gradient in health behaviours (Elgar et al., 2015; Pförtner et al., 2015; Rathmann et al., 2016). Overall, findings were mixed and depended on the health outcome or behaviour and country-level factor under consideration. For example, Elgar et al. (2015) reported that higher income inequality was associated with steeper inequalities in psychological and physical symptoms, but not in physical activity.

An area that, to our knowledge, has not been investigated is the contribution of country-level social mobility to cross-national differences in socioeconomic inequalities in adolescent health behaviours. Country-level social mobility refers to the extent to which adolescents develop a different SES to that of their parents within a given society. In countries with low levels of social mobility, children's socioeconomic chances are more strongly related to their parents' socioeconomic resources. If country-level social mobility is high, young people's own SES is less dependent on their parents' SES and more dependent on individual factors, such as skills and talent (Mackenbach, 2012; Simons et al., 2013). One might expect that countries with high levels of social mobility, which are often characterized by equitable social policies, also feature lower health inequalities. Yet, extensive research on adults has found that socioeconomic health inequalities are often equally strong or even stronger in countries with extensive welfare regimes, such as the Nordic countries, which also have particularly high levels of social mobility (Mackenbach, 2012). Only two studies have focussed specifically on the role of contextual-level social mobility. One study found larger inequalities in mortality in countries with higher levels of social mobility, and the other smaller inequalities in mortality in counties in the USA with more social mobility (Simons et al., 2013; Venkataramani et al., 2020). We were unable to identify any studies on contextual-level social mobility and socioeconomic inequalities in health behaviours (or health) among adolescents.

The inconsistent results of the limited research available may hint at the complexity of the relationship between contextual-level social mobility and health inequalities, yet also give reasons to hypothesize that country-level social mobility may contribute to cross-national variations in the associations between family SES and adolescent health behaviours. There are reasons to think that inequalities in adolescent health behaviours may be larger in countries with either low or high social mobility, without presenting a compelling case as to the direction of this hypothesized interaction. The competing lines of reasoning are outlined below.

1.) Why the association between family SES and adolescent health behaviours may be larger in countries with **low** social mobility

In countries characterized by low social mobility, adolescents are less likely to escape the socioeconomic circumstances of their parents. Once low-SES adolescents from such countries realize how unequal their chances are, they may increasingly feel entrapped in the circumstances of their parents and start to believe that they cannot attain long-term socioeconomic goals valued by society, such as esteemed, well-paid employment. This may lead to a decreased orientation towards the future, increased short-term gratification, and seeking alternative means to gain status, such as substance use and delinquent behaviour (Bak and Yi, 2020; Elstad, 2010; Van Houtte and Stevens, 2008). Accordingly, in a Mexican study, adolescents from poor families had worse health behaviours and higher risks of delinquency if they perceived fewer opportunities for upward social mobility for themselves (Ritterman Weintraub et al., 2015).

A second explanation relates to differences in the role of parental resources in less versus more socially mobile countries. A main predictor of adolescents' health behaviours is their own educational level (Kuntz and Lampert, 2013), which may also be thought of as an important mechanism (mediator) connecting parental SES to adolescent health behaviours. In less socially mobile countries, parental SES is a relatively stronger predictor of adolescent educational level. If the association between parental SES and adolescent educational level is stronger in a given country, then also the associations between family SES and adolescent health behaviours should be larger in this country. Conversely, if the association between parental SES and adolescent educational level is weaker, as expected in high-mobility countries, then also the associations between parental SES and adolescent health behaviours should be weaker.

2.) Why the association between family SES and adolescent health behaviours may be larger in countries with **high** social mobility

Higher country-level social mobility over the past generations may, in contrast, have led to widening socioeconomic inequalities in adolescent health behaviours, due to a potential accumulation of individuals with poor health, low cognitive ability, and vulnerable psychological characteristics amongst the lower socioeconomic strata resulting from an increasing salience of health-related selection mechanisms (Mackenbach, 2012; Simons et al., 2013). During the post-war period, social mobility rose substantially in many high-income countries, facilitated by egalitarian policies (Breen, 2010; Mackenbach, 2012). For example, Sweden removed tuition fees, made books, teaching aids, school meals, and school-based health care freely available, and increased the tracking age within the educational system (Breen, 2010; Jonsson and Erikson, 2000; OECD, 1981). Such policies partially offset disadvantages faced by students from low-SES families, allowing individuals with high cognitive ability and resilient psychological characteristics to attain a higher SES than their family of origin (Breen, 2010). This could have led to a homogenization of an increasingly smaller low-SES group in terms of vulnerable psychological characteristics in highly socially mobile countries. Vulnerable psychological characteristics tend to be associated with decreased chances for upward social mobility, as well as poorer health behaviours (Mackenbach, 2012).

A second explanation of why socioeconomic differences in adolescent health behaviours might be larger in more socially mobile countries could relate to stronger collective beliefs in equality of opportunity and meritocracy (i.e. the idea that people get what they deserve) in these countries. These beliefs may lead to a higher tolerance for inequalities (Heiserman et al., 2020; Shariff et al., 2016) and stigmatization of low-SES individuals, who are considered responsible for their life circumstances (Destin, 2020; Simons et al., 2018). In adults, SES-related stigmatization has been associated with poorer mental health (Chan et al., 2022; Simons et al., 2017) and, somewhat less consistently, with substance use (Ahuja et al., 2022; Sartor et al., 2021; Simons et al., 2017). Accordingly, stronger country-level meritocratic beliefs predicted steeper associations of family affluence with life satisfaction and psychosomatic complaints in adolescents (Weinberg et al., 2021). Stronger collective meritocratic beliefs may thus be a potential mechanism linking higher country-level social mobility to more pronounced socioeconomic inequalities in adolescent health behaviours.

1.1. Aim

To the best of our knowledge, this is the first study investigating whether associations between parental SES and adolescent health behaviours differ depending on country-level social mobility. Depending on the line of reasoning used, these associations might be either larger or smaller in countries characterized by high levels of social mobility. Making use of a large cross-national sample of adolescents from 32 countries with varying levels of social mobility, we evaluated health

behaviours for which socioeconomic inequalities have most consistently been found in adolescents: physical activity, consumption of healthy (i.e. fruit and vegetables) and unhealthy (i.e. sweets and soft drinks) foods, having breakfast regularly, and smoking (Elgar et al., 2015; Moor et al., 2015; Zaborskis et al., 2021).

