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Problematic social media use and adolescent mental well-being: a cross-national study on socioeconomic inequalities

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ABSTRACT

Although the role of social media in youth mental health has been recently examined, how social inequalities structure the relationship between social media use and adolescent well-being across countries remains unclear. Employing a micro–macro framework, this study examines how family-level socioeconomic status (SES) and country-level income inequalities moderate the relationship between Problematic Social Media Use (PSMU) – a concept of risk-related social media use – and adolescents' psychological complaints and life satisfaction. Analyses apply mixed-effect multilevel models to data from 35 countries participating in the Health Behaviour of School Aged Children (HBSC) study (N~145,000). Results show that PSMU is associated with higher psychological complaints and lower life satisfaction consistently across countries. Yet, these effects are stronger for low-SES adolescents than for high-SES adolescents, especially for life satisfaction. At the country level, the relationship between PSMU and poorer adolescent mental well-being is curvilinear, being larger in medium-inequality countries than in both low- and high-inequality countries. Additionally, the observed SES gaps in the association between PSMU and adolescent mental well-being persist across countries with different levels of inequality. Overall, this study shows that risk-related social media behaviours may harm low-SES adolescents more than high-SES adolescents, whereas the relationship between PSMU and adolescent mental well-being is largest in countries with medium income inequality levels.

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Problematic social media use; adolescent mental well-being; socioeconomic inequalities; cross-national research

Introduction

In recent years, adolescents' social media use has increased dramatically (Livingstone et al., 2018; Odgers & Jensen, 2020), while social inequalities and gradients in adolescent well-being by socioeconomic status (SES) persisted strongly (Elgar et al., 2017; Hammami et al., 2023; Jackson, 2015). Although social media allows adolescents to boost

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their sense of belonging and connectivity, exposure to social media among adolescents can also have harmful consequences, including the experience of cyberbullying, unrealistic body standards and gaming addiction (Boyd & Hargittai, 2013; Livingstone et al., 2018; Odgers & Jensen, 2020; Valkenburg & Peter, 2009). Studies found that Problematic Social Media Use (PSMU), a form of addictive and risk-taking social media use, is associated with higher adolescent psychological distress, somatic symptoms, eating disorders and negative mood (Boer et al., 2021; Shannon et al., 2022; Van Den Eijnden et al., 2018; Van Rooij et al., 2010; Wong et al., 2020).

Yet, one fundamental question that remains unanswered is how the relationship between PSMU and adolescent well-being is shaped by socioeconomic inequalities. Considering the pervasive digital and social inequalities in adolescents' daily lives and well-being across contemporary digitalised societies (Büchi & Hargittai, 2022; Gracia et al., 2023), understanding how adolescents' social media behaviours relate to structural inequalities across countries is crucial for both scientific and policy debates. The digital divides framework proposes that inequalities in the *offline* world are increasingly interconnected with inequalities in the *online* world, and then these socio-digital inequalities lead to disparities in adolescents' well-being across different socioeconomic groups (Helsper, 2021; Van Deursen & Van Dijk, 2019). However, the way socioeconomic inequalities structure the relationship between PSMU and adolescents' mental well-being remains understudied.

This study contributes to the social media, adolescent well-being and inequality literatures by examining how the relationship between PSMU and adolescents' mental well-being is shaped by socioeconomic inequalities within and across countries. Using a micro–macro framework, we argue that the harmful effects of PSMU on adolescent mental well-being outcomes are likely to be moderated by socioeconomic inequalities operating at both the *micro* (family) level and *macro* (country) level. At the *micro level*, PSMU could be more harmful to mental well-being for low-SES adolescents than for high-SES adolescents. These inequalities may be explained by the disadvantage that low-SES adolescents often face, as opposed to high-SES adolescents, in accessing protective social, economic and educational resources to mitigate harmful effects from risk-related social media behaviours (Ma, 2021; Mollborn et al., 2022; Notten et al., 2009; Robinson et al., 2015; Van Deursen & Van Dijk, 2019). At the *macro level*, we could expect country-level socioeconomic inequalities to strengthen the negative effect of PSMU on adolescent mental well-being. Previous research found that the diffusion of technological tools and digital resources is particularly slow and segmented in the most unequal societies (Fuchs, 2009; Hilbert, 2016; Zhang, 2013). Other studies show that country-level inequalities are associated with reduced adolescent mental well-being, which is attributed to problems of social comparison and status anxiety that develop more frequently in highly unequal contexts (Pickett & Wilkinson, 2007; Wilkinson & Pickett, 2009). Drawing on the literature on technology diffusion and income inequality effects, we may expect that adolescents are more vulnerable to lacking protective digital resources and engaging in social comparison and anxiety in social media settings in high-inequality countries, thus strengthening the association between PSMU and lower adolescent mental well-being.

We examine three research questions: (1) How does the association between PSMU and adolescent mental well-being differ by SES?; (2) How does the association between

PSMU and adolescent mental well-being vary across countries with different levels of socioeconomic inequalities?; and (3) How do SES gaps in the relationship between PSMU and adolescent mental well-being differ across contexts with different socioeconomic inequalities? To answer these questions, we apply a mixed-effect multilevel design to cross-country data across 35 industrialised countries. The unique feature of our data is that it combines harmonised cross-country measures of PSMU with high-quality cross-country validated measures of mental well-being. We conceptualise mental well-being as a multidimensional construct encompassing both cognitive evaluations and emotional health. We focus on two complementary definitions of mental well-being, including life satisfaction (a global cognitive appraisal of one's overall life circumstances) and psychological complaints (a construct of recurrent feelings of low, irritable, or nervous and sleeping problems) (Inchley et al., 2020).

Overall, our study is, to our knowledge, the first in adopting a micro–macro approach to demonstrate how individual- and country-level socioeconomic inequalities moderate the association between PSMU and adolescent mental well-being. In doing so, the present study advances the literature on social media, adolescent well-being and inequalities by bringing new cross-national evidence to these research fields.

Background

The role of SES in adolescent social media use and mental well-being

Previous research has shown that high-SES children and adolescents report lower mental well-being problems (e.g., decreased levels of anxiety, lower depressive symptoms, fewer behavioural problems) than their low-SES counterparts (Bodovski & Farkas, 2008; Loft & Waldfogel, 2021; Pietropoli & Gracia, 2025; Reiss, 2013). While high-SES parents have privileged resources to allocate time to children, invest financially in their kids, and provide more human capital to their offspring overall, low-SES parents tend to lack such opportunities due to their more limited cultural resources, higher financial stress and economic uncertainties (Kalil & Ryan, 2020; Li & Chzhen, 2024).

