Socioeconomic Disparities in Physical Activity, Sedentary Behaviour and Sleep Patterns Among 6-9-Year-Old Children from 24 Countries in the WHO European Region

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Abbreviations:

World Health Organization – WHO

socioeconomic status – SES

WHO European Childhood Obesity Surveillance Initiative – COSI

odds ratio – OR

95% confidence interval – 95% CI

gross domestic product - GDP

Abstract

Physical activity, sedentary behaviour and sleep ~~time~~ are important predictors of children's health ~~outcomes in children~~. This paper aimed to investigate socioeconomic disparities in physical activity, sedentary behaviour and sleep across the ~~World Health Organization (~~WHO~~)~~ European region. This cross-sectional study used data on 124,700 children aged 6 to 9 years from 24 countries participating in the ~~fourth round of data collection of the~~ WHO European Childhood Obesity Surveillance Initiative ~~(COSI)~~ between 2015 and 2017. ~~Family~~ Ssocioeconomic status (SES) was measured through parental education, parental employment status and family perceived wealth. Overall, results showed different patterns in socioeconomic disparities in children's movement behaviours ~~physical activity, sedentary behaviour and sleep duration in children~~ across countries. In general, ~~children from higher socioeconomic groups~~high SES children were more likely to use motorised transportation ~~to and from school~~. Low SES c~~C~~hildren ~~from lower socioeconomic groups~~ were less likely to participate in sports clubs ~~for at least two hours a week~~ and more likely to have more than 2~~two~~ hours~~/ a~~ day of screen time. Children with low parental education had a 2.24 [95% CI 1.94-2.58] times higher risk of practising sports for less than 2 hours~~/ a~~ week. In the pooled analysis, SES wasn't ~~none of the included socioeconomic indicators were~~ significantly related to active~~ly~~ play~~ing for less than an hour a day~~. The relationship between SES and sleep varied by the SES indicator used. ~~Higher parental education and lower perceived wealth were associated with sleeping for less than 9 hours per night, which was unexpected and ought to be further investigated. The~~ Importantly, r~~r~~esults show~~ed~~ ~~that there are significant socioeconomic disparities in physical activity, sedentary behaviour and sleep among school children from the WHO European region, but~~ that low SES is not always associated with a higher prevalence of "less healthy" behaviours. There is a great diversity in SES patterns across countries which supports the need for country specific, targeted public health interventions.

1 Introduction

The global burden of childhood obesity has drastically risen in the past four decades.[1] In 2016, according to recent World Health Organization (WHO) global estimates, more than 340 million children and adolescents aged 5–19 years were living with overweight or obesity.[2]

Obesity is the consequence of a complex interplay of environmental, socioeconomic and behavioural factors. Obesity in childhood and later in life is one of the leading risk factors for noncommunicable diseases and premature death.[3–5] Stalling the rise in obesity is of global public health concern.[6] Physical inactivity and sedentary behaviour have been identified as two independent risk factors for childhood obesity.[7] There is also increasing evidence that short sleep duration results in metabolic changes that contribute to the development of obesity.[8]

Early school years are a time during which children have the opportunity to develop healthy habits that persist through adolescence into adult life. WHO recommends that children aged 5-17 years do at least an average of 60 minutes per day of moderate- to vigorous-intensity, mostly aerobic, physical activity across the week and that on at least 3 days a week vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, should be incorporated.[9] It is also recommended that children have no more than 2 hours a day of recreational screen time and limit sitting for extended periods.[9–11] However, according to a recent study, only 19% of children aged 11-17 years globally were sufficiently physically active in 2016.[12] Temporal trend studies suggest that since 2002 young people have become less physically active and more sedentary[13–16] - total screen time for 15-year-olds increased for more than two hours daily on average in many countries between 2002 and 2010.[13] In order to be able to address these trends and optimise and target public health interventions, we need to have a better insight on the determinants of children's movement behaviours. Identifying socioeconomic determinants of health related behaviours is especially important because these findings can be used to inform equity policies that reduce health inequalities.

153 With regard to socioeconomic status (SES) and physical activity, heterogeneous results have been
154 found thus far.[17–19] Data from the Health Behaviour in School-aged Children 2017/2018 study showed
155 that physical activity participation is lower among adolescents from less affluent families.[20] While a
156 systematic review suggested that adolescents with higher SES had higher levels of physical activity,
157 it was also reported that 42% of the studies showed an inverse or no association.[21] Possible reasons
158 for these observed inconsistencies were (a) the heterogeneity in the indicators of SES, (b) the mostly
159 self-reported subjective measurement of physical activity and (c) inconsistent criteria of measurement
160 (frequency vs duration) and varying domains of physical activity.[22]

161 Similar to physical activity, research on SES and sedentary behaviour, and more specifically
162 sedentary screen time, i.e. time spent passively watching screen-based entertainment, has suggested
163 that lower SES is associated with spending more time watching television.[23,24] Several more recent
164 studies which included other sedentary activities (such as reading, playing computer games, using
165 social media) also showed that lower SES was associated with increased time watching television,
166 but not with an increase in sedentary activities overall.[25–28] Furthermore, the relationship between
167 SES and sedentary behaviour patterns may not be consistent across countries.[25]

168 Studies suggest that short sleep duration may also be associated with SES, with some indications that
169 children from low socioeconomic backgrounds may be at higher risk for sleep deficiencies.[29–31]

170 The research on SES and physical activity, sedentary behaviour and sleep duration is complicated
171 further by the multifaceted nature and lack of a standardised definition and metric for SES, with a
172 number of different indicators in use. This fact, coupled with the difficulty of accurately assessing
173 physical activity and sedentary behaviour in a standardized way, has led to diversity in methods and
174 hindered the reproducibility of results.[32] The most commonly used indicators of SES have been
175 education, income and occupation.[33,34] Overall, parental education seems to be the strongest predictor
176 of physical activity in children[33,35], but it is also known that participation in different types of physical
177 activity varies according to family income.[36] Parental employment has been independently associated

with children's physical activity and sedentary behaviour as well.[37,38] Composite affluence or deprivation indices are also commonly used as measures of SES in health research but their use is complicated in cross-country studies because of big variations in what constitutes SES in different countries.

Our aim was to investigate the socioeconomic disparities — measured as differences in indicators of parental education, perceived wealth and employment status — in physical activity, sedentary behaviour and sleep duration among children aged 6 to 9 years in 24 countries from the WHO European Region.

2 Methods

In 2015-2017 the fourth round of data collection for the WHO European Childhood Obesity Surveillance Initiative (COSI) took place in 36 countries of the WHO European region.[39,40] Data were collected following a common protocol.[41] The COSI study follows the International Ethical Guidelines for Biomedical Research Involving Human Subjects[42] and protocols for all national studies included in this paper were approved by local ethical committees, with the exception of Spain, where no local ethical committee was asked for approval since it is not mandatory.

Besides measuring children's bodyweight and height, COSI gathered information on indicators regarding children's movement behaviours (physical activity, screen time, sleep duration), parental socioeconomic characteristics and comorbid conditions associated with obesity. These data were collected in 24 out of the 36 countries participating in the fourth round of COSI using a common form which was filled in by children's parents or caregivers.[43] Only the countries that had information on children's physical activity, sedentary behaviour, sleep and SES, were included in this analysis: Albania, Bulgaria, Croatia, Czechia, Denmark, France, Georgia, Ireland, Italy, Kazakhstan, Kyrgyzstan, Lithuania, Latvia, Malta, Montenegro, Poland, Portugal, Romania, Russian Federation (only Moscow), San Marino, Spain, Tajikistan, Turkey and Turkmenistan.

A nationally representative sample of children was drawn in almost all of the above-mentioned countries, with exceptions in Malta and San Marino, where all classes of third graders in the country were included in the study, and in the Russian Federation where data collection was carried out only in Moscow. More information on study and sampling design are provided elsewhere.[39,44,45]

The inclusion criteria for this paper were: i) children aged 6 to 9 years; ii) children with available information on at least one of the variables about physical activity, screen time and sleep pattern; iv) children with available information on at least one of the variables used to measure family SES.

Parents were asked to report on their child's physical activity patterns, sedentary behaviour and sleep. Among these, this paper focused on the following behaviours: transportation to and from school, time spent practising sports, time spent actively/vigorously playing, time spent watching TV or using electronic devices, and hours of sleep per night. The questions and answer options used to gather information on physical activity patterns, sedentary behaviour and sleep are described in Table 1 The answer options were categorized into "healthy" and "less healthy" behaviours in order to enable the comparisons between different socioeconomic population groups. The "less healthy" behaviours included: taking a motorised vehicle to and from school, participating in a sports or dancing club less than two hours per week, playing actively or vigorously for less than one hour a day, watching TV or using electronic devices for two hours a day or more, and sleeping fewer than nine hours a day. The justification for the chosen cut-offs is described elsewhere.[46]

[Insert Table 1 here]

The family SES was measured considering the following three separate categorical variables: parental education, family perceived wealth, and parental employment status. The three SES indicators were analysed separately, and not as a composite measure of SES.

Firstly, parental education was defined in two stages. For the purpose of this study, we created binary categories to describe parents' formal educational attainment. Parents who reported their educational

attainment as “primary school or less”, “secondary or high school”, and “vocational school”, were described as having “lower education”. Parents who reported their educational attainment as “undergraduate or bachelor degree” and “master degree or higher” were described as having “higher education”. Then, to describe parental education from the child’s perspective, we created three categories: 1) Low parental education (both parents with lower education); 2) Medium parental education (one parent with lower education, one parent with higher education); 3) High parental education (both parents with higher education).

Secondly, family perceived wealth describes how easily the family met the end of a typical month with its own earnings. This was defined using three categories: 1) Low family perceived wealth (those who had trouble meeting the end of the month with their own earnings); 2) Medium family perceived wealth (those who met the end of the month with their own earnings without serious problems); 3) High family perceived wealth (those who easily met the end of the month with their own earnings). The first of these categories, “low family perceived wealth”, was created by combining the following two answer options from the family form: ‘We have trouble meeting the end of the month with our earnings’ and ‘We barely meet the end of the month with our earnings’. The variables are described in more detail elsewhere.[47]

Finally, parental employment was defined in two stages. Parents were classified as “employed”, “unemployed” or “inactive” based on the following answer options from the optional family record form: “employed” comprises the answers “government employed”, “non-government employed”, and “self-employed”; “unemployed” is indicated by the answer “unemployed- able to work”; and “inactive” comprises the answers “unemployed- unable to work”, “student”, “homemaker” and “retired”. Thus, from the child’s perspective we defined parental employment status according to two

250 categories: 1) Low parental employment (one or more parent(s) unemployed or inactive); 2) High
251 parental employment (both parents employed).
252
253 The COSI family form asked about the education and employment of the responding caregiver and
254 his/her partner/spouse, so the information about parents' education and employment was generally
255 available only when the form was filled in by the mother or the father. In Bulgaria, Czechia, Italy,
256 Malta, San Marino, Spain and Turkey, however, the education and employment specifically of the
257 parents was gathered, regardless of which caregiver filled in the form. It should be noted that the
258 categories for parental education and employment status tend to presume a traditional two-parent
259 family structure which does not reflect the reality for all children. The family status was not gathered
260 in the fourth round of COSI so it was not possible to identify children living in a single-parent family
261 and include them in the analysis.

262 2.1 **Data analysis**

263 For each "less healthy" behaviour listed above, we calculated country-specific and pooled prevalence
264 values, both considering all children together and stratified by each of the SES variables. We tested
265 for differences between SES in the distribution of the responses using the Rao-Scott $\chi 2$ test, a design-
266 adjusted version of the Pearson's $\chi 2$ test.