2. Methods

2.1. Sample

We used data from the Health Behaviour in School-aged Children (HBSC) study, an international cross-sectional study investigating health behaviours of adolescents aged 10–16 years in collaboration with the World Health Organization (WHO), which is carried out every four years in a network of countries in the WHO European Zone and North America (Inchley et al., 2018). For our analysis, the 2017/2018 wave of HBSC was used, which included nationally representative samples of adolescents from 44 different countries, who were recruited using cluster sampling with classes within schools as initial sampling units (N = 242,581; mean age = 13.50). The response rates at the individual level exceeded 60% for most participating countries (HBSC Network, 2020). Data were collected using self-report questionnaires, which were completed in the classroom under the supervision of a teacher or trained interviewer. The same standardized protocol was used in all countries, ensuring consistency in measures, sampling methods, and implementation (Inchley et al., 2018). Passive or active consent was obtained from school administrators, parents, and adolescents prior to participation, in line with the regulations in each participating country. We restricted our analysis to 32 countries for which country-level social mobility, as defined below, could be calculated based on the European Social Survey (ESS), yielding a final sample of 185,086 adolescents (76% of the original sample).

2.2. Individual-level variables

2.2.1. Family affluence

Parental socioeconomic status (SES) was assessed using the Family Affluence Scale (FAS) III. The FAS III is a validated adolescent-report questionnaire with six items, which has shown good validity and reliability, as well as higher response rates than other adolescent-report SES indicators (Torsheim et al., 2016). The FAS III captures different aspects of the family's material resources: car ownership, having one's own bedroom, holidays abroad, computer ownership, dishwasher ownership, and number of bathrooms. The Cronbach's alpha for the FAS III in our study was 0.56. The HBSC countries vary widely in terms of economic conditions, which needs to be accounted for when evaluating family affluence. Therefore, we ridit-transformed the FAS sum scores (range 0–13) separately for each country, gender, and age group (i.e. <12.5 years, 12.5–14.5 years, and >14.5 years) using the 'egenmore' package for STATA (Cox, 2000; Elgar et al., 2017), eliminating endogeneity due to differences on these variables. This yielded a score ranging from 0 (lowest SES) to 1 (highest SES) with a mean of 0.5 for each country. In regression analyses, coefficients can be interpreted as the differences in the outcome between the highest and lowest SES groups (Elgar et al., 2017).

2.3. Health behaviours

Only health behaviours for which socioeconomic inequalities (i.e. higher FAS = better health behaviours) have been found in most of the HBSC countries were included in this study as outcomes: physical activity, eating behaviours, and smoking (Elgar et al., 2015; Moor et al., 2015; Voráčová et al., 2016; Zaborskis et al., 2021).

2.4. Physical activity

We used two indicators of physical activity: moderate-to-vigorous physical activity (MVPA), and vigorous physical activity (VPA) (Inchley et al., 2018). MVPA was measured using the following item: "Over the past 7 days, on how many days were you physically active for a total of at least 60 min per day?". Response options ranged from 0 to 7 days. VPA was assessed with the following question: "Outside school hours: how often do you usually exercise in your free time so much that you get out of breath or sweat? The response options were 'never' = 0, 'less than once a month' = 1, 'once a month' = 2, 'once a week' = 3, '2 to 3 times a week' = 4, '4 to 6 times a week' = 5, and 'every day' = 6.

2.5. Eating behaviours

Four questions on foods consumed were asked: "How many times a week do you consume fruit/vegetables/sweetened soft drinks/sweets?" (Inchley et al., 2018). Response options were 'never' = 0, 'less than once a week' = 1, 'once a week' = 2, '2–4 days a week' = 3, '5–6 days a week' = 4, 'once daily' = 5, 'more than once daily' = 6. Two sum scores were created (range 0–12), capturing the consumption of healthy (fruit/vegetables) and unhealthy foods (sweets/soft drinks).

Breakfast consumption was assessed as follows: "How often do you usually have breakfast (more than a glass of milk or fruit juice)?" Response options ranged from 'never' = 0 to 'five days' = 5 for weekdays, and from 'never' = 0 to 'both days' = 2 for weekend days. Responses for weekdays and weekend days were summed to generate a score representing the number of days per week on which breakfast was consumed. As breakfast on weekends was not assessed in Slovakia, Slovak participants (N = 4785) were excluded from analyses investigating breakfast consumption.

2.6. Tobacco smoking

Smoking was assessed with the following question: "On how many days (if any) did you smoke cigarettes?" Adolescents could respond with the following options with respect to the last 30 days: 'never' = 0, '1–2 days' = 1, '3–5 days' = 2, '6–9 days' = 3, '10–19 days' = 4, '20–29 days' = 5, and '30 days (or more)' = 6. Adolescents' answers were dichotomized into a binary variable indicating weekly smoking (i.e. '3–5 days or more' = 1 vs. '1–2 days or less' = 0).

2.7. Individual-level covariates

Furthermore, we included age (range 11–16.5) and gender ('female' = 0, 'male' = 1) as individual-level covariates in the analysis.

2.8. Country-level variables

2.8.1. Social mobility

We used data from the 2018 (Round 9) edition of the European Social Survey (ESS) to calculate country-level social mobility (ESS Data Team, 2021). For five countries, data from previous editions of the ESS were used since they were not available in the 2018 version: Russia and Israel (ESS Round 8, 2016), Albania and Ukraine (ESS Round 6, 2012), and Greece (ESS Round 5, 2010). ESS participants were asked to self-report their own and their parents' highest level of education. To compare countries, educational attainment was recoded into a 7-category variable specifically developed for the ESS (ES-ISCED), which is based on the International Standard Classification of Education (ISCED) scale (**S1 Table**) (Schneider, 2020). As no Polish participants were assigned to category I (i.e. less than lower secondary education), and no Finnish, Bulgarian, Portuguese, Ukrainian, and Russian participants to category IIIb (i.e. lower tier upper secondary education), we collapsed category I with II, and IIIb with IIIa, respectively, generating a 5-category measure of educational attainment which is consistent across all 32 countries. In

case mothers and fathers differed in terms of their highest educational attainment, we used whichever was higher (dominance method). The sample of ESS participants was restricted to those aged 25–65, as the majority in this age range have already completed their education and not reached retirement, yielding a sample size of N = 37,653 participants (Gugushvili et al., 2019).

Country-level social mobility was operationalized using a relative educational mobility measure (Bukodi et al., 2020), as this was expected to be the most salient measure for adolescents, who are likely to be more aware of their prospects in terms of educational attainment than occupational status or income. Relative measures of educational mobility compare individuals' positions on the educational ladder (relative to their peers) to their parents' educational position (relative to the parents' own peers). Hence, these measures take into account changes across cohorts in the prevalence of educational credentials (e.g. as consequence of educational expansion) (Gugushvili et al., 2019). A social mobility score was created for each country using uniform difference (UNIDIFF) models and the 'udiff' package for STATA (Breen, 2004; Jann and Seiler, 2019). On their original scale, higher UNIDIFF parameters indicate stronger associations between parents' and children's educational attainment and therefore lower relative educational mobility (Präg and Gugushvili, 2020). To enhance interpretability, we multiplied the scores by −1, such that higher scores indicate more social mobility in a given country.