As digital technologies penetrate in everyday family life, how digital media use links to SES gaps in adolescent well-being becomes a pressing question to understand social stratification patterns. From a *digital divides* approach, it is argued that inequalities operating in offline settings are blurred with inequalities in the online world (Büchi & Hargittai, 2022; Hargittai & Hinnant, 2008; Van Dijk, 2020). Thus, lower-SES families may lack the necessary resources to minimise the harmful effects of risk-related social media engagement. By contrast, high-SES families would be more advantaged, for example through applying parental digital strategies that help adolescents in coping with risky media behaviours or negative online experiences. Although high-SES families often impose high performance pressure and expectations to foster children's soft skills and educational outcomes (Lareau, 2011), and this may partly counterbalance the protective effects from the problematic media use, we argue that high-SES families may be capable of using their resources to adapt to digital media challenges to protect their children's emotional well-being.

Studies found that high-SES adolescents access protective social, physical, educational, and online resources to cope with harmful online experiences, whereas low-

SES adolescents often lack family resources to ensure a protective support in digital settings (Helsper, 2021; Robinson et al., 2015; Van Deursen & Van Dijk, 2019). Adolescents from more privileged SES groups were found to be more prone to receive social and technical support and supervision through their families or schools (Ma, 2021; Mollborn et al., 2022), while low-SES adolescents often miss consistent online support from their social and family environment during their screen-based activities (Gracia & Garcia-Roman, 2018). Other studies found that high-SES adolescents use their digital devices for educational purposes more frequently, while lower-SES adolescents spend more time navigating social media platforms without digital protection (Lenzi et al., 2022; Ma, 2021; Notten et al., 2009). There is some evidence indicating that high-SES adolescents, compared to low-SES adolescents, are advantaged in the socioemotional and academic outcomes derived from digital use (Bohnert & Gracia, 2023; Gracia et al., 2023; Loh et al., 2025). Also, previous literature suggests that such socioeconomic differences are not only discrete inequalities between groups, but also social gradients, whereby risks and protections related to social media vary progressively across the socioeconomic distribution. Overall, existing evidence provides reasons to expect that the relationship between PSMU and mental well-being is weaker among adolescents from higher SES families, compared to their peers from lower SES families.

Hypothesis 1: The expected negative association between PSMU and mental well-being is stronger for lower-SES adolescents than for higher-SES adolescents.

The moderating role of country-level inequalities

Although digitalisation is a global trend, adolescent social media prevalence varies across countries (Livingstone et al., 2011; Smahel et al., 2020). For instance, while the percentage of adolescents with daily access to the internet is similar in Italy, Spain, and Malta (approximately 80%), adolescent average time spent online per day differs by more than an hour across these same countries (Smahel et al., 2020). One study found that the strength of the association between PSMU and lower adolescent well-being differs across countries (Boer et al., 2020). Another study found that country-level income inequalities are associated with higher adolescent PSMU, although these patterns were concentrated among adolescents reporting low family support (Lenzi et al., 2022). However, how country-level socioeconomic factors moderate the association between social media use and adolescent well-being has not been investigated in previous literature.

Previous literature offers two main mechanisms to explain the role of country-level socioeconomic inequalities in moderating the association between social media use and adolescent well-being. First, country-level income inequalities may result in digital inequalities that negatively affect adolescent well-being (Helsper, 2021; Hilbert, 2016). According to diffusion theory (Rogers et al., 2014), the advancement of technological tools and digital resources in a country follows a gradual process by which high-SES groups take advantage in obtaining and benefiting from ICT resources. Studies found that more unequal countries present slower digital adoption and access rates than more equal countries (Fuchs, 2009; Zhang, 2013). Therefore, more unequal countries

may have adolescents with fewer digital resources and ICT skills, which may result in less effective strategies against the risks of adolescent PSMU in countries with higher socioeconomic inequalities.

Second, adolescents' online social comparisons and status anxiety may be particularly salient in more unequal countries, and this may lead to stronger associations between PSMU and adolescent well-being in more unequal societies. Adolescence is a life stage in which social comparisons become critical for self-evaluation and identity formation, and these patterns are particularly prevalent in the most hierarchical and unequal societies (Harter, 2012; Sebastian et al., 2008; Van der Aar et al., 2018; Wilkinson & Pickett, 2009). Similar processes could apply to online media, considering that adolescents frequently compare their lives on social media to people with higher privileges than they have (Cheung & Lucas, 2016; Nesi & Prinstein, 2015). Following previous literature, mechanisms of online social comparisons and digital anxieties toward peers may be particularly salient in highly unequal countries.

Hypothesis 2: The association between PSMU and lower mental well-being is stronger in countries with higher income inequality than in more economically equal countries.

Interacting SES with country-level inequalities

Family-level and country-level inequalities may interact in explaining the association between PSMU and adolescent mental well-being. We propose two alternative hypotheses. First, family SES gaps in the association between adolescent PSMU and mental well-being may be stronger when country-level income inequality increases. The slow diffusion of digital resources in more unequal countries may further hit low-SES adolescents, as they struggle particularly to access structural support systems like digital literacy programmes and mental health services in unequal contexts (Fuchs, 2009; Zhang, 2013). By contrast, high-SES adolescents in high-inequality countries could get access to such buffering resources. Additionally, the starker social status distinctions of more unequal contexts could induce low-SES adolescents to even more intense feelings of deprivation from better life standards and even lower self-esteem in social media settings (Cheung & Lucas, 2016; Harter, 2012; Sebastian et al., 2008).

Hypothesis 3a: SES gaps in the association between PSMU and adolescent mental well-being are stronger in countries with higher income inequalities than in countries with lower income inequalities.

An alternative approach suggests that SES disparities in the association between PSMU and mental well-being are stable across countries with dissimilar socioeconomic inequalities. The role of macro-level inequalities could be relatively trivial if we consider that mechanisms connecting PSMU to mental well-being operate at the interpersonal level, for example, through processes related to family support, digital skills or social comparisons (Livingstone et al., 2018; Mollborn et al., 2022; Nesi & Prinstein, 2015). From this perspective, it could be argued that the global prevalence of contemporary social media platforms leads adolescents from privileged SES groups to be exposed to relatively similar digital content and online risks across countries with different levels of socioeconomic inequalities.

Hypothesis 3b: SES gaps in the association between PSMU and adolescent well-being are stable across different country-level income inequality contexts.

