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Original article

National-Level Wealth Inequality and Socioeconomic Inequality in Adolescent Mental Well-Being: A Time Series Analysis of 17 Countries

Maxim Dierckens, M.Sc.[a,*], Dominic Weinberg, M.Sc.[b], Yanyan Huang, M.Sc.[a], Frank Elgar, Ph.D.[c], Irene Moor, Ph.D.[d], Lilly Augustine, Ph.D.[e], Nelli Lyyra, Ph.D.[f], Benedicte Deforche, Ph.D.[a,g], Bart De Clercq, Ph.D.[a], Gonneke W. J. M. Stevens, Ph.D.[b,1], and Candace Currie, Ph.D.[h,1]

[a] *Department of Public Health and Primary Care, Ghent University, Ghent, Belgium*
[b] *Department of Interdisciplinary Social Science, Faculty of Social and Behavioural Sciences, Utrecht University, Utrecht, the Netherlands*
[c] *Institute for Health and Social Policy, McGill University, Montreal, Quebec, Canada*
[d] *Institute of Medical Sociology, Martin Luther University Halle-Wittenberg, Halle (Salle), Germany*
[e] *Department of Pedagogy and Psychology, Jönköping University, Jönköping, Sweden*
[f] *Faculty of Sport and Health Sciences, University of Jyvaskyla, Jyväskylä, Finland*
[g] *Physical Activity, Nutrition and Health Research Unit, Faculty of Physical Education and Physical Therapy, Vrije Universiteit Brussel, Brussels, Belgium*
[h] *Global Adolescent Health and Behaviour Research Unit, GCU London, London, United Kingdom*

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A B S T R A C T

Purpose: Although previous research has established a positive association between national income inequality and socioeconomic inequalities in adolescent health, very little is known about the extent to which national-level wealth inequalities (i.e., accumulated financial resources) are associated with these inequalities in health. Therefore, this study examined the association between national wealth inequality and income inequality and socioeconomic inequality in adolescents' mental well-being at the aggregated level.
Methods: Data were from 17 countries participating in three consecutive waves (2010, 2014, and 2018) of the cross-sectional Health Behaviour in School-aged Children study. We aggregated data on adolescents' life satisfaction, psychological and somatic symptoms, and socioeconomic status (SES) to produce a country-level slope index of inequality and combined it with country-level data on income inequality and wealth inequality (n = 244,771). Time series analyses were performed on a pooled sample of 48 country-year groups.
Results: Higher levels of national wealth inequality were associated with fewer average psychological and somatic symptoms, while higher levels of national income inequality were associated

IMPLICATIONS AND CONTRIBUTION

Research has established the positive association between national income inequality and adolescent socioeconomic health inequalities, but little is known about national-level wealth inequalities (i.e., accumulated financial resources). This study linked national wealth and income inequality to socioeconomic inequalities in

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* Address correspondence to: Maxim Dierckens, M.Sc., Department of Public Health and Primary Care, Ghent University, Corneel Heymanslaan 10, 9000 Ghent, Belgium.
E-mail address: Maxim.Dierckens@UGent.be (M. Dierckens).
[1] These authors contributed equally to this article.

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with more psychological and somatic symptoms. No associations between either national wealth inequality or income inequality and life satisfaction were found. Smaller differences in somatic symptoms between higher and lower SES groups were found in countries with higher levels of national wealth inequality. In contrast, larger differences in psychological symptoms and life satisfaction (but not somatic symptoms) between higher and lower SES groups were found in countries with higher levels of national income inequality.

Conclusions: Although both national wealth and income inequality are associated with socioeconomic inequalities in adolescent mental well-being at the aggregated level, associations are in opposite directions. Social policies aimed at a redistribution of income resources at the national level could decrease socioeconomic inequalities in adolescent mental well-being while further research is warranted to gain a better understanding of the role of national wealth inequality in socioeconomic inequalities in adolescent health.

adolescents' mental well-being and found contrasting effects.