2.9. Country-level covariates

Gross national income (GNI) and national income inequality, as measured with the GINI index for disposable (post-tax, post-transfer) income, were included as country-level covariates in the analysis. GINI coefficients for each country were obtained from the 9th version of the Standardized World Income Inequality Database (Solt, 2019). We used GINI coefficients for 2018 for all countries, except for Iceland, for which only 2017 scores were available. GNI per capita for each country in 2018 was obtained from the World Bank DataBank (World Bank, 2021). The Atlas Method was used to convert GNI scores in national currencies to USD, to facilitate cross-national comparisons.

2.10. Analysis

We conducted multilevel analyses to account for clustering within countries, with individual-level variables at level one and country-level variables at level two. We used linear regression for all continuous outcomes (i.e. MVPA and VPA, healthy foods consumption, unhealthy foods consumption, breakfast consumption), and logistic regression for weekly smoking. All individual-level variables were group mean centred, and all country-level variables were grand mean centred (social mobility and GINI scores) or standardized over the grand mean (GNI) prior to inclusion in multilevel models. Standardization of GNI scores was necessary to facilitate the convergence of models. Maximum likelihood with robust standard errors (MLR) was used as an estimation method to account for the non-normality of the data.

First, we computed null models (for linear regression only) to determine the proportions of variance in health behaviours explained by between-country differences, which is given by the Intraclass Correlation (ICC) (**S2 – S6 Tables, Model 0**). Second, we added the individual-level predictors (i.e. family affluence, age, and gender) (**S2 – S7 Tables, Model 1**). Third, we added the country-level predictors (i.e. social mobility score, GINI, and GNI) (**S2 – S7 Tables, Model 2**). Fourth, we included a random slope for family affluence, to test whether there were significant differences in the associations between family affluence and health behaviours across countries (**S2 – S7 Tables, Model 3**). Finally, we added cross-level interactions between all country-level variables and family affluence (in case random slopes were significant) (**S2 – S7 Tables, Model 4**), to test whether the association between family affluence and health behaviours differed depending on country-level social mobility, GINI, and GNI.

As the proportion of missing observations was low for all variables (**S8 Table**), missing data were handled using listwise deletion. All analyses were conducted in STATA 16.1 (data processing and UNIDIFF models) and Mplus 8.8 (multilevel models).

3. Results

Table 1 shows differences across countries for all health behaviours, mean levels of family affluence, as well as GNI, income inequality, and country-level social mobility.

Table 2 shows the results of our final multilevel models. The ICCs were rather small, suggesting that only a small proportion of the variance in the five health behaviours was explained by between-country differences (3.9% for MVPA, 2.4% for VPA, 2.2% for healthy food consumption, 6.3% for unhealthy food consumption, and 4.0% for breakfast consumption). The variance of the random slope for family affluence was significant for all six health behaviours, indicating that the strength of the associations between family affluence and health behaviours differed across countries. Higher family affluence was consistently associated with better health behaviours: adolescents from more affluent families tended to be more physically active, eat more healthily, had breakfast on more days per week, and smoked less frequently than youths from less affluent families. Adolescents from more socially mobile countries on average consumed less unhealthy foods, had breakfast more often, and had lower odds of smoking than adolescents from less socially mobile countries.

We only found significant cross-level interactions between country-level social mobility and family affluence for MVPA and VPA (Beta-coefficient: 0.34; SE 0.13; p = 0.009, and 0.31; 0.10; p = 0.002, respectively), indicating that the association between higher family affluence and more physical activity was stronger in countries with higher social mobility. To shed further light on these interactions, we plotted them using the Johnson-Neyman technique (Fig. 1) (Bauer and Curran, 2005; Lin, 2020; Muthén and Muthén, 2022). These plots show the associations between family affluence and MVPA and VPA at different levels of country-level social mobility, as predicted by the multilevel models. For both outcomes, the associations were stronger at higher levels of social mobility, yet the confidence intervals never crossed zero within the observed range of social mobility scores (i.e. −0.58 to 0.79). This suggests that, despite the interaction, there was still an association between family affluence and MVPA/VPA in countries with relatively low social mobility, such as Hungary. These observations are largely confirmed by country-wise linear regression models of the associations of family affluence with MVPA and VPA, of which the resulting beta-coefficients are presented in Fig. 2 (in order of the social mobility score of each country).

4. Discussion

In line with past research, higher family affluence was significantly associated with better health behaviours (i.e. higher levels of moderate-to-vigorous and vigorous physical activity, increased consumption of healthy foods, lower consumption of unhealthy foods, having breakfast more frequently, lower odds of weekly smoking). As expected, we found that associations between family affluence and health behaviours varied across countries (Elgar et al., 2015; Pförtner et al., 2015; Rathmann et al., 2016). Furthermore, we found that higher levels of country-level social mobility were associated with somewhat better health behaviours in the adolescent population: on average, adolescents from more socially mobile countries tended to consume less unhealthy foods, had breakfast more frequently and tended to smoke less. Finally, the positive association between family affluence and physical activity (both MVPA and VPA) was stronger in more socially mobile countries. No cross-level interactions with country-level social mobility were found for any of the other health behaviours.

Table 1
Characteristics of adolescents participating in the HBSC Study (2018, N = 185,086) and their countries (N = 32).