Methods

Data and sample

The data used in this study were obtained from the latest available wave from the *Health Behavior of School-aged Children* (HBSC) for 2017/2018 (Inchley et al., 2020). The HBSC is a school-based survey that collects data from adolescents aged 11, 13 and 15 years old through a cluster sampling approach in each country included in the study ($n = 46$) every four years. All participating countries use a representative sampling for their respective school-aged adolescents and follow a standard protocol. All participating countries comply with the national ethical requirements and obtain informed parental consent (Inchley et al., 2018).

Countries that omitted data on any of the study variables ($n = 4$: Bulgaria, Macedonia, Slovakia, Switzerland) and countries with missing data on our country-level variables ($n = 7$: Azerbaijan, Croatia, France, Greece, Greenland, Russia, Turkey) were excluded from the sample. We excluded participants reporting that questions on social media use did not apply to them, indicating not using social media at the time of the survey ($N = 8{,}151$). Finally, we excluded individual observations containing missing data on our outcome variables ($N = 4{,}085$ for missing psychological complaints, $N = 2{,}149$ for missing life satisfaction), key explanatory measures ($N = 16{,}407$ for missing PSMU, $N = 3{,}589$ for missing SES) and control variables ($N = 5{,}975$ for missing control variables). Attrition analyses using chi-square and *t*-tests (not shown) indicated that missingness was at random. Analyses showed no statistically significant differences between excluded and non-excluded cases, indicating that listwise deletion did not produce biased estimations in our models. The study final sample included a total of 144,934 adolescents across 35 countries ($M_{age} = 13.62$, 52.6% girls).

Individual-Level measures

Psychological complaints

The psychological subscale of the HBSC-symptom checklist has four items: (1) feeling low, (2) irritability/bad temper, (3) feeling nervous, and (4) sleeping difficulties (Gariepy et al., 2016) was used. Each item had a 5-point response scale measuring how often during the past 6 months the complaint was experienced (0 = rarely or never, 1 = about every month, 2 = about every week, 3 = more than once a week, 4 = about every day). A mean score was computed for participants who answered at least three of the four subscale items; higher scores indicated more problems (range, 0–4). The checklist had good internal consistency in all survey years ($\alpha = 0.78$) and had convergent validity with emotional well-being (Gariepy et al., 2016).

Life satisfaction

The Cantril Ladder, an 11-point ladder on how participants feel about their lives, was used. The bottom step of the ladder represented the worst possible life, coded as 0,

and the top of the ladder represented the best possible life, coded as 10. The Cantril Ladder has shown high reliability among adolescents (Levin & Currie, 2014).

PSMU

The Social Media Disorder Scale (Boer et al., 2022; Van den Eijnden et al., 2016) contains nine items: (1) regularly failing to think of anything else but social media, (2) regularly feeling dissatisfied because wanting to spend more time on social media, (3) often feeling bad when not being able to use social media, (4) failing to spend less time on social media, (5) neglecting other activities (e.g., hobbies, sport) because wanting to use social media, (6) regularly having arguments with others because of social media use, (7) regularly lying to parents or friends about the time spent on social media, (8) often using social media to escape from negative feelings, and (9) having serious conflict with parents or siblings because of social media use. Each item had a dichotomous (1 = yes; 0 = no) response scale capturing whether participants experienced each of the items over the last year. A sum score was computed for participants who answered at least six of the nine items; higher scores indicated more problematic social media use (range: 0–9). The scale showed good validity and reliability across countries ($\alpha = 0.89$) (Boer et al., 2022).

SES

The Family Affluence Scale (FAS) (Currie et al., 2008) contains six items on material wealth indicators from participants' families: (1) number of cars, vans, or trucks, (2) having (child's) own bedroom, (3) number of computers, (4) dishwasher ownership, (5) number of bathrooms, (6) number of holidays abroad, was used. A sum score was computed for participants who answered all the questions; the total score ranged from 0 to 13. Three SES categories were created within each country using the total FAS score; the lowest 33% of the participants were coded as low-SES, the highest 33% of the participants were coded as high-SES, and the rest of the participants were coded as middle-SES. The FAS is a widely used, validated SES indicator in large-scale surveys like HBSC, ensuring cross-national comparability (Currie et al., 2008). Previous analyses have demonstrated that FAS is a proxy of inequalities beyond wealth, showing strong correlations with parental education, occupational status or cultural capital (Torsheim et al., 2016).

Control variables

Considering that adolescent mental well-being covaries with *Age* and *Gender*, we controlled for these two variables in our analyses. Age was measured in years and months, and gender was coded following the original binary question from the HBSC data, with 0 = boys and 1 = girls. We also controlled for Frequent social media use (FSMU) to eliminate potential confounding effects. FSMU was measured by a four items scale adapted from the EU Kids Online Survey (Mascheroni & Ólafsson, 2014), asking participants the frequency of online contact through social media with (1) close friends, (2) friends from a larger friend group, (3) friends that they met through the Internet, and (4) other people such as parents, siblings, or classmates. Each item had a 4-point response scale (0 = never/almost never, 1 = every week, 2 = daily, 3 = several times daily, 4 = almost all the time), as well as a 'do not know/does not apply' option. The 'do not know/does not apply' responses were recoded as missing values. A mean score was computed for

participants who answered at least three of the four subscale items; higher scores indicated more frequent social media use (range: 0–4).

Country-level measures

The country-level data were obtained from the World Bank for the year 2018. Income Inequality was measured by the Gini index scores of the countries (World Bank, 2022a). The Gini index theoretically ranges from 0 (perfect equality of individuals) to 100 (perfect inequality of individuals). Using the Gini index scores, we created a three-level categorical variable, with one-third of the countries at each level. Using tertiles allows to compare adolescents living in relatively low, medium, and high socioeconomic inequality contexts by placing them on a common relative scale, which aligns with our theoretical focus on cross-national stratification, rather than marginal linear effects (Firebaugh, 2008). Additionally, categorisation reduces sensitivity to extreme values and influential cases, which is helpful given the heterogeneous distributions of macro-level indicators (Bryan & Jenkins, 2016).

We used three country-level control variables that were identified in previous research as potential confounders of country-level income inequality (Boer et al., 2020; Cruz-Jesus et al., 2017; Nordrum & Gracia, 2024; Van Deursen & Van Dijk, 2019). We controlled for: (i) National Income: measured by countries' gross domestic product (GDP) per capita in thousands of billions of international dollars (World Bank, 2023a); (ii) Educational Expenditure: measured as the percentage of governments' expenditure on secondary education (World Bank, 2022b); and (iii) Internet Use Prevalence (IUP): measured as the percentage of individuals using the Internet regularly in each country (World Bank, 2023b). As with the inequality measures, we created a categorical variable using tertiles for each country-level control variable.