The mental well-being of adolescents is of pressing global concern. Mental health problems affect 10%–20% of children and adolescents worldwide and are a leading cause of health-related disability in young people, while these problems also commonly track through to adulthood [1]. In addition, a recent systematic review found that there has been a decline in adolescent girls' mental health well-being over the previous decade, with more mixed findings for boys [2]. A substantial body of work has furthermore established how socioeconomic conditions at the individual level affect adolescents' mental well-being. Throughout developed countries, socioeconomic inequalities in adolescent mental well-being have been identified, whereby adolescents with a lower socioeconomic status (SES) consistently have worse health compared with their counterparts with a higher SES [3,4]. However, the size of these health inequalities varies considerably across countries [5]. To illustrate, cross-country research indicated that adolescents from lower SES families reported more health complaints than adolescents from higher SES families in 31 of 37 countries, while at the same time, this association varied between countries—for example, the odds ratio of low SES (compared with high SES) adolescents reporting psychosomatic symptoms was 2.1 in Germany, but only 1.2 in Ireland [6].

Accumulating evidence has pointed out that socioeconomic mental health inequalities are greatest in countries with more income inequality (GINI), suggesting that SES differences in mental health are intensified in more unequal countries [7,8]. More recent evidence has established that at the country level, widening socioeconomic inequalities in adolescent health over time coincides with widening income inequalities [9]. National-level GINI is theorized to be associated with socioeconomic health inequalities because it creates social stratification and may lead to less support for the provision of public goods that promote the mental health of low SES adolescents [10]. In addition, in income unequal countries, low SES adolescents may be more likely to make unfavorable social comparisons and therefore may feel relatively deprived, resulting in shame, stress, and worse mental health [11]. However, this research on national GINI does not give a complete picture of how socioeconomic inequalities at the national level are associated with socioeconomic health inequalities within adolescent populations.

Research is increasingly acknowledging the importance of studying national *wealth* inequalities in addition to national *income* inequalities. The rise in wealth inequality (WI) over the last few decades, especially after the "Great Recession" in 2007–2009 [12,13], has been the focus of a growing body of literature that has recognized the relevance of wealth as a dimension of social inequality [14,15]. Studies within this field have primarily concentrated on the aging population, in which wealth becomes a more relevant indicator of SES than income once retired, and have found that wealth is associated with better health and well-being [16]. Where income refers to the flow of current financial resources, wealth is a cumulative stock measure, expressing total financial assets (e.g., savings, real estate, stocks, and bonds) minus total financial liabilities (e.g., mortgage and consumer loans) [14,17,18]. Wealth is therefore more stable than income—for example, a lack of wealth is likely to be persistent over time and across generations [15]—and can provide financial security in the event of a decrease or loss of income [19,20]. Wealth thus more accurately and comprehensively reflects the long-term financial resources at an individual's or family's disposal than income [16,18]. This assertion even more so holds true at the national level and is supported by a recent report on wealth distribution in 28 countries, which found that national WI is twice as unequal as that of income, with the wealthiest 10% holding half of the total wealth [21]. Because of the more "stable" nature of wealth than income, national-level WI may be an even more significant source of social stratification and unfavorable social comparisons. Therefore, it is our expectation that national-level WI may be more strongly associated with socioeconomic health inequalities in adolescent populations than national-level GINI. However, cross-national research has been limited because of the lack of comparable data on national-level WI. We are aware of only one study looking at the association between national-level WI and population health, which found that WI was associated with lower life expectancy and higher infant mortality [22].

This study aims to help fill this gap of scientific knowledge by investigating whether and how national-level WI is associated with socioeconomic inequalities in adolescents' mental well-being across 17 countries. To do so, we established a new WI indicator that allows for cross-national comparisons. Given our relatively small sample of countries, we will test the association between national WI and socioeconomic inequalities in adolescent mental well-being (i.e., life satisfaction and psychological and somatic symptoms) at the aggregated level after taking into account national GINI using pooled time series analysis. Both national-level GINI and WI were expected to exacerbate socioeconomic inequalities in adolescent mental well-being, but we assumed a stronger association with national WI than GINI because of the more stable construct of wealth than income [15].