			Country-level characteristics			Individual-level characteristics								
			Social mobility[c]	GNI	GINI	Family affluence sum score	MVPA	VPA	Healthy foods consumed	Unhealthy foods consumed	Days per week with breakfast	Weekly smoking	Male gender	Age
Country		N				Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	N (%)	N (%)	Mean (SD)
All countries[a]	–	185,086	0.00	33,544	0.30	8.36 (2.48)	4.08 (2.06)	4.00 (1.59)	7.63 (2.87)	5.55 (2.80)	5.25 (2.27)	8476 (4.82)	91,277 (49.32)	13.51 (1.63)
Albania	AL	1765	−0.02	4860	0.38	6.08 (2.83)	4.11 (2.07)	4.14 (1.65)	8.90 (2.75)	6.62 (3.20)	4.76 (2.43)	65 (3.81)	803 (45.50)	13.55 (1.52)
Austria	AT	4129	−0.29	48,950	0.28	9.25 (1.97)	4.30 (2.01)	4.34 (1.33)	7.54 (2.75)	5.71 (2.76)	4.33 (2.53)	182 (4.51)	2036 (49.31)	13.28 (1.62)
Belgium	BE	9911	0.08	46,010	0.26	8.83 (2.20)	3.98 (2.08)	3.85 (1.58)	8.17 (2.84)	6.18 (3.02)	5.42 (2.21)	291 (3.04)	4935 (49.79)	13.33 (1.70)
Bulgaria	BG	4548	−0.30	8530	0.38	7.25 (2.29)	4.19 (2.21)	4.06 (1.79)	7.58 (3.01)	6.40 (3.19)	5.08 (2.11)	576 (12.66)	2200 (48.37)	13.53 (1.65)
Croatia	HR	5169	−0.12	14,280	0.29	7.60 (2.35)	4.39 (2.02)	3.73 (1.73)	7.14 (2.70)	5.75 (2.82)	5.08 (2.21)	456 (9.19)	2635 (50.98)	13.80 (1.70)
Czech Rep	CZ	11,564	−0.33	20,560	0.24	8.05 (2.36)	4.18 (1.97)	4.01 (1.51)	7.94 (2.80)	5.42 (2.71)	5.04 (2.33)	608 (5.33)	5821 (50.34)	13.37 (1.66)
Denmark	DK	3181	0.20	61,260	0.27	9.61 (1.86)	3.55 (1.98)	3.87 (1.42)	7.97 (2.76)	4.69 (2.18)	5.86 (1.92)	104 (3.31)	1545 (48.57)	13.33 (1.61)
Estonia	EE	4725	0.27	21,300	0.31	8.20 (2.27)	4.00 (1.99)	3.95 (1.48)	7.80 (2.70)	5.21 (2.32)	5.38 (2.17)	260 (5.64)	2369 (50.14)	13.78 (1.64)
Finland	FI	3146	0.21	48,160	0.26	8.84 (1.92)	4.80 (1.93)	4.43 (1.35)	6.94 (2.71)	4.48 (1.91)	5.62 (2.06)	168 (5.43)	1562 (49.65)	13.92 (1.61)
France	FR	9170	0.10	41,150	0.30	8.52 (2.10)	3.41 (2.00)	3.75 (1.65)	7.27 (3.01)	5.66 (3.07)	5.41 (2.25)	352 (3.91)	4539 (49.50)	13.30 (1.46)
Germany	DE	4347	−0.05	47,410	0.30	9.32 (2.07)	3.81 (1.93)	4.10 (1.44)	7.33 (2.78)	5.57 (2.61)	5.00 (2.40)	174 (4.06)	2041 (46.95)	13.41 (1.68)
Greece	GR	3863	−0.22	19,060	0.32	6.76 (2.22)	4.03 (2.03)	4.30 (1.49)	7.23 (2.50)	4.76 (2.30)	4.71 (2.37)	196 (5.14)	1927 (49.88)	13.82 (1.66)
Hungary	HU	3789	−0.58	14,980	0.28	7.26 (2.55)	4.05 (2.12)	4.11 (1.60)	7.11 (2.86)	6.13 (2.98)	4.57 (2.41)	178 (6.66)	1788 (47.19)	13.52 (1.63)
Iceland	IS	6996	0.79	67,760	0.25	9.20 (1.80)	4.45 (2.04)	4.25 (1.53)	7.62 (2.87)	3.63 (2.19)	5.49 (2.16)	136 (2.00)	3510 (50.17)	13.60 (1.63)
Ireland	IE	3833	−0.07	59,280	0.30	9.22 (2.19)	4.68 (1.99)	4.42 (1.44)	8.03 (2.82)	4.86 (2.36)	5.89 (1.92)	95 (2.52)	1940 (50.61)	13.41 (1.56)
Israel	IL	7712	−0.09	41,320	0.34	8.47 (2.69)	2.98 (2.22)	3.49 (1.91)	8.10 (3.44)	6.45 (3.33)	4.69 (2.43)	218 (4.10)	3482 (45.15)	13.63 (1.59)
Italy	IT	4144	−0.11	33,810	0.34	7.83 (2.27)	3.36 (1.96)	3.68 (1.62)	6.95 (2.89)	5.63 (2.71)	5.02 (2.48)	317 (7.74)	1998 (48.21)	13.68 (1.62)
Latvia	LV	4412	0.16	16,530	0.35	7.20 (2.49)	3.99 (2.09)	4.09 (1.48)	7.13 (2.53)	5.28 (2.37)	5.35 (2.17)	275 (6.35)	2188 (49.59)	13.47 (1.65)
Lithuania	LT	3797	0.08	17,450	0.36	6.95 (2.50)	4.29 (1.96)	3.76 (1.73)	7.52 (2.81)	5.40 (2.63)	4.93 (2.37)	373 (10.05)	1914 (50.41)	13.70 (1.65)
Netherlands	NL	4698	0.25	51,250	0.27	8.98 (1.84)	4.30 (1.96)	4.24 (1.31)	7.96 (2.18)	6.19 (2.60)	6.24 (1.58)	151 (3.23)	2287 (48.68)	13.51 (1.60)
Norway	NO	3127	0.22	80,320	0.26	9.88 (1.72)	4.30 (1.87)	4.24 (1.30)	7.63 (2.68)	4.65 (2.10)	5.91 (1.82)	42 (3.02)	1517 (48.51)	13.02 (1.61)
Poland	PL	5224	−0.04	14,150	0.29	7.76 (2.31)	4.22 (1.97)	3.71 (1.66)	7.61 (2.78)	5.76 (2.83)	5.44 (2.16)	265 (5.12)	2570 (49.20)	13.59 (1.66)
Portugal	PT	6126	−0.14	22,030	0.32	8.09 (2.30)	3.49 (1.87)	3.53 (1.82)	7.37 (3.06)	4.97 (2.78)	5.85 (1.87)	188 (3.19)	2926 (47.76)	13.31 (1.53)
Russia	RU	4281	0.18	10,250	0.32	6.44 (2.36)			7.59 (2.77)	5.51 (2.74)	5.19 (2.22)	157 (4.08)		

(*continued on next page*)

Table 1 (*continued*)