Empirical strategy

We adopted a mixed-effect multilevel regression modelling approach, where adolescents were clustered within countries. We followed the same steps for psychological complaints and for life satisfaction separately. We first added the control variables (age, gender, and FSMU), SES (low-SES as the reference group), and fixed and random effects of PSMU (Model 1a and Model 1b). Individual-level continuous variables were group-mean centred. We interpreted cross-country variations of the random effects using the 95% prediction interval. Second, we added the interactions of PSMU with SES (Model 2a and Model 2b). Third, we added the cross-level interactions of PSMU with country-level measures (Model 3a and Model 3b). Next, we added a cross-level interaction between SES and Gini variables and three-way interactions between SES, Gini, and PSMU variables (Model 4a and Model 4b). To evaluate the overall statistical significance of the moderating variables, we used χ^2 tests, and we reported the results in the text. Unless otherwise stated, coefficients reported for interaction terms represent interaction terms of the association between PSMU and mental well-being outcomes relative to the reference category of each interaction term. Simple slopes for the reference groups are captured by the main effects of PSMU.

We conducted multiple analyses to assess the quality and robustness of our empirical models. First, to account for differences in population size and sampling, we replicated (not shown) the analyses with international weights and conducted sensitivity tests excluding the countries with the largest samples. The results remained stable across specifications, indicating that our conclusions are not driven by disproportionate sample sizes across countries. Second, we tested for potential multicollinearity among both individual- and country-level predictors. At the individual level, pairwise correlations across gender, age, family social media use, socioeconomic status, and problematic social media use were generally low in magnitude ($|r| < 0.20$), indicating that collinearity is unlikely to bias model estimates. At the country level, we examined both the continuous and categorical (tertile) versions of GDP per capita, Internet use prevalence, and educational expenditure. Belsley's condition index values (6.6 for continuous predictors; 9.0 for categorical tertiles) were well below the conventional threshold of 30, providing no evidence of any problematic level of collinearity (Belsley et al., 1980).

Results

Descriptive results

Table 1 shows the means and percentages of the study variables per country. The average score of PSMU was below 3 in all countries, with Malta being the highest (2.98) and Iceland the lowest (1.27). Italy had the highest mean of psychological problems (1.75), and Canada had the lowest mean of life satisfaction (7.27), whereas Kazakhstan had the lowest mean of psychological problems (0.80) and the highest mean of life satisfaction (8.56). We can also observe that countries' income inequality scores ranged between 25 and 39. Israel had the highest levels of income inequality (38.6), followed by Russia (37.5), whereas Slovenia (24.6), the Republic of Moldova (25.7) and the Czech Republic (25) had the lowest income inequality levels.

Individual-Level associations and interactions

Table 2 shows the multilevel results for psychological complaints and life satisfaction, which are also presented graphically in Figure 1. Overall, there were disproportionately high psychological complaints and low life satisfaction among girls, older adolescents, and lower-SES adolescents. Results of Model 1a demonstrated that PSMU had a statistically significant positive association with psychological complaints (See also Figure 1, Panel A). The association with psychological complaints was consistently positive across countries, although the strength of the association varied from borderline small to borderline moderate (95% PI: [0.190/0.383]). PSMU had a statistically significant association with life satisfaction (Model 1b). The association with life satisfaction was consistently negative across countries, and it ranged from small to moderate (95% PI: [−0.506/−0.181]).

Models 2a and 2b show the associations of PSMU with the outcome variables across SES groups. In Model 2a, there was a statistically significant SES gradient in the association between PSMU and psychological complaints ($\chi^2(2, N = 144{,}934) = 7.06$, $p = 0.029$). Relative to low-SES adolescents (reference group), the interaction indicates that the association between PSMU and psychological complaints was weaker among high-SES

Table 1. Means and percentages of individual and country level measures.

		Individual level							Country level			
Country	*N*	Girl	Age	FAS	FSMU	PSMU	PC	LS	GDP	EE	IUP	Gini
Albania	1,300	57%	13.62	6.26	2.06	2.60	1.14	8.17	13.5	21.56	65.4	30.1
Armenia	3,039	54%	13.72	4.22	1.81	1.48	1.15	8.34	13.55	46.87	68.25	34.4
Austria	3,552	53%	13.38	9.29	2.02	1.68	1.21	7.70	56.96	39.63	87.48	30.8
Belgium (F)	3,540	52%	13.48	9.31	1.75	1.85	1.25	7.79	52.54	42.13	88.65	27.2
Belgium (W)	4,249	52%	13.47	8.52	2.06	2.13	1.50	7.51	52.54	42.13	88.65	27.2
Canada	8,225	54%	13.85	8.94	1.95	1.67	1.33	7.28	49.99	26.4	94.64	33.3
Czech Rep.	9,608	51%	13.51	8.11	1.49	1.55	1.41	7.77	41.14	29.01	80.69	25
Denmark	2,628	53%	13.43	9.64	2.03	1.42	1.22	7.69	57.48	40	97.32	28.2
England	2,651	48%	13.50	9.08	1.82	1.85	1.50	7.45	47.57	37.84	90.69	35.1
Estonia	4,257	51%	13.86	8.21	1.96	1.73	1.43	7.72	36.25	25.2	89.36	30.3
Georgia	3,333	53%	13.53	5.28	1.76	1.53	1.16	7.96	14.59	29.04	62.72	36.4
Germany	3,560	55%	13.62	9.40	1.77	1.74	1.17	7.65	55.24	41.26	87.04	31.7
Hungary	3,346	54%	13.60	7.32	1.81	1.78	1.43	7.58	31.91	40.2	76.07	29.6
Iceland	5,888	52%	13.74	9.25	1.97	1.27	1.35	7.61	57.21	27.27	99.01	26.1
Ireland Republic	3,012	50%	13.53	9.28	1.92	2.44	1.31	7.50	84.56	35.55	87	30.6
Israel	4,434	56%	13.75	8.58	2.08	1.43	1.62	7.88	39.91	30.78	83.73	38.6
Italy	3,692	53%	13.74	7.87	2.07	2.46	1.75	7.58	43.04	42.74	74.39	35.2
Kazakhstan	3,306	52%	13.36	4.18	1.72	1.29	0.80	8.56	26.15	68.56	78.9	27.8
Latvia	3,684	52%	13.58	7.28	1.54	1.81	1.45	7.37	30.88	33.4	83.58	35.1
Lithuania	3,422	51%	13.77	6.98	1.95	1.81	1.28	7.90	36.38	38.63	79.72	35.7
Luxembourg	3,102	52%	13.69	10.16	1.95	2.05	1.49	7.66	116.97	40.71	97.06	35.4
Malta	2,170	54%	13.43	8.67	1.97	2.98	1.58	7.32	45.56	37.54	81.66	28.7
Moldova Republic	4,336	52%	13.59	9.01	1.85	1.47	1.13	7.75	57.83	40.49	91.89	28.1
Netherlands	2,377	52%	13.14	9.93	1.95	1.88	1.18	7.90	69.81	28.58	96.49	27.6
Norway	4,534	52%	13.71	7.80	2.11	2.00	1.52	7.45	32.03	31.31	77.54	30.2
Poland	5,079	54%	13.38	8.18	2.09	1.57	1.19	7.77	34.93	42.61	74.66	33.5
Portugal	3,860	52%	13.66	5.15	1.97	2.23	1.18	8.25	12.66	36	76.12	25.7
Romania	3,891	52%	13.25	6.31	2.09	2.65	1.38	8.34	29.57	39.09	70.68	35.8
Scotland	4,251	54%	13.56	9.03	2.04	2.00	1.33	7.63	47.57	37.84	90.69	35.1
Serbia	3,075	53%	14.18	7.37	1.94	1.77	1.13	8.19	17.72	22.89	73.36	35
Slovenia	4,720	51%	13.70	9.43	1.72	1.47	1.24	7.94	38.96	34.51	79.75	24.6
Spain	3,689	52%	13.75	8.59	2.05	2.62	0.98	8.05	40.7	37.32	86.11	34.7
Sweden	3,275	52%	13.76	9.45	2.10	1.66	1.64	7.43	53.52	27.39	89.25	30
Ukraine	5,161	55%	13.57	5.72	1.83	1.88	1.41	7.66	12.63	30.73	62.55	26.1
Wales	10,688	52%	13.71	9.31	1.85	2.21	1.37	7.60	47.57	37.84	90.69	35.1
Total	144,934	53%	13.63	8.14	1.90	1.87	1.35	7.70	41.53	31.7	36.09	82.91