267 Country-specific multivariate multilevel logistic regression models were estimated for each
268 behaviour separately.

269 All models included the following covariates: family's SES variables, child's sex, age and BMI
270 category according to WHO growth references (normal weight, overweight (including obesity) and
271 obesity), degree of urbanization in the child's residence or school and the region/administrative
272 division of the residence place. The adjusted Odds Ratios (ORs) and relative 95% confidence intervals
273 (95% CIs) for parental education (reference category: both parents with high level), parental

employment status (reference category: both parents employed or self-employed) and family perceived wealth (reference category: families that easily met the end of the month with their own earnings) were estimated. In some countries one or two SES variables were not included in the analysis, as the data were not collected (see Table 2). The same regression analysis was carried out using pooled data from all countries. In this case, the model included country where children had been surveyed as a covariate. All regression models included random effects for primary schools attended by children – except for Czechia, where paediatrician clinics were used instead of schools.

Sampling weights to adjust for the sampling design, oversampling and nonresponse (at the level of the child form) were estimated and applied for all countries that applied a sampling approach in the fourth round.[45] In the pooled analyses a population size adjusting factor was applied to the post-stratification weights. The adjusting factor was calculated based on the number of children belonging to the targeted age group according to Eurostat figures or national official statistics for 2016. All analyses took account of the cluster sample design. A p-value of 0.05 was used to define statistical significance. All statistical analyses were performed in the statistical software package Stata version 15·1.

Only survey sites with complete information on family's SES variables were included in pooled analyses – i.e. all countries except France, Ireland, Italy, Malta, Russian Federation (Moscow), San Marino and Turkmenistan. Due to the heterogeneity in the number and type of age groups targeted by each country, the pooled analysis included only one target age group per country, namely 7 year olds, in order to balance the contribution of each country to the pooled estimates and to limit as much as possible the differences in children's age. If 7-year-olds were not targeted in a country, the nearest targeted age group was chosen.

The results are presented in the tables by grouping included countries into six macro-regions according to the United Nations "Standard Country or Area Codes for Statistical Use": Northern Europe (Denmark, Ireland, Lithuania and Latvia); Western Europe (France); Eastern Europe

(Bulgaria, Czechia, Poland, Romania and Moscow); Southern Europe (Albania, Croatia, Italy, Malta, Montenegro, Portugal, San Marino and Spain); Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan) and Western Asia (Georgia and Turkey).[48]

3 Results

In total, 124,700 children from 24 countries in the WHO European Region fourth round of COSI were included in the study (Supplementary Table 2). The final number of children included in the analyses varied among countries — from below 500 in San Marino to over 40,000 in Italy. Most countries had a slightly higher proportion of boys (51.4%) than girls (Table 2). With regard to SES, more than half of the children (54.9%) came from families with low parental education. However, 73.7% of children came from families with high or medium perceived wealth, and more than half of the children (53.3%), had high parental employment status. These figures varied highly between countries, with countries from Northern and Western Europe showing lower proportions of children with low parental education. Large differences were also determined in the prevalence of investigated "less healthy" behaviours in specific countries, and are described in detail in a recent paper by Whiting et al[44].

[Insert Table 2 here]

3.1 Prevalence of "less healthy" behaviours by SES

Analysis of the pooled data shows that travelling to and from school by motorised vehicle was most common among children from families with high parental education, (45.6%) high parental employment (43.8%), and/or high family perceived wealth (41.3%) (Figure 1). A reverse socioeconomic gradient emerged in relation to practising sports, with children from less affluent families being less engaged in these activities. On average, 70.9% of children from families with low parental education spent less than 2 hours/week on sports compared to 38.2% of children with high parental education. The same gradient was recorded for parental employment and family perceived

323 wealth. The proportion of children playing actively for less than 1 hour/day, however, did not vary
324 significantly among families with different SES. Excessive screen time was more common among
325 children from families with lower SES, with higher proportions of children watching or using
326 electronic devices for at least 2 hours/day among families with low perceived wealth (38.4%) and
327 low parental education (37.5%). Low sleep duration did not show any specific socioeconomic
328 gradient, as differences among different socioeconomic groups were limited and without a clear
329 direction (Figure 1).

330 Country-specific levels of behaviours by SES are given in Supplementary Tables 2, 3, and 4 and show
331 wide variations between countries.

332 *[Insert Figure 1 here]*

333 **3.2 Odds Ratio of having "less healthy" behaviours related to SES**

334 Overall, the pooled estimates found that children of families with lower socio-economic status were
335 less likely to travel to school via motorized vehicle (Figure 2a). Travelling to school via motorized
336 vehicle was less likely among children with low parental education (OR 0.78 [95% CI 0.67-0.90]),
337 low family perceived wealth (OR 0.68 [95% CI 0.60-0.77]), and low parental employment (OR 0.67
338 [95% CI 0.59-0.77]). Similar patterns, for at least one of the SES variables, emerged in all countries
339 – although with different strength – except in Denmark and Russian Federation. In countries in
340 Northern Europe and Central Asia, parental employment status was not related to using motorised
341 transportation to school.

342 *[Insert Figure 2 here]*

343 Overall, no SES variable was associated with playing actively or vigorously for less than one hour a
344 day (Figure 2b). However, the pooled estimates concealed different patterns in countries, especially
345 with regards to parental education. Among most of the Northern, Eastern, and Southern European

346 countries, children with low parental education played actively/vigorously for longer. Meanwhile, the
347 opposite situation emerged among the Central Asian countries.

348 Among the three indicators of physical activity, low engagement in practising sports showed the
349 strongest association with family SES. In fact, lower SES was associated with higher odds of
350 practising sports for less than 2 hours a week in the overall pooled estimates and in almost all
351 countries; and parental education showed a stronger association than the other two SES variables
352 (Figure 2c). On average, children with medium parental education and those with low parental
353 education were, respectively, 1.30 [95% CI; 1.12-1.51] and 2.24 [95% CI 1.94-2.58] times more
354 likely to practise sports for less than 2 hours a week than children with high parental education, i.e.
355 every lower level of parental education brings a significantly higher risk for being less engaged in
356 sports (Figure 2c and Supplementary Table 5). Furthermore, children with low parental education
357 (compared to high parental education) had a higher chance of low participation in sports in almost
358 every country. Odds ratios varied between 1.63 [95% CI 1.18-2.25] in Czechia to 3.98 [95% CI 3.17-
359 4.98] in Portugal, with the only exception being Denmark where the OR was lower than 1 (although
360 this was not statistically significant). Similar patterns were recorded for low family perceived wealth
361 (in comparison to high) and low parental employment (compared to high). In Central Asia no relation
362 between family perceived wealth and practising sports for less than 2 hours a week was detected.

363 Lower parental education and lower perceived wealth were associated with increased screen time in
364 pooled analyses (Figure 3). Children with low parental education were 1.33 [95% CI; 1.18-1.51] times
365 more likely to spend at least 2 hours a day watching TV or using electronic devices than children with
366 high parental education. This association was found in most Northern, Western, Eastern and Southern
367 European countries, although the opposite was observed in Malta, Kazakhstan, Kyrgyzstan and
368 Tajikistan. In pooled analyses, low family perceived wealth was associated with an increased risk for
369 excessive screen time of 1.27 [95% CI 1.14-1.42]. Most of the European countries showed a similar

pattern while there were no associations for countries in Central Asia. There were no clear patterns for parental employment status and screen time.

[Insert Figure 3 here]

The relationship between SES and sleep varied by the SES indicator used. The pooled analyses showed that low family perceived wealth was associated with increased risk of shorter sleep time (less than 9 hours per night); whereas low parental education was associated with a decreased risk (Figure 4). In almost all countries, children with low family perceived wealth were more likely to sleep less than 9 hours/night, the pooled value for the OR being equal to 1.54 [95% CI 1.27-1.87]. Children with low parental education had lower odds of shorter sleep time compared to those with high parental education – pooled OR equal to 0.72 [95% CI; 0.59-0.87]. This pattern emerged in most of the countries but not in Italy, Malta and Spain where the association was the opposite. Finally, parental employment was not associated with sleep time: pooled OR 0.91 [95% CI 0.74-1.11], except in Northern European countries, Lithuania and Latvia, where children with low parental employment had significantly lower odds of shorter sleep time than children with high parental employment. In Tajikistan, low parental employment was associated with a higher risk for shorter sleep time.

[Insert Figure 4 here]

4 Discussion

In this study we analysed highly standardized data pertaining to socioeconomic disparities in physical activity, sedentary behaviour and sleep patterns of 134,874 children aged 6 to 9 years from 24 countries in the WHO European Region.

Overall results showed heterogeneity in direction of associations across SES and with different SES indicators across countries and macro regions.

Active transportation such as walking or cycling to and from school, when it is safe to do so, presents a good opportunity to achieve daily recommended levels of physical activity, by integrating it into

394 daily life without additional costs.[49] Our results showed that transportation to and from school using
395 motorised vehicles was more prevalent among children from families with a higher socioeconomic
396 background. These findings are in line with previous research showing that active transport to and
397 from school is related to lower SES.[50–53] Possible reasons are that lower-income households are less
398 likely to have access to private vehicles because of associated costs[51] and parents with lower SES
399 have less time to drive a child to and from school.[51] Interestingly, in line with other Scandinavian
400 studies, in Denmark active transportation was not related to parental SES.[54] This is likely due to a
401 focus on safe and convenient cycling infrastructure in urban planning policy; in particular having safe
402 walking and cycling lanes close to schools, as well as resulting cultural norms around cycling. No
403 data were available on school proximity or traffic density, which could confound these findings.[55] Air
404 pollution is also a possible factor of parental concern when choosing school transport modes, even
405 though research has shown that health benefits of active transport outweigh the negative impact of
406 air pollution.[56,57] These results point out the need for targeted interventions where active
407 transportation to and from school would be promoted as a healthy choice universally, so that all
408 parents may choose it willingly and not just out of necessity. This is especially important now in the
409 time of the COVID-19 pandemic when many cities introduced more cycling and walking lanes due
410 to air pollution and its role in COVID-19 spread and lethality.[58]

411 Active play is an activity that is natural to children and is a means through which children learn,
412 develop emotionally, acquire motor and problem solving skills, form social relationships and adopt
413 habits.[59] According to the WHO Global Action Plan on Physical Activity 2018-2030, energetic active
414 play should be encouraged within education, health, and child-care sectors due to its positive effects
415 on growth and development.[49,60] In this study, we found that family perceived wealth and parental
416 employment were not significantly related to active play for less than 1 hour a day. In regards to
417 parental education, there was a great diversity at the country level. In most of the European countries
418 in the study children of parents with lower education are at lower risk of playing for less than 1

hour/day, while in Central Asian countries it is the other way around. Previous studies on the association of SES with children's active play are scarce and conflicting.[61–63] Our findings confirm that the association between SES and active play is seemingly very context specific and that it should be investigated on a more local level. Since neighbourhood characteristics are also correlated with active play, promotion of active play by creation of activity-friendly neighbourhoods with formal and informal play areas and high traffic safety is important.[62]

The last "less healthy" physical activity behaviour we investigated, practising sports for less than 2 hours per week, was more prevalent among children from families with lower SES and especially common in children from families with economic difficulties. The finding that children from families with lower SES had lower participation rates in organized sports aligns with previously published research from individual European countries, the European region and other countries around the world.[53,64–66] In Central Asian countries family perceived wealth was not related to practising sports for less than 2 hours a week. All Central Asian countries included in our study, i.e. Kazakhstan, Kyrgyzstan, Turkmenistan and Tajikistan, show a high overall prevalence of this "less healthy" behaviour in children and over half of children from these countries practice sports less than 2 hours per week regardless of SES. The observed higher prevalence of participation in sports in Western and Northern Europe may be due to cultural norms regarding sports clubs, available infrastructure or funding to support participation.