Country		N	Country-level characteristics: Social mobility[c]	GNI	GINI	Individual-level characteristics: Family affluence sum score	MVPA	VPA	Healthy foods consumed	Unhealthy foods consumed	Days per week with breakfast	Weekly smoking	Male gender	Age
						Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	N (%)	N (%)	Mean (SD)
							3.67 (2.07)	3.95 (1.67)					2043 (47.72)	13.82 (1.66)
Serbia	RS	3933	−0.38	6410	0.33	7.26 (2.50)	4.72 (2.16)	4.20 (1.76)	7.94 (2.90)	6.32 (3.18)	5.41 (2.06)	284 (7.38)	1945 (49.45)	13.98 (1.68)
Slovakia[b]	SK	4785	−0.35	18,320	0.23	7.72 (2.47)	4.38 (2.06)	4.30 (1.58)	7.63 (2.92)	6.31 (2.97)	–	302 (6.71)	2455 (51.31)	13.32 (1.52)
Slovenia	SI	5667	−0.25	24,610	0.25	9.38 (2.09)	4.53 (1.97)	4.28 (1.43)	7.83 (2.78)	4.57 (2.46)	4.65 (2.37)	241 (4.28)	2879 (50.80)	13.59 (1.63)
Spain	ES	4320	0.33	29,280	0.33	8.57 (2.27)	4.39 (1.97)	3.94 (1.58)	7.25 (2.76)	5.01 (2.68)	5.54 (2.10)	186 (4.38)	2088 (48.33)	13.62 (1.62)
Sweden	SE	4185	0.14	55,640	0.26	9.35 (1.98)	3.93 (2.02)	3.81 (1.54)	7.43 (2.80)	4.73 (2.17)	5.75 (2.00)	146 (3.64)	2081 (49.73)	13.63 (1.64)
Switzerland	CH	7510	−0.10	83,280	0.30	9.81 (1.97)	4.16 (1.87)	4.05 (1.32)	8.07 (2.70)	6.19 (2.66)	4.96 (2.39)	290 (3.89)	3785 (50.40)	13.42 (1.60)
UK	GB	24,369	0.34	42,410	0.32	9.16 (2.35)	4.23 (1.99)	4.03 (1.56)	7.39 (3.03)	5.87 (2.70)	5.01 (2.44)	891 (3.75)	12,221 (50.15)	13.50 (1.59)
Ukraine	UA	6660	0.08	2800	0.27	5.64 (2.34)	4.28 (2.15)	4.22 (1.57)	8.35 (2.75)	6.02 (2.81)	5.77 (1.97)	309 (4.76)	3247 (48.75)	13.40 (1.63)

SD = standard deviation; MVPA = moderate-to-vigorous physical activity; VPA = vigorous physical activity. [a] for the country-level variables, the mean of all 32 countries is given; [b] data on breakfast consumption is missing for Slovakia; [c] grand mean centred.

4.1. Interpretation of findings

In this study, we investigated whether associations between family affluence and adolescent health behaviours differ depending on country-level social mobility. Two competing lines of reasoning suggest that socioeconomic inequalities in adolescent health behaviours are either smaller or larger in countries with higher levels of social mobility.

The first line of reasoning was not supported by our results, as for none of the health-behaviours investigated socioeconomic differences based on parental SES were larger in countries with low levels of social mobility. It is possible that adolescents from low-SES backgrounds living in these countries may not be aware of the structural inequalities of opportunity in their societies and may instead be more strongly affected by factors in their immediate social environment, for example at school. It has been found that socioeconomic inequalities in adolescent smoking and mental health tend to be smaller in highly stratified educational systems, which more commonly characterize countries with low social mobility (Hanushek and Wößmann, 2006; Högberg et al., 2019; Pekkarinen, 2018; Rathmann et al., 2016; Van de Werfhorst and Mijs, 2010). A potential explanation for this surprising result could be that socially disadvantaged adolescents may experience less pressure from social comparison in their immediate social environment if grouped together with adolescents from similar backgrounds at school (Högberg et al., 2019), and this could at least temporarily offset the negative psychosocial consequences of a lack of social mobility in a given society. The differences in the educational systems between high- and low mobility countries also raise the possibility of variations in the associations between adolescents' own educational level and their health behaviours, depending on country-level social mobility. This could also explain why putatively stronger associations between parental SES and adolescents' own educational level in low-mobility countries did not lead to wider socioeconomic inequalities in these countries. Future studies may attempt to delineate potential differences in associations between measures of adolescents' own educational level and health behaviours between countries with high and low levels of social mobility.

We found only partial support for the second line of reasoning, as we detected larger inequalities in adolescent physical activity (both MVPA and VPA) in countries characterized by more social mobility. Country-level social mobility was not associated with inequalities in any of the other health behaviours we have assessed. These results corroborate previous international findings using HBSC data, which also found that interactions between country-level characteristics and family affluence are not comparable across all dimensions of adolescent health (behaviours) (Elgar et al., 2015). Since we only found cross-level interactions for two out of six outcomes, our findings are not fully compatible with the two explanations for potentially larger inequalities in more socially mobile countries explained above (i.e. increased health-related selection, stronger country-level meritocratic beliefs). Psychological characteristics relevant to health-related selection, such as behavioural control (Schmengler et al., 2022), are expected to predict multiple health behaviours simultaneously (Gray-Burrows et al., 2019; Stautz et al., 2016), rather than only physical activity specifically (Audiffren and André, 2019; Padin et al., 2017). Similarly, country-level meritocratic beliefs, which are potentially more prevalent in socially mobile societies, are unlikely to explain why we found a significant interaction for physical activity only, as SES-related stigmatization, partly by affecting mental health (Simons et al., 2018), would be expected to be associated with multiple health behaviours, including diet and smoking.

Explanations of why inequalities in physical activity are larger in socially mobile countries might instead be sought in factors specifically related to physical activity, but not necessarily other health behaviours. Future studies might, for example, focus on differences in educational systems between high- and low mobility countries (Hanushek and Wößmann, 2006; Pekkarinen, 2018), as stated above, specifically in relation to adolescents' participation in physical activity, as well as

Table 2
Multilevel regression models for adolescent health behaviours with country-level predictors and cross-level interaction terms between country-level predictors and individual-level family affluence in the HBSC Study (2017/2018, N participants = 185,086, N countries = 32).