Note. Data for country-level indicators were obtained from the year 2018, or the latest available year prior to 2018. FAS: Family Affluence Scale; FSMU: Frequent social media use; PSMU: Problematic social media use; PC: Psychological complaints; LS: Life satisfaction; GDP: Gross domestic product. Educ. Exp.: Educational expenditure. IUP: Internet use prevalence. Belgium (F) includes Flanders and Belgium (W) includes Wallonia.

Table 2. Mixed-effect multilevel models on psychological complaints and life satisfaction.

	Psychological complaints			Life satisfaction		
	Model 1a: Random effect B (SE)	Model 2a: Ind. level interaction B (SE)	Model 3a: Cross-level interactions B (SE)	Model 1b: Random effect B (SE)	Model 2b: Ind. level interaction B (SE)	Model 3b: Cross-level interactions B (SE)
Fixed effects						
Intercept	1.179*** (0.033)	1.179*** (0.033)	1.094*** (0.080)	7.626*** (0.053)	7.626*** (0.053)	7.924*** (0.114)
Low-SES						
Mid-SES	−0.035*** (0.006)	−0.035*** (0.006)	−0.035*** (0.006)	0.136*** (0.005)	0.136*** (0.005)	0.136*** (0.005)
High-SES	−0.053*** (0.006)	−0.053*** (0.006)	−0.053*** (0.006)	0.291*** (0.011)	0.290*** (0.011)	0.290*** (0.011)
Problematic Social Media Use (PSMU)	0.139*** (0.004)	0.141*** (0.005)	0.128*** (0.010)	−0.167*** (0.008)	−0.179*** (0.008)	−0.132*** (0.016)
Ind. level interaction						
PSMU x Low-SES						
PSMU x Mid-SES		0.001 (0.003)	0.001 (0.003)		0.013* (0.005)	0.013* (0.005)
PSMU x High-SES		−0.006* (0.003)	−0.006* (0.003)		0.021*** (0.005)	0.021*** (0.005)
Cross-level interactions						
PSMU x Low-GDP						
PSMU x Mid-GDP			−0.018 (0.017)			0.026 (0.026)
PSMU x High-GDP			−0.048* (0.021)			0.040 (0.032)
PSMU x Low-Educ. Expenditure						
PSMU x Mid-Educ. Expenditure			0.002 (0.011)			0.009 (0.017)
PSMU x High-Educ. Expenditure			0.017 (0.010)			−0.015 (0.015)
PSMU x Low-Internet Use Prevalence						
PSMU x Mid – Internet Use Prevalence			0.033 (0.019)			−0.067* (0.029)
PSMU x High-Internet Use Prevalence			0.042* (0.021)			−0.092** (0.031)
PSMU x Low-Gini						
PSMU x Mid-Gini			0.020* (0.010)			−0.039** (0.014)
PSMU x High-Gini			−0.004 (0.010)			−0.006 (0.016)

(*Continued*)

Table 2. Continued.

	Psychological complaints			Life satisfaction		
	Model 1a: Random effect B (SE)	Model 2a: Ind. level interaction B (SE)	Model 3a: Cross-level interactions B (SE)	Model 1b: Random effect B (SE)	Model 2b: Ind. level interaction B (SE)	Model 3b: Cross-level interactions B (SE)
Random parameters						
Residual variance PSMU	0.001*** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)
Variance at country level	0.037*** (0.009)	0.037*** (0.009)	0.030*** (0.007)	0.094*** (0.023)	0.093*** (0.023)	0.060*** (0.015)
Variance at ind. level	0.909*** (0.003)	0.909*** (0.003)	0.909*** (0.003)	2.991*** (0.011)	2.991*** (0.011)	2.991*** (0.011)
PSMU 95% PI (std.)	[0.190/0.383]			[−0.506/−0.181]		
Model statistics						
Free Parameters	10	12	28	10	12	28
AIC	397739	**397735**	397749	570368	570356	**570354**
BIC	**397838**	397854	398026	**570467**	570474	570630

Note: $N_{individuals} = 144{,}934$, $N_{countries} = 35$. Individual level controls include age, gender, Frequent social media use. Fixed effects of country-level indicators are added in Table A2. Explained cross-country variance in Problematic Social Media Use (PSMU) slopes: (0.0006026–0.0004333)/0.0006026 = 0.281 for psychological complaints, and (0.0017707–0.0009468)/0.0017707 = 0.465 for life satisfaction. SES: Socioeconomic Status. GDP: Gross domestic product. AIC: Akaike information criterion. BIC: Bayesian information criterion. Lowest AIC and BIC for each outcome are shown in bold. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