Methods

Study participants and design

For this study, data from the Health Behaviour in School-aged Children (HBSC) study were used, which is an international World Health Organization collaborative cross-sectional study and is carried out every 4 years in a growing network of countries and regions within the World Health Organization European zone and North America [5,23]. Repeated individual-level cross-sectional data on psychological symptoms, somatic symptoms, life satisfaction, and SES were collected in 17 countries (Austria, Belgium [Flemish and French region], Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain) participating in the successive 2009/2010, 2013/2014, and 2017/2018 waves of the HBSC study. Data from other countries involved in the HBSC study were not used because no country-level data on WI were available for these countries. In total, our pooled sample consisted of 244,771 adolescents from 48 country and year groups. The sex and age distribution was almost equal across all survey years (Table 1). In 2010, Malta was omitted from the analysis because data on mental well-being and SES were not available, and Latvia and Finland were omitted because economic information required to calculate a WI measure was unavailable (Table 1).

Conforming to the international research protocol, in each participating country, a national representative sample of 11-, 13- and 15-year-old adolescents was drawn, using a cluster probability sampling design with classes within schools as the initial sampling units [24–26]. Response rates at the individual level were higher than 60% for most countries and regions [27,28]. Data were collected through an internationally standardized and validated self-completion questionnaire. Questionnaires were administered in classrooms after instruction by and under the supervision of a teacher or trained interviewer. Pupils participation was anonymous and voluntarily after passive or active consent from school administrators, parents, and children (in accordance with the requirements in the different countries). This research was approved by the Ethics Committee of the University Hospital of Ghent (EC 2019/0755), and ethical clearance or equivalent approval to conduct the study was granted in each country.

Dependent variables

Psychological and somatic symptoms were measured with the HBSC Symptom Checklist assessing the frequency of four psychological symptoms (feeling low, irritability or bad temper, feeling nervous, and difficulty sleeping) and four somatic symptoms (headache, stomach ache, backache, and feeling dizzy) experienced over the past 6 months [29]. Response options varied on 5-point scale from "*rarely or never = 0*" to "*about every day = 4*." A sum score was calculated for each of the two dimensions (range: 0–16). Previous research has demonstrated the validity and reliability of the HBSC Symptom Checklist and use of these two-dimension subscales [30,31]. Life satisfaction was assessed using the Cantril ladder, which is a reliable and valid measure to be used within adolescent samples [32]. Adolescents were asked to rate how they felt about their life at present. Answers ranged from "*worst possible life = 0*" to "*best possible life = 10*."

SES was assessed using the HBSC Family Affluence Scale (FAS) [33]. The FAS is an index capturing the families' material assets based on the answer to four simple questions, including "Does your family own a car, van or truck?" ("*no = 0*," "*yes, one = 1*," and "*yes, two or more = 2*"), "Do you have your own bedroom for yourself?" ("*no = 0*" and "*yes = 1*"), "During the past 12 months, how many times did you travel abroad on holiday?" ("*not at all = 0*," "*once = 1*," and "*twice or more = 2*"), and "How many computers does your family own?" ("*none = 0*," "*one = 1*," and "*two or more = 2*"). A summary score was calculated and then ridit transformed to facilitate comparisons of SES between countries and time-varying socioeconomic contexts. This resulted in a continuous material deprivation index, ranging from 0 (lowest SES) to 1 (highest SES) for each country- and year-group with a sample mean of .5. When included in a regression model, the coefficient can be interpreted as the difference in health between the highest and lowest SES individual (detailed below) [34]. The FAS was used to measure SES because missing data on FAS items are generally low and the instrument has proven to be valid [33].