Furthermore, we found that lower parental education level was associated with a significantly higher risk of children practicing sports for less than 2 hours a week; more so than the other two SES indicators (parental employment status and family perceived wealth). Compared to children with high parental education, the likelihood of lower participation in sports was increased by 30% among children with medium parental education, and more than doubled among children with low parental education. These findings are in line with the results from a German study, which found that parental education was more strongly associated with children's physical activity than were employment and

444 income.[67] Similarly, previous studies suggest that the children of parents with higher levels of
445 education tend to participate more regularly in organized sport activities.[65] In general, families from
446 different socioeconomic backgrounds support their children in different ways.[68] Families with higher
447 SES usually have more financial resources to support their child's extracurricular activities, and may
448 have been taught more about the importance of regular physical activity for children's health.
449 Therefore, high SES parents are more likely to encourage their children to actively engage in sport
450 clubs.[69,70] Children of parents with lower SES may not be able to access as many extracurricular
451 activities due to financial barriers, and therefore are more likely to choose other available solutions
452 for physical activity, such as free school sports and playing sports informally in public spaces such
453 as parks.[71]

454 Low parental education and low family perceived wealth were found to be risk factors for watching
455 TV or using electronic devices for at least 2 hours a day; except in Kazakhstan, Kyrgyzstan, Tajikistan
456 and Turkmenistan. Similar results were found by a study from Ireland, in which children who attended
457 schools in communities at risk of disadvantage and social exclusion spent more time watching
458 television in comparison to children who attended other schools.[53] Even though this study used a
459 subjective perception of family wealth, its results are consistent with studies that used material
460 household characteristics as metrics of family affluence.[72] Other studies also confirm the relationship
461 between sedentary behaviour and lower SES, mostly using parental education as a metric,[73,74] and
462 hypothesize that TV watching may be an affordable means of entertainment for families with limited
463 time and financial resources.[74] Parental employment was not related to children's TV watching or
464 electronic device using time, which suggests that increased screen time may be more influenced by a
465 lack of funds/affordable entertainment options than a lack of time. It must be noted that this study
466 only used screen time as an indicator of sedentary behaviour and recent research showed that screen
467 time may not be associated with total sedentary time in children.[75]

Another factor that contributes to a healthy active lifestyle throughout the life course is sleep. We observed that the majority of children from the sample slept for 9 hours per night or longer, as recommended. [11,76] The prevalence of children who slept under 9 hours per night was highest among children from families with low perceived wealth. Two SES indicators, parental education and family perceived wealth, were associated with insufficient sleep in different directions: higher parental education and lower perceived wealth were risk factors for shorter sleep time among children. So far, researchers have discovered significant differences in children's sleeping patterns in groups with different SES. The relationship between lower SES and sleep disorders, later bed times, shorter sleep periods and the lack of bedtime routine[77,78] has been explained by an interaction between environmental, biomedical and psychosocial factors.[79] In terms of home environments, insufficient sleep in children may be explained by a lack of spatial resources, inadequate heating and poor air conditions.[79] An association between screen media use and delayed bedtime and/or decreased total sleep time has also been observed.[80] In the biomedical realm, chronic diseases such as asthma, overweight and obesity, and others have been associated with sleep disturbances and are more prevalent in children with lower SES.[81] Lastly, in the psychosocial domain, research has found that lower income families tend to have more inconsistent daily routines, more family stressors and less parental monitoring,[82] all of which may influence sleeping habits in children. Our finding, that higher parental education was associated with sleeping less than 9 hours per night, has to our knowledge not been described in the literature and merits further investigation in future research.

4.1 Strengths and limitations

The major strength of this study is its large population, comprising nationally representative samples from almost every country that participated. Furthermore, the standardized method of data collection and processing allowed inter-country comparisons, as well as enhanced the generalizability of our results.

There are, however, some limitations. Firstly, the presented data were self-reported. In order to obtain more reliable information, physical activity, sedentary behaviours and sleeping patterns would need to be measured objectively. Secondly, we only looked at family level indicators of SES but it is very likely that community level SES is independently associated to investigated behaviours as well – high SES neighbourhoods offer more opportunities for active transportation, outdoor play and recreational sports. Thirdly, as some regions were more represented than the others, we need to be cautious when interpreting regional differences. Fourthly, differences in sample sizes within countries, even though they are nationally representative, may have impacted cross country comparisons. There were also varying response rates for the relevant questionnaire (the "family form") including the SES measures, and we do not know if the variation across SES measures in different countries and regions is representative of the distribution in the overall population. We did not have information available on the SES of all children with family form filled in. The information on a child's family structure was not available, and therefore we were able to classify the parental education and employment status only when this information was available for both parents. We included for this analysis only children who had one mother and one father as primary caregivers; the exclusion of families with a different structure (or single parent families) may have resulted in selection bias and limited our capacity to accurately examine associations between SES and health behaviours. It is possible that vulnerable families were less likely to participate in this study, and that this lower level of representation may have caused us to underestimate the level of inequalities. Finally, due to the use of cross-sectional data it is not possible to make any causal inferences about the obtained results.

5 Conclusion

In conclusion, our study provides a snapshot of current physical activity, sedentary behaviour and sleep patterns among children from different SES backgrounds in the WHO European region. The results show that there are significant socioeconomic disparities in physical activity, sedentary behaviour and sleep, but different "less healthy" behaviours exhibit different SES patterns and vary

517 across countries. The results of this study also disprove the common notion that low SES is always
518 associated with a higher prevalence of "less healthy" behaviours. As can be seen from the country
519 level results of this study, there is much that high SES groups can learn and model from the low SES
520 groups in specific countries. This finding should be used for empowering low SES families through
521 public health efforts.

522 In general, children from families with low SES had the highest odds for low engagement in sport
523 activities (less than two hours per week) and for more screen time than recommended (more than two
524 hours per day). In contrast, children from high SES families were shown to have a higher risk of not
525 using active transportation to and from school. Higher parental education also seemed to pose a risk
526 for sleeping less than 9 hours per night which was surprising and ought to be further investigated.
527 Since previous research shows that both the behaviours examined in this study and SES are related
528 to childhood obesity, a wider analysis that observed the association between SES and physical activity
529 and eating-related behaviours in different weight status groups would be of great interest. Considering
530 that the studied behaviours are also interrelated, future research should also look at patterns and
531 clustering in child movement behaviours and how they are associated to SES.

532 Both this study and the one on socio-economic differences in eating habits published in this
533 supplement[83] show that SES is associated with the prevalence of "less healthy" behaviours in varying
534 patterns across countries, which is why it is necessary to develop and implement public health
535 interventions to promote child health and prevent obesity using different strategies for different SES
536 groups and depending on the country context. In order to continuously develop and re-evaluate such
537 targeted interventions, it is crucial to continue nationally-comparable surveillance of children's and
538 family's activity behaviours and SES. COSI is highly relevant for this purpose; using a standardized
539 methodology and direct measurements by trained staff to regularly provide relevant information on
540 children's bodyweight status. It also collects school and parent reported information on lifestyle and
541 environments, all of which facilitates comparison at the level of the WHO European region. This vital

542 evidence can support public health professionals, policy makers and other important stakeholders to
543 invest in healthy active children today, and thus promote healthy active adults in the future.

Table 1 - Questions and their predefined answer options as included in the COSI family record form to collect data on children's physical activity, sedentary behaviour and SES and categorization of the answer options for the paper's analyses.

	Family record form items – children's physical activity, screen time and sleep duration	Answer options	'Less healthy' behaviour
	Physical activity		
	'How does your child usually get to and from school?	'Walking or cycling'; 'Motorised vehicles'; 'Combination of walking and cycling and motorised vehicles'	'Motorised vehicles'
	'Is your child a member of one or more sports clubs or dancing courses (e.g. football, running, hockey, swimming, tennis, basketball, gymnastics, ballet, fitness, ballroom dancing, etc.)?'	'Yes'; 'No'	<2 hours/week='None'; '1 hour a week';
	'Over a typical or usual week (including weekends), on how many hours does your child spend on sports and physical activities with these sport clubs or dancing courses?'	'None'; '1 hour a week'; '2 hours a week'; '3 hours a week'; '4 hours a week'; '5 hours a week'; '6 hours a week'; '7 hours a week'; '8 hours a week'; '9 hours a week'; '10 hours a week'; '11 hours a week'	
	'In his/her free time, about how many hours per day is your child usually playing actively/vigorously (e.g. running, jumping outside or moving fitness games inside)? Please tick one box for weekdays and one box for weekend	'Never'; 'less than 1 hour per day'; 'about 1 hour per day'; 'about 2 hours per day'; 'about 3 or more hours per day'	<1 h/d[b],
	'Outside school lessons, how much time does your child usually spend watching TV or using electronic devices such as computer, tablet, smartphone or other device (not including moving or fitness games), either at home or outside home (e.g. cafes, game centres, etc,)?' Please tick one box for weekdays and one box for weekend	Number of hours per day	≥2 h/d[c]
	'At what time does your child usually go to bed on school days?' 'At what time does your child usually wake up on school days?'	___ hours/__minutes	<9 h/d

[a] Data were not collected or different wording was used or they were not included due to high level of missing data.

[b] Numerical values are assigned to the items 'playing actively/vigorously on a weekday' and 'playing actively/vigorously on a weekend day' enabling the conversion of this item to a numerical scale ('never'=0; 'less than 1 hour per day' =0·5; 'about 1 hour per day' =1; 'about 2 hours per day'=2; 'about 3 or more hours per day' =3). Usual play time per day is calculated weighing weekday (5/7) and weekend hours (2/7) accordingly.

[c] Number of hours per day is calculated weighing weekday (5/7) and weekend hours (2/7) accordingly.