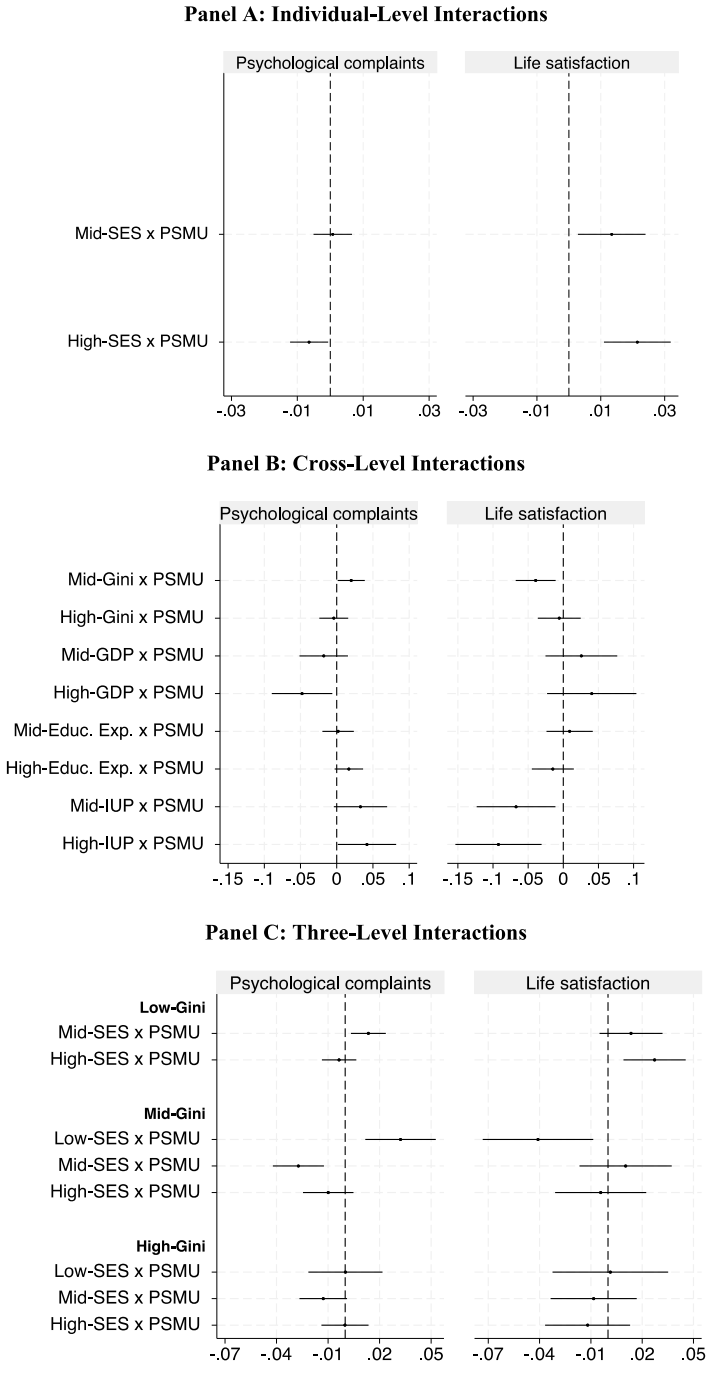

Figure 1. Mixed-effect multilevel interaction effects for psychological complaints and life satisfaction (95% CI).

Note: $N_{individuals}$ = 144,934, $N_{countries}$ = 35. Panel A: Model 2a and Model 2b; Panel B: Model 3a and Model 3b; Panel C: Model 4a and Model 4b. For brevity, only the interaction results are illustrated. SES: Socioeconomic Status. PSMU: Problematic Social Media Use. GDP: Gross domestic product. Educ. Exp.: Educational expenditure. IUP: Internet use prevalence.

adolescents (B = −0.006, SE = 0.003, $p = 0.029$), while no statistically significant difference in slopes was observed between middle-SES and low-SES adolescents ($p = 0.802$). In Model 2b, we found a statistically significant SES gradient in the association between life satisfaction and PSMU ($\chi^2(2, N = 144{,}934) = 16.74$, $p < 0.001$). Compared to low-SES adolescents (reference group), interaction contrasts indicate weaker negative associations between PSMU and life satisfaction among high-SES (B = 0.021, SE = 0.005, $p < 0.001$) and middle-SES adolescents (B = 0.013, SE = 0.005, $p = 0.013$). Differences between high-SES and middle-SES adolescents were not statistically significant ($p = 0.133$).

Cross-level interactions

In Table 2, we see that the cross-country variance in the association between PSMU and adolescent mental well-being outcomes by the country-level variables explained is 28% for psychological complaints and 47% for life satisfaction, as observed in the PSMU slopes for psychological complaints (0.0006026-0.0004333)/(0.0006026 = 0.281) and life satisfaction (0.0017707-0.0009468)/(0.0017707 = 0.465).

In terms of cross-level interactions, Model 3a illustrated mixed results (see Table 2 and Figure 1, Panel B). Gini levels moderated the association between PSMU and psychological complaints ($\chi^2(2, N = 144{,}934) = 6.14$, $p = 0.046$). Interaction terms indicate that, relative to low-Gini countries (reference group), the association between PSMU and psychological complaints was stronger in mid-Gini countries (B = 0.020, SE = 0.010, $p = 0.035$), while differences between high-Gini and low-Gini countries were not statistically significant ($p = 0.691$). GDP levels moderated the positive association between PSMU and psychological complaints ($\chi^2(2, N = 144{,}934) = 6.57$, $p = 0.037$). Specifically, relative to low-GDP countries, the association between PSMU and higher psychological complaints was attenuated in high-GDP countries (B = −0.048, SE = 0.021, $p = 0.025$), indicating that adolescents in wealthier contexts experience smaller increases in psychological complaints linked to PSMU, compared to adolescents in less wealthy countries. Educational expenditure ($\chi^2(2, N = 144{,}934) = 2.88$, $p = 0.237$) and IUP ($\chi^2(2, N = 144{,}934) = 4.12$, $p = 0.127$) did not moderate the association between PSMU and psychological complaints, although there was a statistically significant differences between high-IUP to low-IUP countries (B = 0.042, SE = 0.021, $p = 0.042$).