	MVPA			VPA			Healthy foods consumed			
	N = 173,580			N = 174,119			N = 172,240			
	B	(SE)	p-value	B	(SE)	P-value	B	(SE)	p-value	
Individual-level										
Male gender	**0.50**	**(0.03)**	**<0.001**	**0.44**	**(0.04)**	**<0.001**	**−0.54**	**(0.03)**	**<0.001**	
Age	**−0.17**	**(0.02)**	**<0.001**	**−0.12**	**(0.01)**	**<0.001**	**−0.16**	**(0.01)**	**<0.001**	
Family affluence	**0.93**	**(0.04)**	**<0.001**	**0.68**	**(0.03)**	**<0.001**	**1.25**	**(0.06)**	**<0.001**	
Residual variance of the outcome at the individual level	**3.83**	**(0.07)**	**<0.001**	**2.33**	**(0.08)**	**<0.001**	**7.75**	**(0.21)**	**<0.001**	
Country-level										
Social mobility	0.10	(0.23)	0.670	−0.06	(0.12)	0.628	−0.01	(0.26)	0.957	
GINI	**−3.87**	**(1.75)**	**0.027**	−2.08	(1.07)	0.053	−0.12	(2.57)	0.964	
GNI	−0.08	(0.07)	0.298	0.01	(0.04)	0.829	0.00	(0.09)	0.999	
Intercept	**4.10**	**(0.07)**	**<0.001**	**4.03**	**(0.04)**	**<0.001**	**7.64**	**(0.08)**	**<0.001**	
Residual variance of the outcome at the country level	**0.15**	**(0.03)**	**<0.001**	**0.05**	**(0.01)**	**<0.001**	**0.18**	**(0.05)**	**<0.001**	
Residual variance of the slope of family affluence	**0.04**	**(0.01)**	**0.002**	**0.03**	**(0.01)**	**0.004**	**0.08**	**(0.03)**	**0.005**	
Cross-level interactions										
Family affluence × social mobility	**0.34**	**(0.13)**	**0.009**	**0.31**	**(0.10)**	**0.002**	0.17	(0.25)	0.481	
Family affluence × GINI	0.12	(1.22)	0.921	−0.44	(0.89)	0.621	1.04	(1.37)	0.446	
Family affluence × GNI	−0.01	(0.05)	0.892	0.02	(0.04)	0.586	−0.03	(0.05)	0.549	
Intraclass correlation coefficient	3.9%			2.4%			2.2%			
	Unhealthy foods consumed			Days per week with breakfast[a]			Weekly smoking			
	N = 172,224			N = 163,658			N = 168,271			
	B	(SE)	p-value	B	(SE)	P-value	B	(SE)	OR	p-value
Individual-level										
Male gender	**0.30**	**(0.03)**	**<0.001**	**0.31**	**(0.05)**	**<0.001**	0.05	(0.07)	1.05	0.525
Age	**0.12**	**(0.01)**	**<0.001**	**−0.21**	**(0.02)**	**<0.001**	**0.70**	**(0.03)**	**2.01**	**<0.001**
Family affluence	**−0.19**	**(0.07)**	**0.006**	**0.64**	**(0.06)**	**<0.001**	**−0.29**	**(0.06)**	**0.75**	**<0.001**
Residual variance of the outcome at the individual level	**7.24**	**(0.28)**	**<0.001**	**4.77**	**(0.16)**	**<0.001**	–	–	–	–
Country-level										
Social mobility	**−1.16**	**(0.37)**	**0.002**	**0.85**	**(0.32)**	**0.008**	**−0.57**	**(0.15)**	**0.56**	**<0.001**
GINI	5.47	(2.86)	0.056	−3.00	(1.70)	0.076	2.87	(1.74)	17.67	0.100
GNI	−0.06	(0.12)	0.626	−0.01	(0.07)	0.892	**−0.17**	**(0.05)**	**0.84**	**0.001**
Intercept/threshold	**5.49**	**(0.10)**	**<0.001**	**5.28**	**(0.07)**	**<0.001**	**3.53**	**(0.07)**	**34.02**	**<0.001**
Residual variance of the outcome at the country level	**0.31**	**(0.07)**	**<0.001**	**0.14**	**(0.03)**	**<0.001**	**0.09**	**(0.03)**	**1.10**	**0.001**
Residual variance of the slope of family affluence	**0.13**	**(0.03)**	**<0.001**	**0.09**	**(0.02)**	**<0.001**	**0.04**	**(0.02)**	**1.04**	**0.023**
Cross-level interactions										
Family affluence × social mobility	0.47	(0.31)	0.134	0.09	(0.18)	0.619	−0.31	(0.25)	0.74	0.219
Family affluence × GINI	−1.87	(1.94)	0.335	−0.75	(1.79)	0.673	1.89	(1.50)	6.64	0.208
Family affluence × GNI	−0.22	(0.12)	0.061	0.06	(0.06)	0.322	−0.03	(0.08)	0.97	0.714
Intraclass correlation coefficient	6.3%			4.0%			–			

B = unstandardized regression coefficient; SD = standard deviation; OR = odds ratio; MVPA = moderate-to-vigorous physical activity; VPA = vigorous physical activity. Unstandardized linear regressions were used for continuous outcomes (i.e. MVPA, VPA, healthy/unhealthy foods consumption, breakfast consumption). Logistic regression was used for weekly smoking. [a] Data on breakfast consumption is missing for Slovakia. Therefore, this analysis is based on 31 countries.

cultural differences in beliefs on the importance of sports for health and personal/group identity (Bann et al., 2019). Educational systems vary widely across countries in terms of curriculum time allocated to physical activity and the extent to which participation in sports is enforced at school (Bann et al., 2019). This could have implications for differences across countries in the engagement of low-SES adolescents in physical activity both as part of the formal curriculum, and during extracurricular activities. Furthermore, future studies might seek to gain understanding of the role of sports as source of a positive social identity (Hughson, 2009), sense of community, and belonging for low-SES adolescents in high and low social mobility countries (Eriksen and Stefansen, 2021). For example, it is possible that in low-mobility countries, which are characterized more strongly by traditional class structures and their transmission across generations, sports may be important for forming a positive "working class" social identity in low-SES adolescents (Hughson, 2009). Crucially, it is likely that educational, policy, and sociocultural factors interact in complex ways in shaping inequalities in adolescent physical activity. A complex system approach might therefore help understand why we find larger inequalities in physical activity in countries with high levels of social mobility (Diez Roux, 2011; Holdsworth et al., 2017).

An additional finding that warrants reflection is the association between higher country-level social mobility and better health behaviours, which was found for three out of six behaviours (i.e. less consumption of unhealthy foods, having breakfast more regularly, lower prevalence of smoking). This echoes previous studies showing that more egalitarian societies (e.g. in terms of social mobility (Gugushvili and Kaiser, 2020), and income equality (Pickett and Wilkinson, 2015)) often feature better overall population health, even whilst health inequalities in such countries are not necessarily smaller (Mackenbach, 2012; Simons et al., 2013). Country-level social mobility therefore also seems to be related to health behaviours in the whole population of adolescents rather than specifically those from low-affluent families. Socially mobile countries are frequently characterized by more generous welfare regimes, and higher educational spending (OECD, 2018) which, to a certain extent, may benefit adolescents from all socioeconomic groups similarly (Pickett and Wilkinson, 2015).

4.2. Strengths and limitations

Key strengths of this study are its large sample size and its cross-national approach, reflecting a wide range of socio-cultural, economic, and political contexts, whilst including identical measures of health behaviours and family affluence across 32 different countries (Inchley et al., 2018). However, our study also has several limitations. First, associations of the FAS with more conventional measures of family SES (parental income, educational level, occupational level) are often moderate at best (Corell et al., 2021), suggesting that we might not have