Independent and control variables

Three country-level variables were considered in our analyses: gross national income (GNI), GINI, and WI. Data on GNI for every country and year came from the World Bank Databank [35]. To allow cross-national comparisons, GNI calculated in national currencies were converted to U.S. dollars using the Atlas Method. Data on national GINI for every country and year were obtained from version 8 of the Standardised World Income Inequality Database [36]. This dataset provides comparable GINI indices of net GINI for 174 countries covering the largest possible timespan for these countries from 1960 till present. Theoretically, the GINI index ranges from 0 (perfect equality) to 1 (perfect inequality).

A new indicator of WI was devised for the purpose of this analysis. It was calculated by simulating household balance sheets over a 10-year period (October 2008 to December 2017) because of the lack of comparable time series data on the composition of households' balance sheets [37,38]. First, using data from the second wave of the European Central Bank Household Finance and Consumption Survey, we constructed household balance sheets for each quintile of household wealth distribution in each country in 2014 [39,40]. The composition of assets and liabilities in household balance sheets is fixed with four asset values (deposits, bonds, equities, and real estate) and two liability values (mortgage and consumer loans). Second, using European market data from October 2008 to December 2017, we constructed quarterly time series of returns, and thus balance sheets for this period, for both asset and liability values. European market data on quarterly changes in asset and liability values for each county were collected from several financial and economic databases: Statistical Data Warehouse (deposits and liabilities), Thomson Reuters Datastream (bonds and equities), and Bank for International Settlements (real estate; in Appendix Table 1). For each country separately, WI at every time point was measured by calculating the percentage of wealth held by the top two quintiles of the wealth distribution.

Statistical analysis

Given that we have repeated cross-sectional observations at the individual-level and repeated time series data at the country

Table 1
Sample characteristics and descriptive statistics by survey year

	2010 (n = 72,057)	2014 (n = 90,350)	2018 (n = 82,364)
Individual characteristics			
Sex, n (%)			
Girl	36,461 (50.6)	45,976 (50.9)	41,713 (50.6)
Boy	35,596 (49.4)	44,374 (49.1)	40,651 (49.4)
Age, n (%)			
11	22,092 (31.0)	28,057 (31.3)	28,167 (34.5)
13	24,878 (34.9)	32,022 (35.8)	28,652 (35.1)
15	24,344 (34.1)	29,469 (32.9)	24,757 (30.3)
Age	13.56 (1.64)	13.57 (1.62)	13.46 (1.62)
Country characteristics			
Gross national income, US$	37,428 (18,892)	35,821 (16,787)	34,241 (15,901)
Income inequality[a]	.29 (.04)	.30 (.04)	.30 (.04)
Wealth inequality[b]	.82 (.06)	.85 (.07)	.85 (.07)
Countries	14[c]	17	17

Data are mean (SD) unless otherwise indicated.
[a] The countries' income inequality level measured from 0 to 1 with higher values indicating for greater income inequality.
[b] The percentage of wealth held by wealthiest 40% of the population measured from 0 to 1.
[c] In 2010, individual-level data are missing for Malta, and wealth inequality data are missing for Latvia and Finland.

level, we aggregated the individual-level data to the country-level data by means of a country health inequality index. This health inequality index is established through a weighted regression analysis by estimating the slope coefficient of a ridit-based index of SES (family affluence) for life satisfaction and psychological and somatic symptoms, adjusted for age and sex. The resulting slope index of inequality (SII) is an ecologic summary statistic denoting the difference in health between the highest and lowest SES groups. We combined these country-level data on health inequality with the country-level data on GNI, GINI, and WI. We applied data weights to account for sampling differences between countries.

Given these data were repeated observations from a small group of countries (14 countries in 2009/2010 and 17 countries in 2013/2014 and 2017/2018), we performed a pooled time series analysis on our pooled dataset of 48 country and year groups. By partialing out the dependency in the data, this analysis enabled us to examine the association between national-level WI and socioeconomic inequalities in life satisfaction and psychological and somatic symptoms in adolescent populations. We applied Prais-Winsten time series regression models with panel-correct standard errors on our pooled dataset of 48 country and year groups in our sample using the "xtpcse" command in STATA 16 (Statacorp LLC, College Station, TX) [41].