Model 3b indicated that Gini levels moderated the cross-country variations in the negative association between adolescent PSMU and life satisfaction ($\chi^2(2, N = 144{,}934) = 7.90$, $p = 0.019$), with stronger effects for mid-Gini countries than for low-Gini countries (B = −0.039 (SE = 0.014); $p = 0.007$), and no statistically significant differences between low-Gini and high-Gini countries ($p = 0.712$). While GDP ($\chi^2(2, N = 144{,}934) = 1.55$, $p = 0.460$) and educational expenditure ($\chi^2(2, N = 144{,}934) = 1.66$, $p = 0.437$) did not moderate the association between adolescent PSMU and life satisfaction, IUP levels did moderate the association ($\chi^2(2, N = 144{,}934) = 8.91$, $p = 0.012$). The negative association was stronger in high-IUP (B = −0.092, SE = 0.031, $p = 0.003$) and mid-IUP countries (B = −0.067, SE = 0.029, $p = 0.019$) than in low-IUP countries.

Finally, the results of Model 4a and 4b showed opposing results (Figure 1, Panel C). For psychological complaints, the three-way interaction was statistically significant ($\chi2(4, N = 144{,}934) = 13.97$, $p = 0.007$), but not for life satisfaction ($\chi2(4, N = 144{,}934) = 2.72$, $p = 0.606$). The tables of Model 4a and 4b are presented in the Appendix (Table A2).

Discussion

This study has adopted a micro–macro approach to examine how socioeconomic inequalities moderate the relationship between PSMU and adolescent psychological complaints and life satisfaction. Using high-quality cross-country data from 35 industrialised countries spanning across Europe, North America and Asia, our study is, to our knowledge, the first multilevel account to show how family and societal contexts of socioeconomic inequality intersect in shaping the relationship between PSMU and adolescent mental well-being.

Our study adds important findings to the interdisciplinary media, communication and sociological literatures focusing on adolescent well-being, social media and inequalities. First, at the *individual level*, we found that PSMU is consistently associated with more frequent psychological complaints and lower life satisfaction scores across countries. Critically, in line with *Hypothesis 1*, we show that the association between PSMU and poorer mental well-being is stronger for adolescents from low-SES backgrounds than for their peers from high-SES backgrounds. These results add to recent sociological research on social and digital divides in adolescent outcomes (Bohnert & Gracia, 2023; Loh et al., 2025), indicating how high-SES families can mobilise their resources – e.g., family support, digital parenting strategies, digital skills – as buffers to mitigate risky social media behaviours, whereas lower-SES adolescents are more harmed by risk-related social media experiences. Although SES gaps were observed for the two mental well-being outcomes examined, effects were stronger for life satisfaction than for psychological complaints. This finding suggests that a global and relatively stable indicator of adolescent well-being (i.e., life satisfaction) is more vulnerable to family SES inequalities than more episodic, symptom-based outcomes (i.e., psychological complaints). Future research should further investigate these relevant mechanisms.

Second, at the *country level*, we found an interesting U-shaped relationship: adolescents from medium – inequality countries were the least protected from PSMU with regard to both psychological complaints and life satisfaction. These findings can only partially support *Hypothesis 2*. The more unequal context of mid – inequality countries, compared to low-inequality countries, may lead adolescents to stronger comparisons and status anxiety in social media settings, potentially contributing to exacerbating mental health harms derived from PSMU (Cheung & Lucas, 2016; Nesi & Prinstein, 2015). However, while low-inequality countries often provide more generous support systems and educational opportunities for ICT skills, digital literacy, and health provision than high-inequality countries (e.g., Fuchs, 2009; Helsper, 2021; Zhang, 2013), the association between PSMU and adolescents' mental well-being was similar between low-inequality and high-inequality countries. One explanation for this finding could be that adolescents in high-inequality contexts are conscious of the prominent disparities in their own country. This consciousness may strengthen solidarity and cooperation with peers from similar social status in ways that counterbalance the vulnerability associated with living in a highly unequal country (e.g., Stornaiuolo & Thomas, 2017; Xenos et al., 2014). Also, high-inequality regions present higher levels of spatial socioeconomic segregation than low-inequality regions (Reardon & Bischoff, 2011). As a result, high-inequality contexts give more room to homophily (i.e., people having social networks from their own social class), as shown with regard to adolescents' friendships (Mijs & Roe, 2021). Thus, adolescents from more unequal countries would be less exposed to social media

content shared by people from other SES backgrounds, offsetting certain social comparison and status anxiety mechanisms. Overall, the moderation role of country-level inequalities in worsening the association between PSMU and mental well-being works only until countries reach intermediate levels of income inequalities, but not anymore when comparing low- to high-inequality countries. Future studies should address related underlying sociological mechanisms in online settings by considering different types of social networks and macro-level factors. This U-shaped pattern is based on our comparisons across categorical (tertile) inequality groups. As our inequality measures are categorical, we cannot estimate non-linear functional forms. Future studies should devote more attention to examining these macro-level U-shaped patterns.

Third, we found that SES inequalities in the association between PSMU and adolescent mental well-being are stable across countries with different inequality levels, in line with *Hypothesis 3b*. Previous literature highlights how digital skills, social support, and social comparison processes act as the most prominent explanations for negative outcomes derived from PSMU, highlighting that these mechanisms operate at the micro level (Livingstone et al., 2018; Mollborn et al., 2022; Nesi & Prinstein, 2015). This finding suggests that micro-level processes of inequality, compared to broader macro-level structural inequalities, are particularly powerful in explaining socio-digital inequalities behind the relationship between social media use and adolescent well-being outcomes.

Finally, beyond income inequality, our results also indicate that national wealth moderates the association between problematic social media use and adolescent psychological complaints. Adolescents in wealthier countries were more protected from higher PSMU in their mental well-being than those in less wealthy countries. As households in wealthier countries have higher disposable income, parents in high-income countries could afford higher-quality digital devices, better internet services, and mental health support to prevent harmful effects from risk-related online time (Hilbert, 2010; Van Dijk, 2020). These findings may also reflect that wealthier countries have access to educational resources to help adolescents to acquire digital skills and support from schools and teachers, while less affluent countries face financial challenges in accessing diverse digital and educational resources (Ma et al., 2019). Future research should investigate these income-related macro-level mechanisms more extensively.