Table 2 – Children's sex and age, parental education and employment status and family perceived wealth (i.e. how the family met the end of the month with earnings at its disposal) by country and overall *. COSI/WHO Europe round 4 (2015-17)

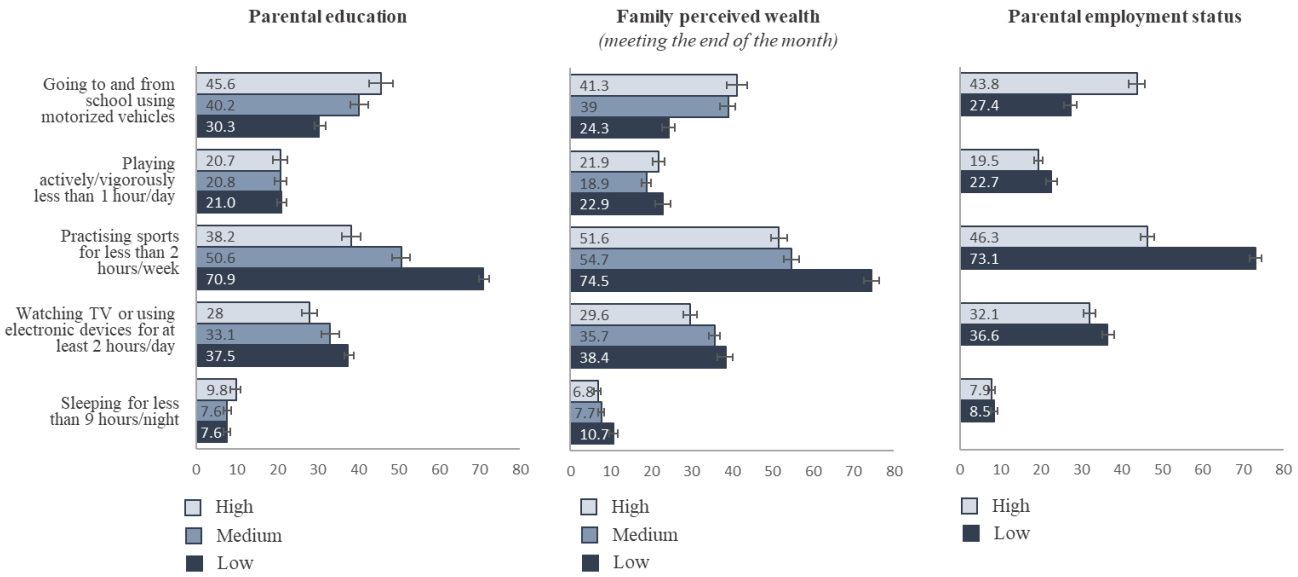
	Child's characteristics		Parental education (%)			Family perceived wealth (%)			Parental employment status (%)	
	Boys, %	**Age in years, median (Q1-Q3)**	**High**	**Medium**	**Low**	**High**	**Medium**	**Low**	**High**	**Low**
Northern Europe										
DEN	52.2	7.2 (0.3)	34.5	31.6	33.9	57.5	35.6	6.9	84.7	15.3
IRE	52.1	7.1 (0.4)	43.3	28.3	28.5	n.a.	n.a.	n.a.	64.1	35.9
LTU	50.8	7.8 (0.3)	33.9	29.9	36.2	34.5	46.7	18.8	77.7	22.3
LVA	48.3	8.3 (1.0)	35.8	31.7	32.5	20.6	60.6	18.8	77.6	22.4
Eastern Europe										
BUL	51.5	7.6 (0.2)	22.3	21.0	56.7	17.2	52.3	30.6	70.3	29.7
CZH	51.1	7.0 (0.2)	14.5	21.2	64.3	36.4	51.1	12.5	75.6	24.4
POL	49.8	8.4 (0.2)	40.4	26.4	33.2	26.1	60.3	13.6	74.4	25.6
ROM	49.3	8.5 (0.6)	26.7	14.4	58.9	30.4	45.9	23.7	62.8	37.3
RUS	49.8	7.4 (0.4)	n.a.	n.a.	n.a.	49.2	40.9	9.9	n.a.	n.a.
Western Europe										
FRA	49.5	8.1 (0.7)	47.0	29.7	23.2	n.a.	n.a.	n.a.	73.1	26.9
Southern Europe										
ALB	52.7	8.5 (0.7)	19.5	11.0	69.5	42.2	29.2	28.7	57.1	42.9
CRO	51.3	8.5 (0.3)	17.1	22.4	60.5	29.3	50.5	20.2	71.6	28.5
ITA	51.6	8.8 (0.3)	12.0	18.3	69.8	10.0	41.0	49.0	n.a.	n.a.
MAT	50.2	7.8 (0.3)	18.7	22.6	58.7	n.a.	n.a.	n.a.	62.9	37.1
MNE	52.9	7.4 (0.6)	15.0	22.1	62.9	25.8	48.1	26.1	57.9	42.1
POR	50.8	7.5 (0.6)	14.6	19.7	65.8	26.1	44.2	29.8	73.5	26.5
SMR	45.3	8.8 (0.3)	13.2	25.3	61.6	12.5	52.7	34.9	n.a.	n.a.
SPA	50.8	8.0 (1.1)	27.7	27.9	44.5	45.7	37.8	16.5	58.5	41.5
Central Asia										
KAZ	50.5	9.0 (0.5)	28.1	25.0	47.0	36.8	30.2	33.1	54.3	45.8
KGZ	50.7	7.9 (0.7)	19.4	20.0	60.6	35.3	20.4	44.2	32.6	67.4
TJK	51.8	7.4 (0.3)	5.5	21.3	73.2	32.4	22.4	45.2	25.5	74.5
TKM	50.1	7.7 (0.3)	3.7	12.9	83.4	60.3	32.3	7.4	n.a.	n.a.
Western Asia										
GEO	51.0	7.6 (0.4)	26.1	15.2	58.7	36.5	38.2	25.3	59.5	40.5
TUR	51.0	7.5 (0.4)	10.0	12.6	77.4	25.4	33.2	41.4	15.5	84.6
Pooled estimates	**51.4**	**7.9 (0.7)**	23.5	21.6	54.9	33.9	39.8	26.3	53.3	46.7

Figures refer to primary school children from: Albania (ALB); Bulgaria (BUL); Croatia (CRO); Czechia (CZH); Denmark (DEN); France (FRA); Georgia (GEO); Ireland (IRE); Italy (ITA); Kazakhstan (KAZ); Kyrgyzstan (KGZ); Lithuania (LTU); Latvia (LVA); Malta (MAT); Montenegro

(MNE); Poland (POL); Portugal (POR); Romania (ROM); Russia – only Moscow city (RUS); San Marino (SMR); Spain (SPA); Tajikistan (TJK); Turkmenistan (TKM) and Turkey (TUR). Q1, first quartile; Q3, third quartile. Abbreviations: n.a. – not available.

* Information on parental education was not available for Moscow. Data on family perceived wealth were not collected in France, Ireland and Malta; while those on parental employment status were not gathered in Italy, Moscow, San Marino and Turkmenistan. Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan.

Figure 1 - Pooled prevalence (%) of children's "less healthy" behaviours related to physical activity, screen time and sleep pattern by socioeconomic characteristics [*]. COSI round 4 (2015-2017)



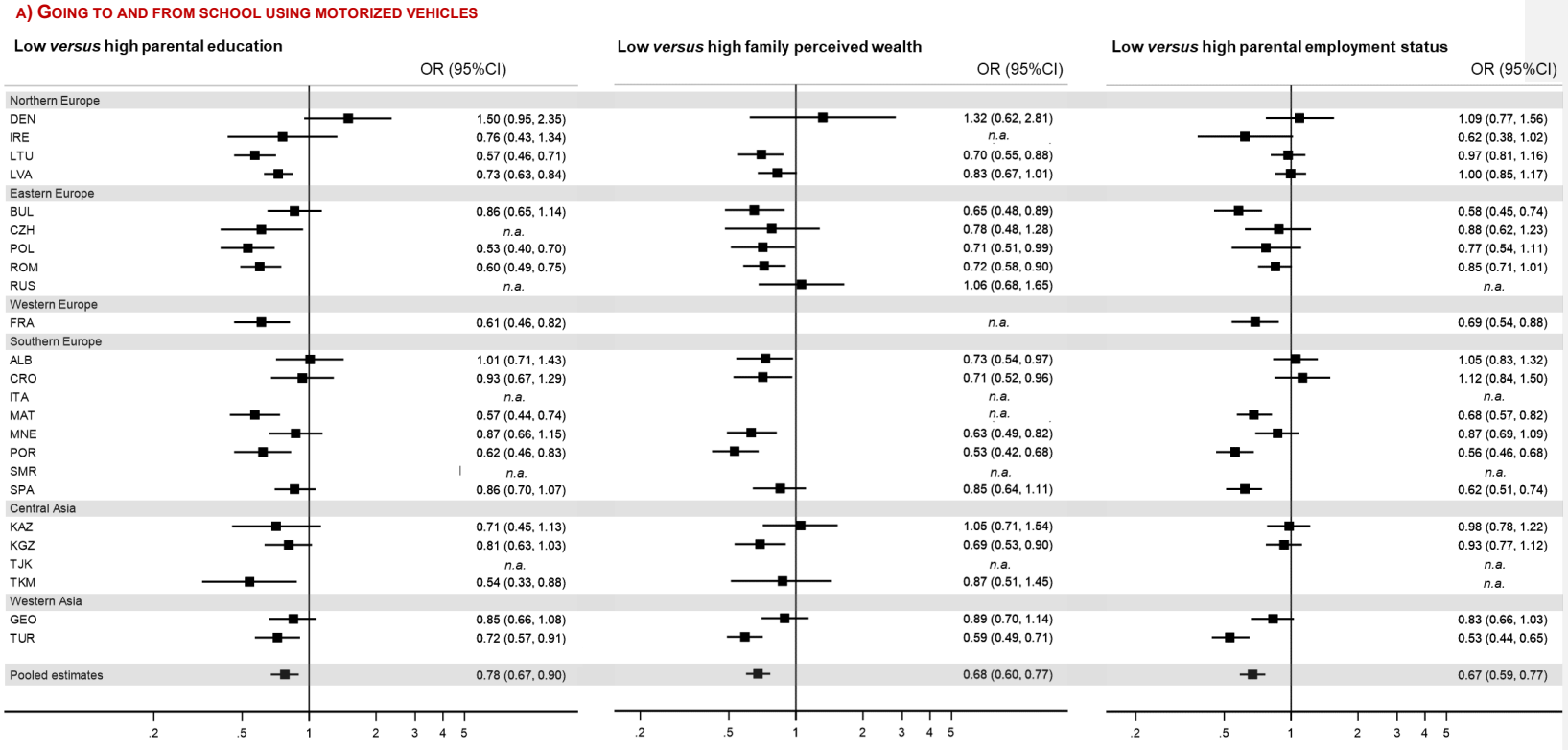
[*] Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan.

[a, b] Statistically significant difference of proportions between parental educational attainments for each 'less healthy' behaviour - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.001$ (a), $p < 0.0001$ (b).