We ran two models. In a first model, we examined the effect of national WI on (socioeconomic inequalities in) adolescent life satisfaction and psychological and somatic symptoms. In a second model, we added national GINI to the model. Both models were controlled for GNI to account for differences in national income between countries. GINI and WI were scaled to the same theoretical range (0–1), and GNI was changed to thousands of U.S. dollars to facilitate reading of its regression coefficient. GINI, WI, and GNI were grand mean centered. Alpha level was set at .05.

Results

Descriptive results

Mean values for adolescents' psychological symptoms, somatic symptoms, and life satisfaction across countries are shown in Table 2. Psychological symptoms were low but increased every survey cycle from 2010 (mean = 4.34) to 2018 (mean = 5.38). Somatic symptoms were low but increased from 2010 (mean = 3.00) to 2014 (mean = 3.30) and then remained relatively stable (mean = 3.35). Life satisfaction was quite high in 2010 (mean = 7.64) but decreased slightly in 2014 (mean = 7.57) and increased again in 2018 (mean = 7.68). Descriptive statistics of the SII indicated that socioeconomic inequalities in mental well-being decreased from 2010 to 2014 only to increase again in 2018, as shown in Table 2. This pattern is visible for psychological symptoms, somatic symptoms, and life satisfaction.

Across countries, the wealthiest 40% had, on average, 82% of the wealth in 2010, which increased to 85% by 2014 and remained stable thereafter (Table 1). The lowest WI was .71 (Slovakia, 2010), and the highest was .99 (The Netherlands, 2018; Appendix Table 2). This means that for the Netherlands, the wealthiest 40% of the population held 99% of the wealth in 2018. Average GINI remained stable from 2010 to 2018. The lowest GINI was .24 (Slovenia, 2010) and the highest was .36 (Latvia, 2010; Appendix Table 2). As shown in Table 1, average GNI dropped by US$ 3,000 between 2010 and 2018 (from US$ 37,428 to US$ 34,241). From 2010 to 2018, GNI ranged from US$ 13,420 (Latvia, 2010) to US$ 88,000 (Luxembourg, 2010; Appendix Table 2). Table 3 depicts correlations between the dependent and independent variables. There was a strong positive association between somatic and psychological symptoms. A negative but weak association between life satisfaction and both somatic and psychological symptoms was observed. Similarly, socioeconomic inequalities in psychological symptoms were strongly positively associated with socioeconomic inequalities in somatic symptoms, whereas socioeconomic inequalities in life satisfaction

Table 2
Average mental well-being and socioeconomic inequalities in mental well-being over three survey years

	Psychological symptoms	Somatic symptoms	Life satisfaction
Average mental health			
2010	4.34 (3.24 to 5.84)	3.00 (1.98 to 4.12)	7.64 (7.40 to 8.00)
2014	4.86 (3.32 to 6.25)	3.30 (2.31 to 4.18)	7.57 (7.33 to 7.95)
2018	5.38 (3.84 to 6.88)	3.35 (2.36 to 4.59)	7.68 (7.33 to 8.09)
Slope index of inequality (SII)[a]			
2010	.54 (.03 to 1.37)	.35 (−.10 to .90)	−.75 (−1.16 to −.42)
2014	.30 (−.31 to 1.07)	.20 (−.33 to .69)	−.65 (−1.22 to −.22)
2018	.52 (−.04 to 1.39)	.33 (−.11 to .92)	−.79 (−1.49 to −.29)

Data are regression-based mean and regression slope coefficient (minimum and maximum values).
[a] Difference in health between the highest (1) and lowest (0) socioeconomic groups.