Our study has important policy implications. At the *family level*, because PSMU can be a sign of addiction-like digital use behaviours (Van den Eijnden et al., 2016; Van Rooij et al., 2010), implementing early digital interventions and prevention programmes targeted to reduce PSMU could help adolescents in dealing positively with social media and improve their well-being. These programmes should be addressed particularly to low-SES families, as adolescents in these vulnerable families are most harmed by risky and addictive social media habits. At the *country level*, special focus should be given to countries with moderate levels of income inequality and lower levels of national income, the ones where risk and addictive related social media use seems most harmful to adolescent mental well-being. For example, policies aiming to diffuse digital resources more rapidly across families, as well as educational programmes on digital literacy and risk awareness, may help adolescents to get protective resources against risky online interactions, particularly in families and countries with scarcer resources. In addition, integrating digital well-being education into school curricula and community

programmes could equip adolescents with useful skills to navigate online environments regardless of their social background. Policymakers should also consider that reducing broader socioeconomic inequalities may indirectly protect adolescents from the harms of problematic social media use among low-SES adolescents.

This study has some limitations. First, the cross-sectional dataset we used in our study cannot account for the role of country-level inequalities in the reverse causality between PSMU and adolescent well-being. However, to our knowledge, there is no longitudinal cross-country multilevel data to address this issue. Second, while we examined micro- and macro-level factors, future research should also consider various meso-level mechanisms that were beyond the scope of our study, such as neighbourhood and community-level characteristics. Third, we could not examine whether digital skills help explain why PSMU relates differently to well-being across SES groups, as this theme is beyond the scope of the HBSC survey. Future research should address these limitations to further advance our understanding of how socioeconomic inequalities shape the link between PSMU and adolescent well-being.

To conclude, this study contributes to the emerging sociological and media research on PSMU and adolescent mental well-being by using an innovative framework linking micro to macro mechanisms. Our results reveal the complex interplay between PSMU, adolescent well-being and structural inequalities across societies. We find that PSMU is consistently associated with greater psychological complaints and lower life satisfaction across countries, whereas low-SES adolescents are at greater risk than high-SES adolescents, especially with regard to life satisfaction. We further show a U-shaped macro-level pattern: mid-inequality countries pose greater well-being harms from PSMU than both low- and high-inequality countries. Finally, we demonstrate that the observed SES gaps behind the association between PSMU and adolescent mental well-being persist across countries and schools with different levels of socioeconomic inequalities. We hope future research will benefit from our study to further address the societal drivers of adolescents' social media behaviours and well-being outcomes.

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Author contributions

CRediT: **Seyma Celik:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing; **Pablo Gracia:** Conceptualization, Funding acquisition, Project administration, Supervision, Writing – review & editing.

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Data availability statement

The data used in this study are available to open access at https://www.uib.no/en/hbscdata/113290/open-access

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Appendix

Table A1. Fixed effects of country-level predictors on intercepts for psychological complaints and life satisfaction

	Psychological complaints		Life satisfaction	
	Model 3a: Cross-level interactions	Model 4a: 3-way interactions	Model 3b: Cross-level interactions	Model 4b: 3-way interactions
Fixed effects (country-level)	B (SE)	B (SE)	B (SE)	B (SE)
Low-GDP (reference)				
Mid-GDP	0.231 (0.133)	0.231 (0.133)	– 0.070 (0.190)	– 0.070 (0.190)
High-GDP	0.178 (0.166)	0.178 (0.166)	– 0.107 (0.237)	– 0.107 (0.237)
Low-Educ. Expenditure (reference)				
Mid-Educ. Expenditure	– 0.069 (0.087)	– 0.069 (0.087)	0.010 (0.124)	0.010 (0.124)
High-Educ. Expenditure	– 0.084 (0.077)	– 0.084 (0.077)	0.048 (0.663)	0.048 (0.663)
Low-Internet Use Prevalence (reference)				

(*Continued*)

Table A1. Continued.

	Psychological complaints		Life satisfaction	
	Model 3a: Cross-level interactions	Model 4a: 3-way interactions	Model 3b: Cross-level interactions	Model 4b: 3-way interactions
Fixed effects (country-level)	B (SE)	B (SE)	B (SE)	B (SE)
Mid – Internet Use Prevalence	– 0.076 (0.147)	– 0.076 (0.147)	– 0.067* (0.029)	– 0.067* (0.029)
High-Internet Use Prevalence	– 0.080 (0.161)	– 0.080 (0.161)	– 0.092** (0.031)	– 0.092** (0.031)
Low-Gini (reference)				
Mid-Gini	0.068 (0.074)	0.078 (0.074)	– 0.192 (0.106)	– 0.257* (0.107)
High-Gini	0.093 (0.079)	0.109 (0.080)	– 0.047 (0.113)	– 0.128 (0.114)

Note: $N_{individuals} = 144{,}934$, $N_{countries} = 35$. Analyses present the Fixed effects of country-level predictors on intercepts for psychological complaints and life satisfaction that are not presented in the comparable models in Table 2. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table A2. Three-way cross-level interaction coefficients on psychological complaints and life satisfaction

	Psychological complaints Model 4a: 3-way interactions B (SE)	Life satisfaction Model 4b: 3-way interactions B (SE)
Fixed effects		
Intercept	1.086*** (0.080)	7.971*** (0.114)
Problematic Social Media Use (PSMU)	0.123*** (0.011)	−0.134*** (0.016)
Cross-level interactions		
PSMU x Low-SES x Low-Gini (ref)		
PSMU x Mid-SES x Low-Gini	0.014** (0.005)	0.013 (0.009)
PSMU x High-SES x Low-Gini	– 0.004 (0.005)	0.027** (0.009)
PSMU x Low – SES x Mid-Gini	0.032** (0.010)	– 0.041* (0.016)
PSMU x Mid-SES x Mid-Gini	– 0.027*** (0.008)	0.010 (0.014)
PSMU x High-SES x Mid-Gini	– 0.010 (0.007)	– 0.004 (0.014)
PSMU x Low-SES x High-Gini	0.000 (0.011)	0.001 (0.017)
PSMU x Mid-SES x High-Gini	– 0.013† (0.007)	– 0.008 (0.013)
PSMU x High-SES x High-Gini	– 0.000 (0.007)	– 0.012 (0.013)
Random parameters		
Residual variance PSMU	0.000*** (0.000)	0.001*** (0.000)
Variance at country level	0.030*** (0.007)	0.060*** (0.015)
Variance at ind. level	0.909*** (0.003)	2.990*** (0.011)
Model statistics		
Free Parameters	36	36
AIC	397742.9	570,354
BIC	398,098.7	570,630

Note: $N_{individuals} = 144{,}934$, $N_{countries} = 35$. Analyses present the three-way cross-level interaction coefficients for psychological complaints and life satisfaction that are not presented in the comparable models in Table 2. †$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.