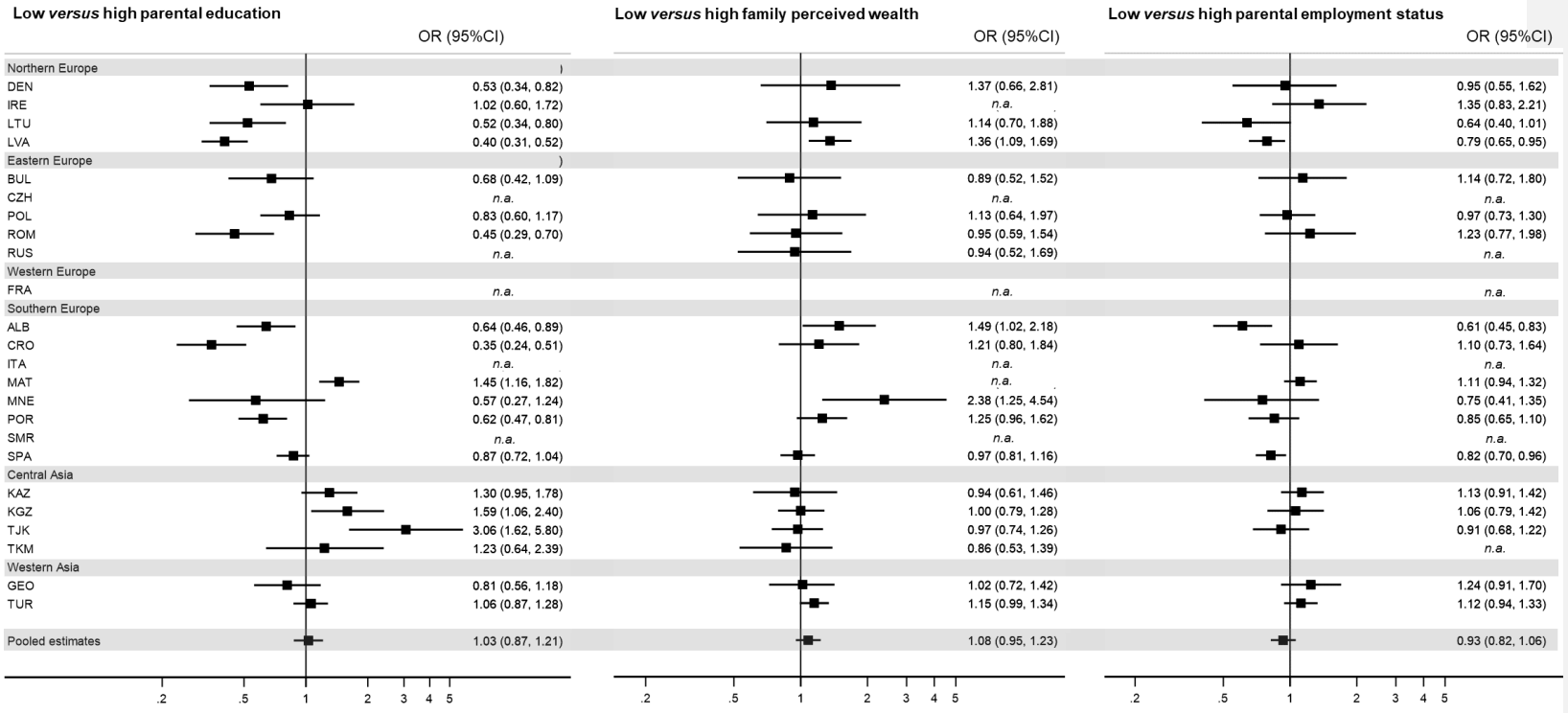
[c, d] Statistically significant difference of proportions between family perceived wealth levels for each 'less healthy' behaviour - Pearson's chi-squared corrected using Rao-Scott method $p < 0.001$ (c), $p < 0.0001$ (d).

[e, f] Statistically significant difference of proportions between parental employment status for each 'less healthy' behaviour - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.001$ (e), $p < 0.0001$ (f).

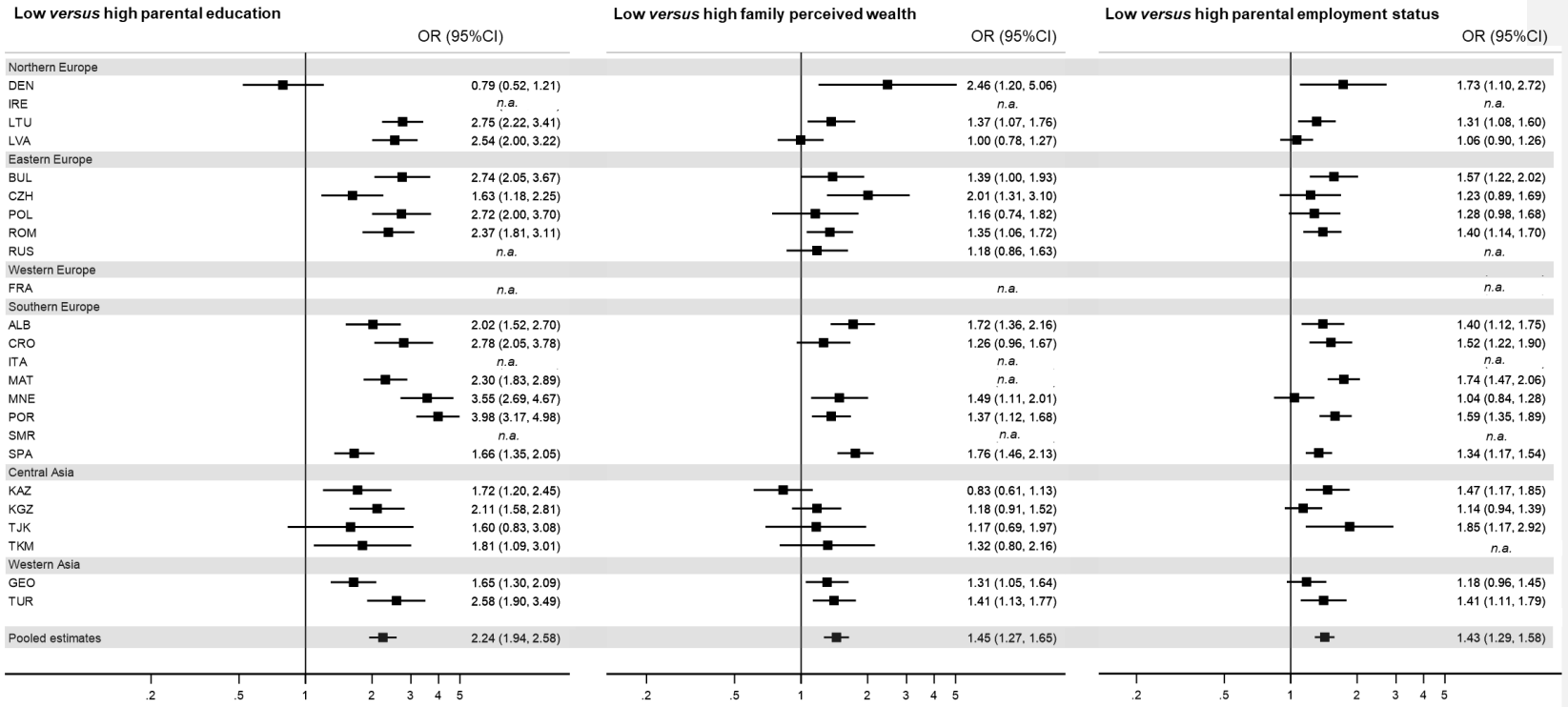
Figure 2 - Country-specific and pooled adjusted odds ratios of having a "less healthy" physical activity behaviour (compared to not having) related to parental education, family perceived wealth (i.e. how the family met the end of the month with earnings at its disposal) and parental employment status, COSI/WHO Europe round 4 (2015-17)



B) ACTIVELY/VIGOROUSLY PLAYING FOR LESS THAN 1 HOUR A DAY



c) PRACTISING SPORTS FOR LESS THAN 2 HOURS A WEEK

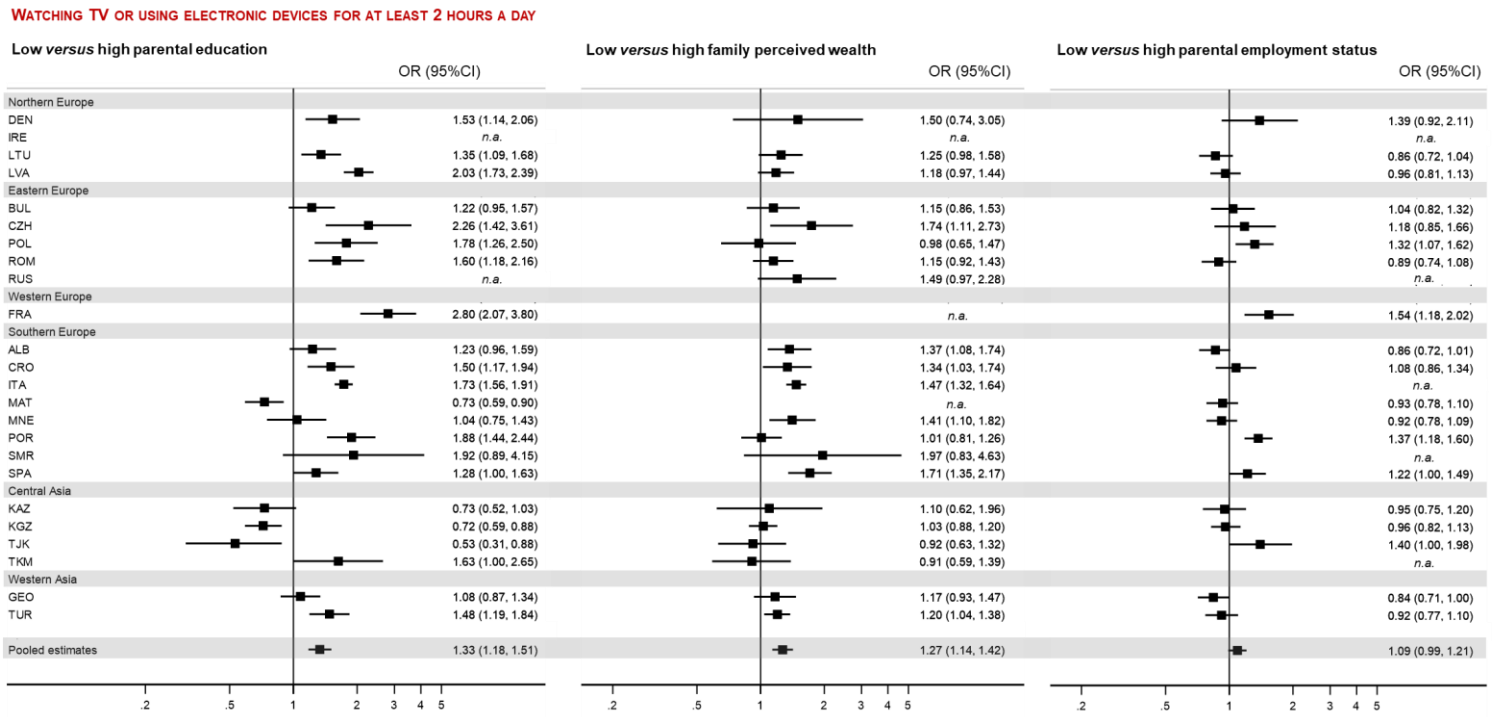


For an explanation of the country abbreviations, see Table 2.

[a] Adjusted ORs and 95% CI were estimated through a multilevel logistic regression analysis. Besides family characteristics (parental education, family perceived wealth and parental employment status), all models included child's, sex, age, nutritional status according to WHO definition (i.e. with

normal weight – overweight – obesity) and region of residence among covariates. Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan. Pooled regression model includes country as covariate.