Table 3
Correlations between mental wellbeing, socioeconomic inequalities in mental wellbeing and wealth inequality, income inequality and gross national income across countries

	1	2	3	4	5	6	7	8	9
1. Average psychological symptoms	1.00	.79**	−.29*	.03	.01	−.16	−.19	.08	−.05
2. Average somatic symptoms		1.00	−.49**	.14	.17	−.12	−.08	−.04	.17
3. Average life satisfaction			1.00	.03	−.12	.12	−.04	−.03	.03
4. SII psychological symptoms				1.00	.72**	−.70**	.01	.15	.04
5. SII somatic symptoms					1.00	−.53**	−.03	−.01	.30*
6. SII life satisfaction						1.00	−.16	−.29*	.01
7. Wealth inequality							1.00	.24	.39*
8. Income inequality								1.00	−.29*
9. Gross national income, US$									1.00

SII = slope index of inequality (i.e., represents the difference in health between the highest [1] and lowest [0] SES groups).
*$p < .05$ and **$p < .001$.

were strongly negatively associated with socioeconomic inequalities in both somatic and psychological symptoms. GNI had a small positive association with national WI and a small negative association with national GINI. There was a small negative association between national GINI and socioeconomic inequalities in life satisfaction and a small positive association between GNI and socioeconomic inequalities in somatic symptoms.

National WI and GINI and socioeconomic inequalities in adolescent mental well-being

The results from model 1 show that more national WI was associated with fewer average psychological and somatic symptoms (Table 4). More specifically, a 1-unit increase in WI led to a −2.58 decrease in psychological symptoms ($p < .001$) and a −1.48 decrease in somatic symptoms ($p = .001$). For life satisfaction, no association was found (−.16; $p = .501$). In terms of the effect of national WI on differences in mental well-being between the highest and lowest SES groups, that is, SII, we found that a higher level of national WI was associated with greater differences in life satisfaction between higher and lower SES groups (−.74; $p = .006$). National WI was not associated with the size of the differences in psychological and somatic symptoms between the highest and lowest SES groups (psychological: −.06; $p = .908$; and somatic: −.71; $p = .192$).

In model 2 (Table 4), GINI was added to the model, enabling us to investigate the association of national WI with (socioeconomic inequalities in) life satisfaction and psychological and somatic symptoms after taking GINI into account. In this model, the negative association between national WI and psychological and somatic symptoms not only remained significant but also increased in strength (psychological: −3.44; $p < .001$; and somatic: −1.80; $p < .001$). The proportion of total variance slightly improved from 4% to 6% in psychological symptoms and from 5% to 6% in somatic symptoms when national GINI was added to the model. For life satisfaction, again no association was found (−.16; $p = .514$).

In contrast, model 2 indicated that national GINI was positively associated with psychological (4.46; $p = .005$) and somatic symptoms (1.65; $p = .002$), that is, greater GINI was associated with more psychological and somatic symptoms. There was no association between national GINI and life satisfaction (−.01; $p = .969$).

In model 2, national WI was negatively associated with socioeconomic inequalities in somatic symptoms (−1.01, $p = .012$), denoting that differences in somatic symptoms between high and low SES groups were smaller in countries with greater national wealth inequalities. This association appeared only after including national GINI to the model, and it increased the proportion of total variance in socioeconomic inequalities accounted for by national wealth and income inequalities from 11% to 14%. National wealth inequalities were not associated with socioeconomic inequalities in psychological symptoms (−.54; $p = .203$) or life satisfaction (−.31, $p = .321$). The results for national GINI showed opposite patterns. National GINI was positively associated with socioeconomic inequalities in psychological symptoms (2.50; $p < .001$) and life satisfaction (−2.22, $p < .001$), denoting that differences in psychological symptoms and life satisfaction between high and low SES groups were larger in countries with greater national income inequalities. There was no association between national GINI and socioeconomic inequalities in somatic symptoms (1.54; $p = .067$).