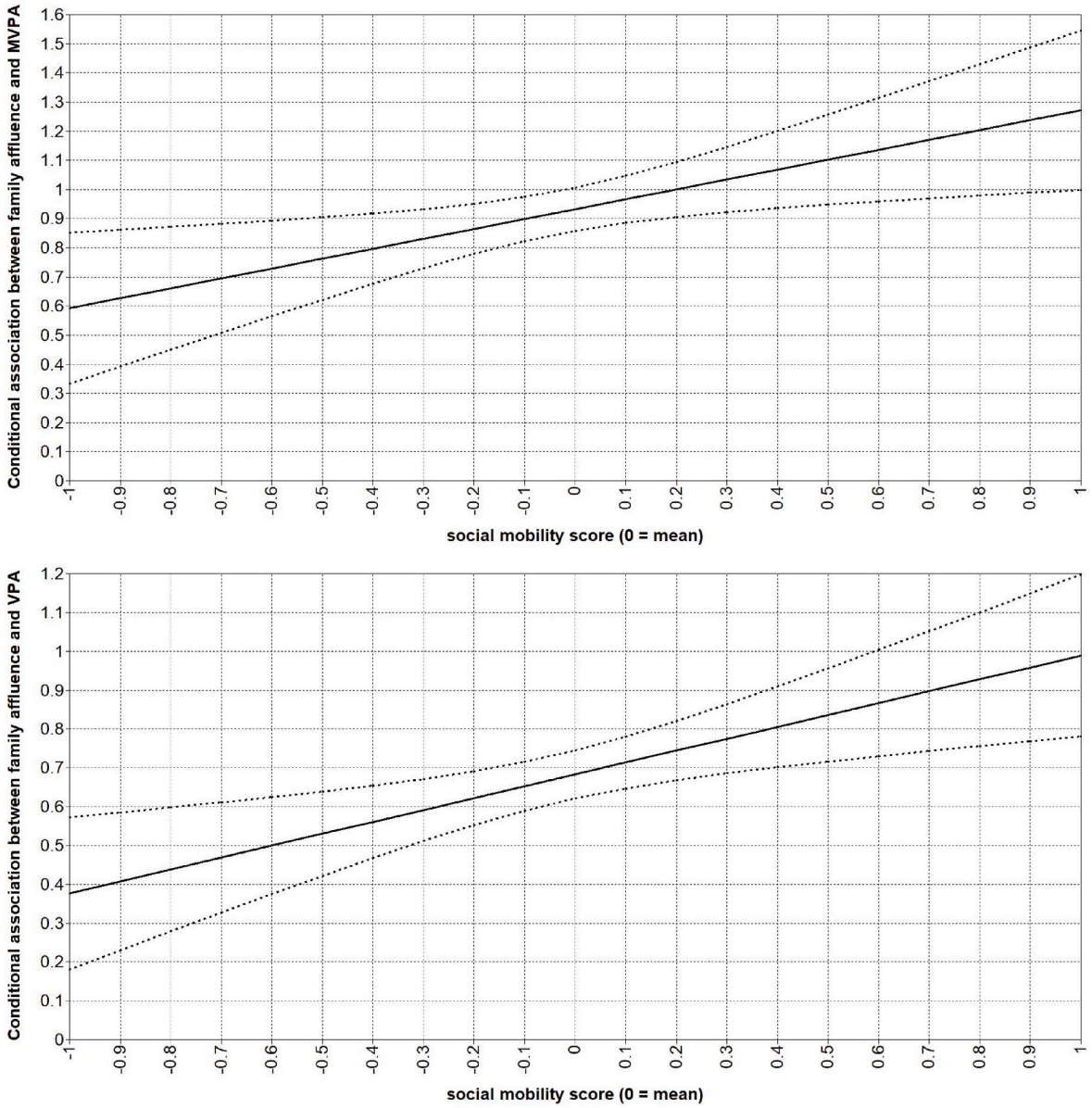
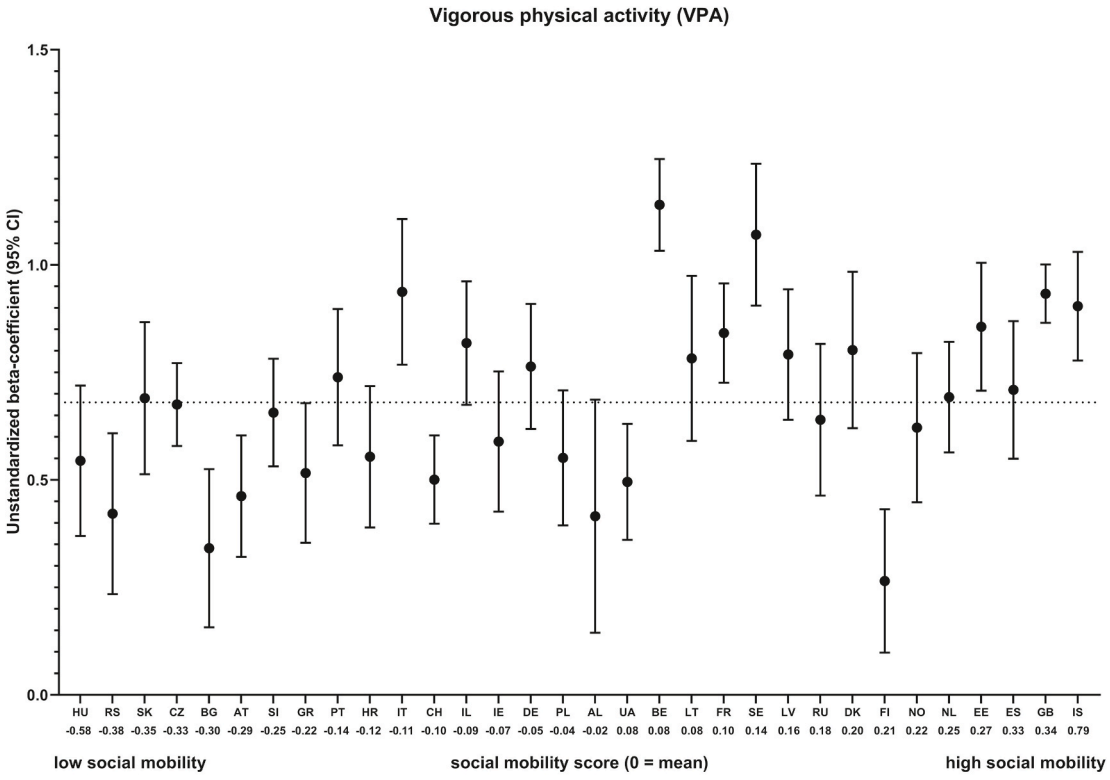


Fig. 1. Johnson–Neyman plots depicting the conditional associations of family affluence with moderate-to-vigorous physical activity (MVPA) and vigorous physical activity (VPA) at different levels of country-level social mobility. 95% confidence intervals (CIs) are represented by dotted lines.

tapped into all aspects of families' socioeconomic circumstances. Unfortunately, information on parental educational attainment, occupational status, and income are difficult to collect in exclusively adolescent-report surveys like HBSC, as adolescents often do not know detailed information on these variables from their parents (Hartley et al., 2016). Nevertheless, the FAS III is one of the most reliable and valid self-report measures of family SES of adolescents, with high agreement between parent and child-report scores (Andersen et al., 2008; Hartley et al., 2016). Information on other important dimensions of adolescents' SES, such as own educational level, were also not included in our study. Previous research suggests that different aspects of SES have distinct associations with health behaviours (Kuntz and Lampert, 2013; Schmengler et al., 2022) and may also interact differently with country-level factors, as compared to family affluence (Weinberg et al., 2021). Future studies may include more detailed assessments of SES, including adolescents' educational level, as well as parent-report questionnaires to additionally collect information on parents' educational level, income, and occupational status.