Figure 3 - Country-specific and pooled adjusted ORs of having a "less healthy" behaviour on screen time (compared to not having) related to parental education, family perceived wealth (i.e. how the family met the end of the month with earnings at its disposal) and parental employment status, COSI/WHO Europe round 4 (2015-17)



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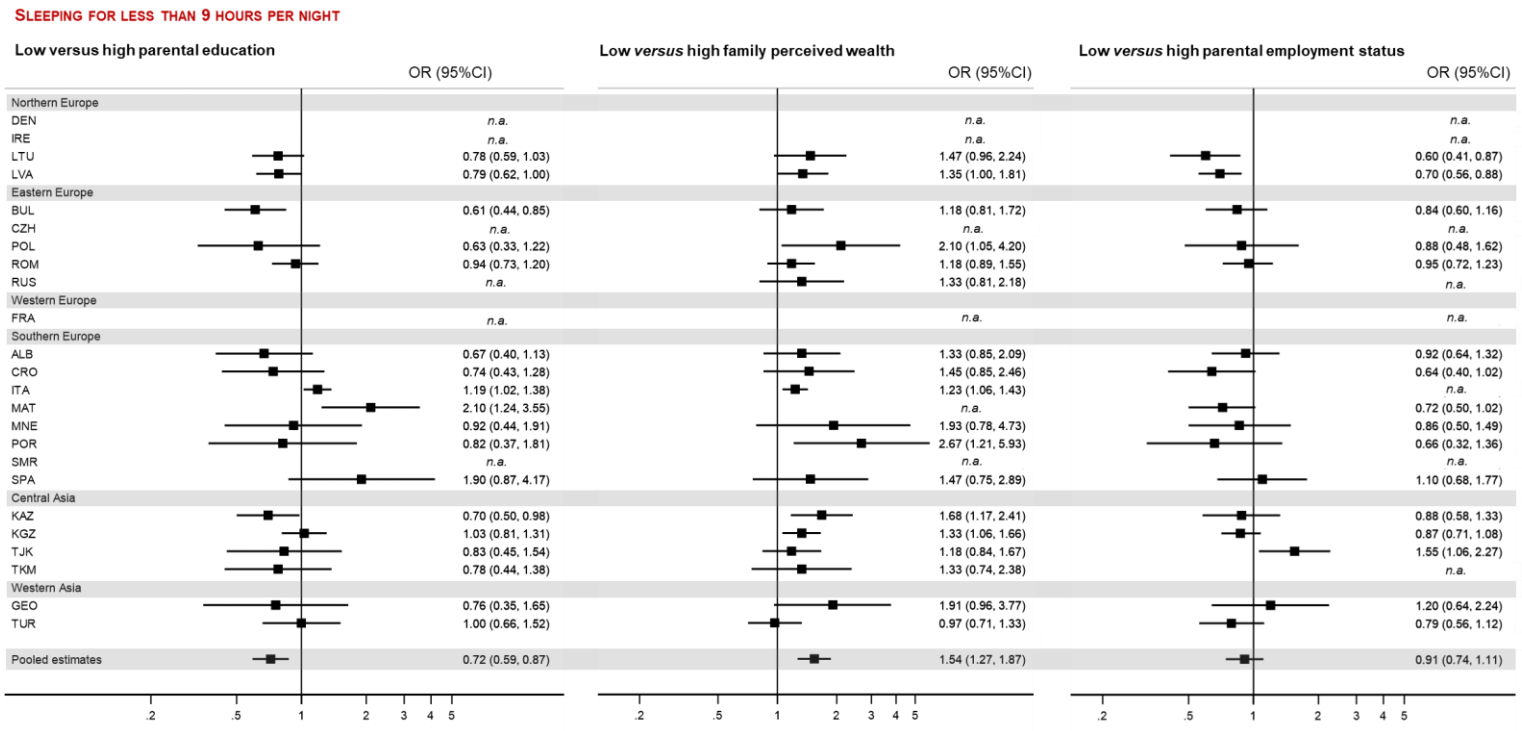
[a] Adjusted ORs and 95% CI were estimated through a multilevel logistic regression analysis. Besides family characteristics (parental education, family perceived wealth and parental employment status), all models included child's, sex, age, nutritional status according to WHO definition (i.e. with normal weight – overweight – obesity) and region of residence among covariates. Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan

and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan. Pooled regression model includes country as covariate.

Figure 4 - Country-specific and pooled adjusted ORs of having a "less healthy" behaviour on sleeping patterns (compared to not having) related to parental education, family perceived wealth (i.e. how the family met the end of the month with earnings at its disposal) and parental employment status, COSI/WHO Europe round 4 (2015-17)



For an explanation of the country abbreviations, see Table 2.

[a] Adjusted ORs and 95% CI were estimated through a multilevel logistic regression analysis. Besides family characteristics (parental education, family perceived wealth and parental employment status), all models included child's, sex, age, nutritional status according to WHO definition (i.e. with normal weight – overweight – obesity) and region of residence among covariates. Pooled estimates were calculated including the following age

groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan. Pooled regression model includes country as covariate.

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SUPPLEMENTARY TABLES

Supplementary Table 1 - Percentages of completed family record forms in COSI/WHO Europe round 4 and number of children included in the analysis by country[a].

Country[a]	Children invited to participate[b]		Children aged 6-9 years with family form filled in	Children included in the analysis[d]
	Total number	Proportion whose family record form was filled in[c], %		
ALB	7,113	36.2	2,527	2,184
BUL	4,090	83.1	3,400	3,217
CRO	7,220	76.0	2,651	2,520
CZH	n.a.	n.a.	1,406	1,342
DEN	3,202	29.9	957	878
FRA	7,094	75.6	5,318	4,462
GEO	4,143	78.4	3,246	2,950
IRE	2,704	32.4	874	802
ITA	50,902	95.2	43,696	40,576
KAZ	6,026	82.3	4,311	3,598
KGZ	8,773	86.6	7,567	5,790
LTU	5,527	69.8	3,812	3,436
LVA	8,143	71.5	5,707	5,071
MAT	4,329	73.4	3,179	2,813
MNE	4,094	66.8	2,736	2,613
POL	3,828	76.9	2,945	2,656
POR	7,475	85.6	6,391	5,458
ROM	9,094	73.6	6,610	5,736
RUS	3,900	52.6	2,052	1,922

SMR	329	93.6	306	289
SPA	14,908	70.1	10,453	9,755
TJK	3,502	93.5	3,270	2,924
TKM	4,085	95.3	3,891	3,518
TUR	14,164	81.7	10,502	10,190
Total [d]	**184,645**	**79.1**	137,807	124,700

Abbreviations: n.a. – not available

[a] Figures refer to primary school children from: Albania (ALB); Bulgaria (BUL); Croatia (CRO); Czechia (CZH); Denmark (DEN); France (FRA); Georgia (GEO); Ireland (IRE); Italy (ITA); Kazakhstan (KAZ); Kyrgyzstan (KGZ); Lithuania (LTU); Latvia (LVA); Malta (MAT); Montenegro (MNE); Poland (POL); Portugal (POR); Romania (ROM); Russia – only Moscow city (RUS); San Marino (SMR); Spain (SPA); Tajikistan (TJK); Turkmenistan (TKM) and Turkey (TUR). Data on family perceived wealth were not collected in France, Ireland and Malta; while Italy, San Marino and Turkmenistan did not collect information on parental employment status. Data on parental education and employment status collected in Moscow city were not included due to the high level of missing data.

[b] Total figures were calculated including only countries with available information on the number of children invited to participate in COSI.

[c] For Croatia, only data on 8-year-olds were available for comparison at the European level. Families' participation in the survey was calculated in the whole sample (not only on 8-year-olds).

[d] All children whose age is between 6 and 9 years old, whose parents filled in the family form and with complete information on all of the following variables: physical activity, sedentary behaviour, sleep, parental educational attainment, employment status and family perceived wealth, unless noted otherwise.

Supplementary table 2 – Country-specific and pooled prevalence (%) of children's "less healthy" behaviours related to physical activity, screen time and sleep patterns by parental education [*]. COSI/WHO Europe round 4 (2015-17)

	Going to and from school by motorised vehicles			**Actively/vigorously playing for less than 1 hour a day**			**Practising sports for less than 2 hours a week**			**Watching TV or using electronic devices for 2 hours a day or more**			**Sleeping for less than 9 hours per night**		
	Parental education														
	High	***Medium***	***Low***	***High***	***Medium***	***Low***	***High***	***Medium***	***Low***	***High***	***Medium***	***Low***	***High***	***Medium***	***Low***
	%														
Northern Europe															
DEN [a;d;g;n]	33.8	47.6	47.6	33.9	25.6	21.8	45.1	34.2	42.7	27.5	38.0	43.6	0	0	0
IRE	74.0	74.0	63.8	13.9	16.6	15.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0	0	0
LTU [a;f;i;n]	48.9	42.3	38.1	10.2	7.2	5.0	31.3	43.7	60.0	34.8	39.7	43.5	11.0	10.6	9.3
LVA [c;f;i;n;p]	52.1	45.4	41.5	21.3	15.9	8.7	15.8	24.6	33.0	35.9	46.9	53.4	15.1	12.8	10.8
Eastern Europe															
BUL [d;i;n;q]	36.4	38.1	32.0	9.7	6.7	6.4	36.0	44.5	77.6	39.1	42.5	53.9	20.0	17.2	12.7
CZH [h;n]	42.9	40.1	36.7	1.6	0.3	2.2	38.4	42.5	54.0	24.4	21.4	42.2	0.7	0.9	1.5
POL [i;n;p]	46.8	47.6	41.7	18.6	17.7	15.8	29.0	41.4	59.3	29.8	44.3	50.3	9.2	5.1	4.7
ROM [c;f;i;n;p]	41.4	39.7	28.5	8.1	4.3	3.0	41.4	59.3	80.7	40.4	49.2	54.7	16.5	15.5	13.1
RUS	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Western Europe															
FRA [a;n]	55.7	56.4	48.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	18.2	29.9	42.9	n.a.	n.a.	n.a.
Southern Europe															
ALB [b;d;i;p]	48.9	32.3	27.7	15.4	14.2	9.5	44.6	69.7	72.4	40.4	46.0	43.8	12.8	9.1	7.5

CRO [f;i;n]	32.8	30.4	33.2	16.0	8.5	5.8	15.6	28.0	43.9	39.3	45.9	55.2	6.0	5.5	4.7
ITA [n;r]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	54.0	61.3	71.4	10.7	11.5	14.2
MAT [c;f;i;r]	81.3	78.4	68.4	31.2	33.0	40.9	27.0	36.9	50.3	44.5	44.2	36.5	3.3	6.2	6.5
MNE [i;n]	41.2	39.6	36.1	3.6	3.6	2.8	28.4	43.3	62.8	49.1	50.8	50.3	3.2	3.3	3.4
POR [c;d;i;n]	84.5	82.9	75.4	17.6	12.5	12.4	24.0	35.2	60.0	15.1	16.7	25.5	1.3	1.6	1.2
SMR [n]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	55.3	57.8	71.2	5.3	5.5	6.7
SPA [c;d;i;n]	52.9	47.8	39.0	30.5	32.5	27.0	27.6	35.5	45.9	15.0	18.9	23.3	1.1	1.7	2.3
Central Asia															
KAZ [c;l;p]	28.5	23.6	12.9	26.5	26.6	30.8	55.9	62.4	67.6	28.9	27.0	20.9	22.4	19.0	14.2
KGZ [c;d;i;m]	34.4	22.1	14.2	8.3	8.1	12.5	68.7	84.5	92.1	54.6	49.2	45.9	18.8	17.8	16.3
TJK [b;d]	10.3	5.3	2.3	24.2	32.6	38.9	83.1	89.3	90.4	34.4	33.9	31.0	16.3	16.3	15.3
TKM [c;d]	37.3	26.8	11.5	14.6	13.6	19.2	69.6	77.6	78.6	49.4	55.0	60.6	10.4	9.1	8.4
Western Asia															
GEO [b;d;i]	46.9	42.9	36.2	11.9	12.4	8.5	38.4	49.6	58.7	40.1	38.4	41.8	2.5	2.2	1.9
TUR [c;i;n]	59.3	41.2	26.8	26.5	26.5	28.8	62.6	76.1	88.4	26.9	36.2	36.6	6.3	7.3	5.7
Pooled estimates	**45.6**	**40.2**	**30.3**	**20.7**	**20.8**	**21.0**	**38.2**	**50.6**	**70.9**	**28.0**	**33.1**	**37.5**	**9.8**	**7.6**	**7.6**

For an explanation of the country abbreviations, see Table 1. Abbreviation 'n.a.' means 'not available'.