Discussion

This is one of the first studies to examine whether socioeconomic inequalities in adolescent mental well-being are associated with national wealth inequalities independently from national income inequalities. The results indicated that higher levels of national WI were associated with lower average psychological and somatic symptoms, whereas higher levels of national GINI were associated with more psychological and somatic symptoms. No associations between either national WI or GINI and life satisfaction were found. The results further showed that with higher levels of national WI, differences in life satisfaction between higher and lower SES groups increased, but this was only true when national GINI was not controlled for. However, when taking national level GINI into account, smaller differences in somatic symptoms between higher and lower SES groups were found in countries with higher levels of national WI, which was not in line with our hypothesis. In contrast, and as expected, a higher level of national GINI was associated with larger socioeconomic inequality in psychological symptoms and life satisfaction, whereas for somatic symptoms, no association was found.

Several explanations may be put forward as to why we did not find national WI to strengthen the association between adolescents' SES and their mental well-being, while we did for national GINI. National GINI and national WI were expected to negatively impact on socioeconomic inequalities in adolescent mental well-being because in countries with high WI and GINI, there is

Table 4
Pooled time series analysis of average mental well-being and socioeconomic inequalities in mental well-being in 48 country and year groups, model 1 without controlling for income inequality and model 2 with controlling for income inequality

	Model 1			Model 2		
	Psychological symptoms	Somatic symptoms	Life satisfaction	Psychological symptoms	Somatic symptoms	Life satisfaction
Average health						
Constant	4.90 (4.50 to 5.29)	3.23 (3.11 to 3.35)	7.63 (7.56 to 7.70)	4.89 (4.50 to 5.29)	3.23 (3.11 to 3.35)	7.63 (7.56 to 7.70)
GNI	.00 (−.01 to .01; $p = .826$)	.01 (.00 to .01; $p < .001$)	.00 (−.00 to .00; $p = .588$)	.01 (−.01 to .02; $p = .359$)	.01 (.01 to .01; $p < .001$)	.00 (−.00 to .00; $p = .612$)
WI[a]	−2.58 (−3.96 to −1.20; $p < .001$)	−1.48 (−2.35 to −.61; $p = .001$)	−.16 (−.64 to .31; $p = .501$)	−3.44 (−4.72 to −2.15; $p < .001$)	−1.80 (−2.55 to −1.05; $p < .001$)	−.16 (−.65 to .32; $p = .514$)
GINI[b]				4.46 (1.36 to 7.55; $p = .005$)	1.65 (.63 to 2.67; $p = .002$)	−.01 (−.61 to .58; $p = .969$)
R^2	.04	.05	.00	.06	.06	.00
Slope index of inequality						
Constant	.45 (.32 to .59)	.29 (.21 to .37)	−.73 (−.81 to −.65)	.45 (.31 to .59)	.29 (.21 to .37)	−.73 (−.81 to −.65)
GNI	.00 (−.00 to .00; $p = .250$)	.01 (.00 to .01; $p < .001$)	.00 (−.00 to .00; $p = .143$)	.00 (.00 to .01; $p < .001$)	.01 (.01 to .01; $p < .001$)	−.00 (−.00 to .00; $p = .234$)
WI[a]	−.06 (−1.01 to .89; $p = .908$)	−.71 (−1.79 to .36; $p = .192$)	−.74 (−1.27 to −.21; $p = .006$)	−.54 (−1.37 to .29; $p = .203$)	−1.01 (−1.80 to −.22; $p = .012$)	−.31 (−.93 to .30; $p = .321$)
GINI[b]				2.50 (1.47 to 3.54; $p < .001$)	1.54 (−.11 to 3.18; $p = .067$)	−2.22 (−3.18 to −1.26; $p < .001$)
R^2	.00	.11	.03	.03	.14	.09

Data are regression-based mean and regression slope coefficient (95% confidence interval; *p* value).
GINI = income inequality; GNI = gross national income per person (scaled to thousands of US$); WI = wealth inequality.
[a] WI represents the percentage of wealth held by wealthiest 40% of the population measured from 0 to 1.
[b] GINI represents the countries' income inequality level measured from 0 to 1, with higher values indicating for greater income inequality. No autocorrelation was observed for any of the models.