Second, our approach to measuring social mobility cannot distinguish between the extent of upward and downward social mobility in a given society, which may differ substantially between countries with similar overall social mobility (Bukodi et al., 2017), yet contextual levels of upward and downward mobility may have distinct associations with inequalities in adolescent health behaviours. Future research may study the extent of upward and downward social mobility in relation to health inequalities. Third, we cannot rule out residual confounding by country-level variables we have not assessed, and which are associated with both inequalities in health behaviours and country-level social mobility. While we have controlled for income inequality and GNI, we have not accounted for differences in policy factors that characterize countries with high vs. low social mobility, such as those related to the educational system. Further studies could evaluate such factors as a potential explanation of the wider inequalities in physical activity we found in highly socially mobile counties. Fourth, caution must be applied when interpreting our results in light of the 'ecological fallacy', as the units of analysis for social mobility were at the aggregate/country-level (Carneiro and Howard, 2011). We therefore do not know about the extent of social mobility individual HBSC



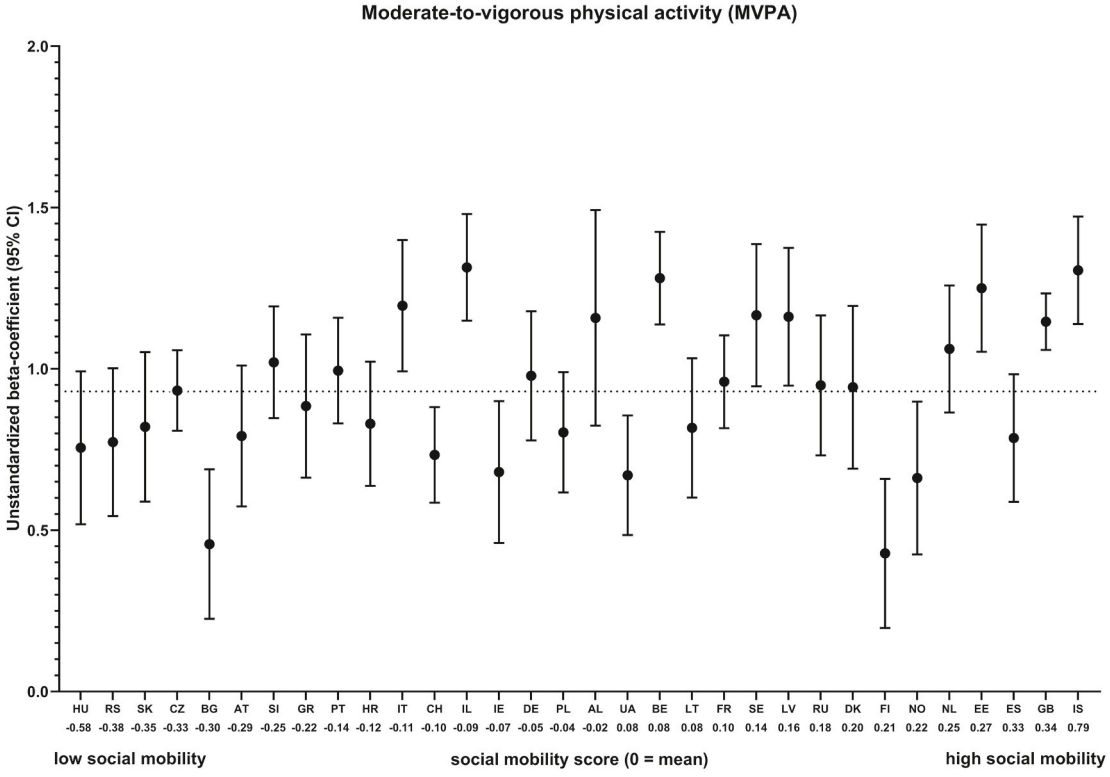


Fig. 2. Country-wise adjusted[a] unstandardized linear regressions of the associations between family affluence and moderate-to-vigorous (MVPA) and vigorous physical activity (VPA) according to the level of country-level social mobility, in 32 countries participating in the HBSC Study (2017/2018, N participants = 185,086, N countries = 32). [a] adjusted for gender and age; CI = confidence interval; the dotted lines represent the unstandardized linear regression coefficients for family affluence for all 185,086 participants, after controlling for clustering within countries, individual- and country-level variables, as well as cross-level interactions, as reported in Table 2.

participants were exposed to in their specific social context (e.g., school, town, family, etc.). Finally, limitations apply to the external validity of our study. Particularly adolescents from very low-SES families tend to be underrepresented in epidemiologic studies (Fakkel et al., 2020), which could lead to an underestimation of the associations between family affluence and health behaviours. Luckily, response rates in school-based surveys like HBSC tend to be higher than in studies where adolescents are approached outside the educational context (Dey et al., 2021).

5. Conclusion

Few studies have focussed on the role of country-level social mobility as potential explanation for cross-national differences in socioeconomic health inequalities. This study contributes to the literature by investigating the role of country-level social mobility in socioeconomic inequalities in adolescent health behaviours. While higher country-level social mobility predicted more inequalities in physical activity only, it was generally associated with somewhat better health behaviours (i.e. less tobacco use, lower consumption of unhealthy foods, more frequent breakfast) in adolescents. To identify targets for intervention, future research should focus on identifying socio-cultural and policy factors specifically related to inequalities in adolescent physical activity, which characterize countries with low and high levels of social mobility.

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Ethical standard statement

Passive or active consent for participation in the HBSC Study was obtained from school administrators, parents, and adolescents prior to participation, in line with the regulations in each participating country. Institutional ethical approval was obtained in each participating country.

Author contributions

Heiko Schmengler: Conceptualization, Methodology, Formal analysis, Visualization, Writing - Original Draft, Writing - Review & Editing, Margot Peeters: Supervision, Project administration, Writing - Review & Editing, Gonneke W. J. M. Stevens: Project administration, Data Curation, Resources, Funding acquisition, Writing - Review & Editing, Anton E. Kunst: Writing - Review & Editing, Katrijn Delaruelle: Writing - Review & Editing, Maxim Dierckens: Writing - Review & Editing, Lorena Charrier: Writing - Review & Editing, Dom Weinberg: Writing - Review & Editing, Albertine J. Oldehinkel: Supervision, Writing - Review & Editing, Wilma A. M. Vollebergh: Conceptualization, Supervision, Project administration, Funding acquisition, Writing - Review & Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Please refer to the data availability statement on the cover page

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2022.115289.

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