[*] Information on parental education was not available for Moscow. Data on transportation to and from school, playing actively/vigorously and practising sports were not collected in Italy and San Marino. Data on playing actively/vigorously, practising sports and sleep patterns were not collected in France. Data on practising sports and watching TV or using electronic devices were not collected in Ireland. Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan.

[a, b, c] Statistically significant difference of proportions between parental educational attainments for going to and from school by motorised vehicles - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (a), $p < 0.001$ (b), $p < 0.0001$ (c).
[d, e, f] Statistically significant difference of proportions between parental educational attainments for actively/vigorously playing for less than 1 hour a day - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (d), $p < 0.001$ (e), $p < 0.0001$ (f).
[g, h, i] Statistically significant difference of proportions between parental educational attainments for practising sports for less than 2 hours a week - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (g), $p < 0.001$ (h), $p < 0.0001$ (i).
[l, m, n] Statistically significant difference of proportions between parental educational attainments for watching TV or using electronic devices for 2 hours a day and more - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (l), $p < 0.001$ (m), $p < 0.0001$ (n).
[p, q, r] Statistically significant difference of proportions between parental educational attainments for sleeping for less than 9 hours per night - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (p), $p < 0.001$ (q), $p < 0.0001$ (r).

Supplementary table 3 – Country-specific and pooled prevalence (%) of children's "less healthy" behaviours related to physical activity, screen time and sleep patterns by family perceived wealth [*]. COSI/WHO Europe round 4 (2015-17)

	Going to and from school by motorised vehicles			**Actively/vigorously playing for less than 1 hour a day**			**Practising sports for less than 2 hours a week**			**Watching TV or using electronic devices for 2 hours a day and more**			**Sleeping for less than 9 hours per night**		
	Family perceived wealth: how a family met the end of the month with its own earnings														
	High	***Medium***	***Low***	***High***	***Medium***	***Low***	***High***	***Medium***	***Low***	***High***	***Medium***	***Low***	***High***	***Medium***	***Low***
	%														
Northern Europe															
DEN [h;l]	42.6	41.6	48.2	29.2	23.4	29.3	37.2	43.3	60.9	32.4	39.5	51.8	0	0	0
IRE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
LTU [b;i;l;p]	46.0	44.3	35.3	7.5	7.5	7.5	39.7	46.2	55.7	36.2	40.6	43.2	8.4	11.4	10.7
LVA [a;n]	50.7	44.9	46.6	16.3	14.7	17.0	21.5	24.4	25.7	41.4	44.0	51.6	12.4	12.5	14.3
Eastern Europe															
BUL [b;i;m]	39.9	36.0	28.0	8.4	6.6	7.3	53.9	55.0	76.5	46.0	45.3	55.0	14.8	15.8	14.6
CZH [d;i;m;p]	41.3	37.6	33.5	0.3	1.7	5.3	42.6	49.7	64.3	32.2	34.3	50.4	1.2	0.6	3.9
POL [a;p]	48.0	47.2	34.5	15.3	18.7	17.5	42.4	42.0	46.0	40.7	39.0	44.6	6.0	6.0	10.3
ROM [c;i;l]	37.4	34.6	26.4	5.1	4.3	3.9	63.4	63.5	80.5	48.2	50.0	54.4	13.5	15.9	14.0
RUS	19.4	16.2	18.7	9.3	8.2	8.6	30.8	36.7	34.4	22.7	27.0	30.7	9.4	11.1	12.7
Western Europe															
FRA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Southern Europe															
ALB [b;i;l]	36.2	35.0	23.7	10.9	10.9	11.4	61.2	62.8	78.2	38.9	45.6	46.8	8.1	9.3	8.8
CRO [a;d;i;l]	35.3	32.3	28.7	9.9	6.7	9.0	30.5	34.8	44.8	46.1	50.0	58.2	4.9	4.6	6.7
ITA [n;r]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	57.4	64.3	72.5	10.6	12.0	15.0
MAT	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

MNE c;e;i;l	40.5	40.0	30.2	2.7	2.3	5.8	48.3	49.9	65.2	45.7	50.9	53.6	2.9	3.0	5.2
POR c;i;n;p	83.5	81.5	68.7	12.5	13.3	13.6	41.9	46.1	61.8	19.7	20.9	26.7	0.8	1.1	2.1
SMR [n]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	52.9	63.3	74.2	14.3	4.7	6.1
SPA [c;d;i;n]	51.0	41.9	35.9	31.3	28.9	27.1	30.3	41.3	54.1	15.8	21.1	29.4	1.6	1.6	2.8
Central Asia															
KAZ [a]	20.5	23.8	15.5	28.7	27.8	29.5	61.2	63.3	66.0	23.2	28.9	22.2	16.7	18.6	17.4
KGZ [c;i]	26.0	24.1	12.2	10.2	10.7	11.3	83.0	80.5	91.4	48.7	51.2	46.3	15.8	17.5	18.1
TJK [l]	3.6	3.4	3.1	35.0	33.0	38.0	89.5	89.9	89.2	33.9	39.4	27.6	13.5	15.0	17.5
TKM [d]	15.7	13.2	11.9	20.6	14.4	17.5	78.2	76.0	83.8	58.7	60.0	59.4	8.9	8.0	9.2
Western Asia															
GEO [i]	41.0	39.9	38.9	10.0	9.6	9.9	51.5	47.3	60.6	39.6	40.6	43.6	1.8	2.0	2.7
TUR c;f;i;m	42.9	34.3	23.0	27.0	25.6	31.2	78.0	81.1	90.4	32.8	34.2	38.3	6.2	6.4	5.6
Pooled estimates	**41.3**	**39.0**	**24.0**	**21.9**	**18.9**	**22.9**	**51.6**	**54.7**	**74.5**	**29.6**	**35.7**	**38.4**	**6.8**	**7.7**	**10.7**

For an explanation of the country abbreviations, see Table 1. Abbreviation 'n.a.' means 'not available'.

[*] Information on family perceived wealth was not available for France, Ireland and Malta. Data on transportation to and from school, playing actively/vigorously and practising sports were not collected in Italy and San Marino. Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan.

[a, b, c] Statistically significant difference of proportions between parental educational attainments for going to and from school by motorised vehicles - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (a), $p < 0.001$ (b), $p < 0.0001$ (c).

[d, e, f] Statistically significant difference of proportions between parental educational attainments for actively/vigorously playing for less than 1 hour a day - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (d), $p < 0.001$ (e), $p < 0.0001$ (f).

[g, h, i] Statistically significant difference of proportions between parental educational attainments for practising sports for less than 2 hours a week - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (g), $p < 0.001$ (h), $p < 0.0001$ (i).

[l, m, n] Statistically significant difference of proportions between parental educational attainments for watching TV or using electronic devices for 2 hours a day and more - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (l), $p < 0.001$ (m), $p < 0.0001$ (n).
[p, q, r] Statistically significant difference of proportions between parental educational attainments for sleeping for less than 9 hours per night - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (p), $p < 0.001$ (q), $p < 0.0001$ (r).

Supplementary table 4 – Country-specific and pooled prevalence (%) of children's "less healthy" behaviours related to physical activity, screen time and sleep patterns by parental employment status [a]. COSI/WHO Europe round 4 (2015-17)

	Going to and from school by motorised vehicles		**Actively/vigorously playing for less than 1 hour a day**		**Practising sports for less than 2 hours a week**		**Watching TV or using electronic devices for 2 hours a day and more**		**Sleeping for less than 9 hours per night**	
	Parental employment status									
	High	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*
	%									
Northern Europe										
DEN [g;l]	41.7	47.7	27.8	23.6	38.2	54.7	34.8	45.2	0	0
IRE [d;i;p]	73.5	66.6	14.0	17.6	n.a.	n.a.	n.a.	n.a.	0	0
LTU [e;g;q]	43.8	42.4	8.2	5.3	42.5	55.0	39.6	38.8	11.3	7.2
LVA	46.7	45.8	16.4	11.8	23.2	27.1	44.6	46.1	13.8	9.6
Eastern Europe										
BUL [c;i;m;p]	37.6	25.8	6.9	6.8	53.2	80.3	45.6	54.4	16.7	12.1
CZH [g]	39.9	34.1	1.3	3.0	46.1	56.4	33.0	38.8	1.1	1.6
POL [i;n]	47.0	42.8	17.9	16.4	38.7	54.2	36.8	49.9	7.0	5.6
ROM [b;d;i]	37.0	28.0	5.2	3.5	58.0	83.9	48.6	52.8	15.5	13.1
RUS	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Western Europe										
FRA [c;n]	57.2	42.6	n.a.	n.a.	n.a.	n.a.	23.8	39.4	n.a.	n.a.
Southern Europe										
ALB [a;e;i;p]	35.9	27.9	13.1	8.4	59.7	75.6	44.6	41.7	9.6	7.1
CRO [i;l]	32.7	32.5	8.6	7.0	30.1	48.2	48.2	55.2	5.6	4.1
ITA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
MAT [c;f;i;n;r]	76.9	67.2	35.6	40.4	36.2	53.4	41.2	37.7	6.3	5.1

MNE [b;i]	40.8	32.1	3.2	3.2	48.3	60.2	50.8	49.6	3.2	4.1
POR [c;i;n]	81.8	69.0	13.7	11.4	44.6	63.4	20.2	27.9	1.3	1.2
SMR	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SPA [c;e;i;n]	51.5	36.7	31.8	26.5	31.5	45.8	16.2	25.2	1.7	2.1
Central Asia										
KAZ [a]	22.6	16.7	27.1	30.4	59.7	68.1	26.1	22.3	18.7	16.5
KGZ [c;i]	25.1	16.8	9.4	11.2	80.6	88.8	50.3	47.4	18.5	16.6
TJK [a;i;p]	5.4	2.5	37.1	36.1	83.3	91.9	30.5	32.2	10.7	17.3
TKM	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Western Asia										
GEO [c;i]	44.1	34.4	9.3	10.8	48.2	58.5	42.3	39.3	2.0	2.2
TUR [c;i;l]	53.3	28.0	26.0	28.5	68.3	87.0	32.3	36.1	6.7	5.8
Pooled estimates	**43.8**	**27.4**	**19.5**	**22.7**	**46.3**	**73.1**	**32.1**	**36.6**	**7.9**	**8.5**

For an explanation of the country abbreviations, see Table 1. Abbreviation 'n.a.' means 'not available'.

[a] Information on parental employment status was not available for Italy, Moscow, San Marino and Turkmenistan. Data on playing actively/vigorously, practising sports and sleep patterns were not collected in France. Data on practising sports and watching TV or using electronic devices were not collected in Ireland. Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan.

[a, b, c] Statistically significant difference of proportions between parental educational attainments for going to and from school by motorised vehicles - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (a), $p < 0.001$ (b), $p < 0.0001$ (c).

[d, e, f] Statistically significant difference of proportions between parental educational attainments for actively/vigorously playing for less than 1 hour a day - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (d), $p < 0.001$ (e), $p < 0.0001$ (f).

[g, h, i] Statistically significant difference of proportions between parental educational attainments for practising sports for less than 2 hours a week - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (g), $p < 0.001$ (h), $p < 0.0001$ (i).

[l, m, n] Statistically significant difference of proportions between parental educational attainments for watching TV or using electronic devices for 2 hours a day and more - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (l), $p < 0.001$ (m), $p < 0.0001$ (n).

[p, q, r] Statistically significant difference of proportions between parental educational attainments for sleeping for less than 9 hours per night - Pearson's chi-squared corrected using Rao-Scott method, $p < 0.05$ (p), $p < 0.001$ (q), $p < 0.0001$ (r).