more social comparison that potentially has detrimental effects for the mental well-being of adolescents from low SES families, and there is less support for vulnerable groups such as those with low SES [10]. Tentatively, such processes might apply more strongly to national GINI than to national WI. More specifically, relative to GINI, adolescents may be less aware of national wealth inequalities and their own family wealth, which might mean they make fewer negative social comparisons [10]. Wealth is often a hidden commodity, by its nature being stored in bank accounts or properties. Income may be more visible especially because it seems easier to spend income than wealth (particularly when wealth is reflected in property). Parents may talk more about their income than their wealth, and adolescent family members may suffer more immediately or directly when family income is short, especially because adolescence is a developmental period with specific demands in terms of biological, cognitive, emotional, and psychosocial changes requiring resources and support [42]. In addition, although national GINI may clearly reflect the extent to which countries attempt to redress social inequalities in their society by setting up support systems for vulnerable groups, this may be less true for national WI as the latter may particularly reflect the housing market.

In terms of the contrasting findings of national income and WI on adolescents' average levels of mental well-being, it is possible that a positive spillover effect might be at play in which countries with higher wealth inequalities have better social and environmental structures that everyone benefits from, resulting in better mental well-being.

Some limitations should be noted. First, our results are based on cross-sectional data, so causal inferences in the association between WI and socioeconomic mental health inequalities cannot be drawn. Second, our analysis describes associations at the population level and may not be inferred to the individual level to prevent ecological fallacy (i.e., false assumptions about individual-level relationships deduced from aggregate data only) [43]. Multilevel analyses aimed at examining how national-level WI and GINI relate to mental well-being at the individual level are therefore recommended and will accordingly facilitate better understanding of the potential mechanisms at play. Third, in this study, we focused on three measures of adolescent mental well-being. It is however possible that other health measures and health behaviors are differently affected by national wealth inequalities. Fourth, as there was not a WI indicator available, we devised a measure collecting reliable data on four asset and two liability values from different financial and economic databases for 17 countries in total. The WI measure did not include all assets and was not available for all countries at every time point. In addition, the measure represents the percentage of wealth held by the wealthiest 40% of the population while considering the very top of the distribution (e.g., top 10% or top 1% share) could have led to different estimation results. However, the measure correlated highly with available data on WI from Organisation for Economic Co-operation and Development. Fifth, although response rates at individual level exceeded 60% for most countries and regions [27,28], some individuals might not be included because of illness or truancy, which might induce nonresponse bias. However, we do not expect high bias as each national sample is representative to the country.

Despite these limitations, this is one of the first international studies to address whether and how national-level WI is associated with socioeconomic inequalities in adolescents' mental well-being and with average levels of mental well-being. Before this

study, inequality research has paid scant attention to the potential role of national wealth and in particular of national WI in explaining socioeconomic inequalities in adolescent mental well-being. Our study therefore lays the groundwork for future research aimed at examining how different national level economic measures interact with socioeconomic inequalities in adolescent mental wellbeing. This is necessary to gain better understanding in the mechanisms at play to successfully address socioeconomic health inequalities. Consistent with previous studies [7–9], our results especially indicate that in countries with high GINI, socioeconomic inequalities in adolescent mental well-being are largest. In contrast, the role of national WI is less evident and needs to be further substantiated. However, the results suggest that more focus on social redistribution of income resources on the national level could decrease inequalities in adolescent mental wellbeing.

Conclusion

Our results suggest that socioeconomic inequalities in somatic symptoms and average psychological and somatic symptoms decreased with increasing national WI. In contrast, higher national GINI was associated with worse average psychological and somatic symptoms and greater socioeconomic inequalities in psychological symptoms and life satisfaction. Given these opposing effects of national WI and GINI on (socioeconomic inequalities in) mental well-being within adolescent populations, and being one of the first studies addressing this issue, further research is warranted before any substantial conclusions and policy recommendations can be made.

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Suplementary Data

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