Supplementary table 5 – Country-specific and pooled adjusted ORs of having a "less healthy" behaviours on physical activity – i.e going to and from school by motorised vehicles; actively/vigorously playing for less than 1 hour a day and practising sports for less than 2 hours a week (compared to not having) related to medium versus high parental education and medium versus high family perceived wealth.[a] COSI/WHO Europe round 4 (2015-17)

	Going to and from school by motorised vehicles		**Actively/vigorously playing for less than 1 hour a day**		**Practising sports for less than 2 hours a week**	
	Parental education	**Family perceived wealth**	**Parental education**	**Family perceived wealth**	**Parental education**	**Family perceived wealth**
	Medium vs High	*Medium vs High*	*Medium vs High*	*Medium vs High*	*Medium vs High*	*Medium vs High*
Northern Europe						
DEN	1.63 [1.12-2.37]	0.73 [0.53-1.01]	0.67 [0.48-0.96]	0.85 [0.56-1.27]	0.66 [0.43-1.01]	1.33 [0.97-1.83]
IRE	0.80 [0.45-1.43]	n.a.	1.33 [0.82-2.15]	n.a.	n.a.	n.a.
LTU	0.77 [0.61-0.98]	0.94 [0.76-1.15]	0.72 [0.47-1.12]	1.04 [0.69-1.57]	1.68 [1.37-2.06]	1.20 [1.01-1.42]
LVA	0.86 [0.73-1.02]	0.81 [0.69-0.95]	0.76 [0.61-0.95]	1.03 [0.82-1.29]	1.68 [1.38-2.05]	1.05 [0.86-1.28]
Eastern Europe						
BUL	1.12 [0.86-1.47]	0.84 [0.66-1.06]	0.65 [0.42-1.01]	0.78 [0.49-1.22]	1.10 [0.80-1.50]	1.16 [0.87-1.56]
CZH	0.84 [0.52-1.38]	0.81 [0.61-1.07]	n.a.	n.a.	1.11 [0.76-1.63]	1.26 [0.97-1.62]
POL	0.85 [0.67-1.08]	0.95 [0.69-1.32]	0.96 [0.65-1.41]	1.43 [0.94-2.16]	1.44 [1.04-2.00]	0.96 [0.74-1.24]
ROM	0.98 [0.72-1.33]	1.02 [0.87-1.21]	0.59 [0.37-0.94]	0.80 [0.54-1.19]	1.36 [1.09-1.70]	1.09 [0.91-1.30]
RUS	n.a.	0.83 [0.64-1.08]	n.a.	0.83 [0.57-1.20]	n.a.	1.28 [1.03-1.60]
Western Europe						
FRA	0.79 [0.58-1.07]	n.a.	n.a.	n.a.	n.a.	n.a.
Southern Europe						
ALB	0.87 [0.54-1.39]	1.01 [0.76-1.35]	0.96 [0.54-1.68]	1.12 [0.83-1.52]	2.51 [1.72-3.66]	1.03 [0.83-1.28]
CRO	0.81 [0.59-1.11]	0.85 [0.68-1.07]	0.51 [0.34-0.78]	0.78 [0.53-1.14]	1.69 [1.20-2.38]	1.06 [0.84-1.33]
ITA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
MAT	0.94 [0.70-1.28]	n.a.	1.02 [0.78-1.32]	n.a.	1.37 [1.05-1.78]	n.a.
MNE	0.95 [0.71-1.27]	0.96 [0.73-1.25]	0.80 [0.36-1.79]	0.80 [0.38-1.70]	1.73 [1.28-2.34]	1.03 [0.79-1.32]
POR	0.94 [0.66-1.32]	0.88 [0.69-1.13]	0.66 [0.49-0.88]	1.12 [0.90-1.39]	1.57 [1.22-2.03]	0.99 [0.82-1.18]
SMR	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SPA	0.95 [0.75-1.19]	0.83 [0.72-0.97]	1.13 [0.93-1.38]	0.96 [0.83-1.11]	1.30 [1.08-1.56]	1.28 [1.10-1.49]

ALB	0.87 [0.54-1.39]	1.01 [0.76-1.35]	0.96 [0.54-1.68]	1.12 [0.83-1.52]	2.51 [1.72-3.66]	1.03 [0.83-1.28]
Central Asia						
KAZ	0.93 [0.62-1.39]	1.22 [0.84-1.78]	1.12 [0.80-1.56]	1.00 [0.72-1.37]	1.03 [0.76-1.39]	0.88 [0.66-1.18]
KGZ	0.97 [0.76-1.23]	1.02 [0.80-1.31]	1.03 [0.71-1.51]	1.12 [0.82-1.55]	1.40 [1.09-1.81]	0.94 [0.73-1.22]
TJK	n.a.	n.a.	2.03 [1.17-3.51]	0.88 [0.66-1.17]	1.51 [0.80-2.83]	0.92 [0.60-1.41]
TKM	0.82 [0.49-1.37]	0.99 [0.70-1.41]	0.84 [0.40-1.74]	0.89 [0.65-1.22]	1.58 [0.96-2.59]	1.01 [0.72-1.42]
Western Asia						
GEO	1.09 [0.81-1.47]	0.82 [0.64-1.04]	1.19 [0.76-1.85]	0.89 [0.64-1.24]	1.32 [1.00-1.74]	0.92 [0.75-1.12]
TUR	0.88 [0.67-1.14]	0.86 [0.72-1.03]	1.05 [0.83-1.33]	0.88 [0.77-1.02]	1.49 [1.10-2.03]	0.97 [0.78-1.20]
Pooled estimates	**0.98 [0.82-1.16]**	**0.89 [0.79-1.00]**	**1.00 [0.85-1.18]**	**1.02 [0.90-1.17]**	**1.30 [1.12-1.51]**	**1.13 [1.00-1.27]**

For an explanation of the country abbreviations, see Table 1. Abbreviation 'n.a.' means 'not available'.

[a] Data on transportation to and from school were not collected in Italy and San Marino. Data on actively/vigorously playing were not collected in France, Italy and San Marino. Data on practising sports were not collected in France, Ireland, Italy and San Marino. Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan. Adjusted ORs and 95% CI were estimated through a multilevel logistic regression analysis. Besides family characteristics (parental education, family perceived wealth and parental employment status), all models included child's, sex, age, nutritional status according to WHO definition (i.e. with normal weight – overweight – obesity) and region of residence among covariates. The following regression models were not estimated due to the limit number of children who had the analysed "less healthy" behaviour: the model related to going to and from school by motorized vehicles for Tajikistan; the model for actively/vigorously playing for less than 1 hour a day Czechia

Supplementary table 6 – Country-specific and pooled adjusted ORs of having a "less healthy" behaviour (compared to not having) on watching TV or using electronic devices for 2 hours a day and more and on sleeping for less than nine hours per night, related to medium versus high parental education and medium versus high family perceived wealth [a]. COSI/WHO Europe round 4 (2015-17)

	Watching TV or using electronic devices for 2 hours a day and more		**Sleeping for less than nine hours per night**	
	Parental education	**Family perceived wealth**	**Parental education**	**Family perceived wealth**
	Medium vs High	*Medium vs High*	*Medium vs High*	*Medium vs High*
DEN	1.37 [0.96-1.95]	1.18 [0.88-1.59]	n.a.	n.a.
IRE	n.a.	n.a.	n.a.	n.a.
LTU	1.14 [0.91-1.43]	1.20 [1.01-1.44]	0.83 [0.63-1.08]	1.57 [1.20-2.06]
LVA	1.52 [1.29-1.80]	0.98 [0.84-1.15]	0.87 [0.68-1.10]	1.12 [0.88-1.41]
BUL	0.92 [0.69-1.23]	0.96 [0.76-1.22]	0.74 [0.52-1.05]	1.05 [0.77-1.43]
CZH	0.83 [0.47-1.46]	0.92 [0.68-1.26]	n.a.	n.a.
POL	1.61 [1.11-2.36]	0.88 [0.67-1.17]	0.59 [0.33-1.05]	1.17 [0.62-2.22]
ROM	1.32 [0.96-1.82]	1.08 [0.89-1.32]	1.06 [0.77-1.46]	1.31 [1.04-1.65]
RUS	n.a.	1.24 [0.90-1.71]	n.a.	1.18 [0.87-1.60]
FRA	1.66 [1.29-2.15]	n.a.	n.a.	n.a.
ALB	1.27 [0.92-1.76]	1.31 [1.02-1.69]	0.74 [0.46-1.19]	1.19 [0.83-1.71]
CRO	1.17 [0.87-1.58]	1.08 [0.88-1.34]	0.88 [0.50-1.54]	0.95 [0.58-1.57]
ITA	1.23 [1.11-1.37]	1.18 [1.06-1.31]	1.04 [0.88-1.23]	1.11 [0.96-1.29]
MAT	1.02 [0.80-1.29]	n.a.	1.78 [0.98-3.23]	n.a.
MNE	1.08 [0.76-1.55]	1.18 [0.92-1.50]	1.02 [0.51-2.03]	1.28 [0.54-3.03]

POR	1.08 [0.81-1.44]	0.97 [0.8-1.18]	1.34 [0.54-3.36]	1.35 [0.67-2.73]
SMR	1.19 [0.53-2.67]	n.a.	1.04 [0.18-5.92]	n.a.
SPA	1.16 [0.88-1.51]	1.19 [0.99-1.44]	1.72 [0.74-3.98]	0.76 [0.41-1.40]
ALB	1.27 [0.92-1.76]	1.31 [1.02-1.69]	0.74 [0.46-1.19]	1.19 [0.83-1.71]
KAZ	0.91 [0.68-1.22]	1.11 [0.80-1.54]	0.96 [0.70-1.32]	1.11 [0.82-1.51]
KGZ	0.80 [0.64-1.00]	1.11 [0.91-1.35]	1.15 [0.88-1.51]	1.10 [0.86-1.42]
TJK	0.73 [0.43-1.24]	1.09 [0.79-1.52]	0.83 [0.46-1.49]	1.09 [0.77-1.54]
TKM	1.25 [0.75-2.08]	0.86 [0.65-1.16]	0.83 [0.41-1.66]	0.91 [0.62-1.33]
GEO	0.92 [0.71-1.19]	1.00 [0.82-1.23]	0.89 [0.34-2.35]	0.92 [0.43-1.98]
TUR	1.56 [1.18-2.08]	1.02 [0.88-1.17]	1.26 [0.74-2.16]	1.05 [0.75-1.46]
Pooled estimates	**1.24 [1.08-1.44]**	**1.11 [1.01-1.22]**	**0.77 [0.63-0.95]**	**1.27 [1.07-1.51]**

For an explanation of the country abbreviations, see Table 1. Abbreviation 'n.a.' means 'not available'.

[a] Data on screen time were not collected in Ireland. Pooled estimates were calculated including the following age groups/countries: i) 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Lithuania, Latvia, Montenegro, Portugal, Spain, Tajikistan and Turkey; ii) 8-year-olds from Albania, Croatia, Poland and Romania; iii) 9-year-olds from Kazakhstan. Adjusted ORs and 95% CI were estimated through a multilevel logistic regression analysis. Besides family characteristics (parental education, family perceived wealth and parental employment status), all models included child's, sex, age, nutritional status according to WHO definition (i.e. with normal weight – overweight – obesity) and region of residence among covariates. The regression model on sleep pattern was not estimated for Denmark, Ireland and Czechia due to the absence or the limited number of children who had the analysed "less healthy" behaviour.