



Multiple social positions and well-being among Nordic adolescents: An intersectional MAIHDA analysis of the interplay between gender, age, immigrant background, family structure, and perceived socioeconomic status

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ABSTRACT

Background: Research on well-being inequalities has typically examined the independent effects of social positions, often overlooking how the interplay of multiple social categorizations can shape well-being outcomes. This study explored how multiple social positions based on gender, age, immigrant background, family structure, and perceived family socioeconomic status shape patterns of inequality in three well-being outcomes—psychosomatic complaints, mental well-being, and problematic social media use—among Nordic adolescents.

Methods: Data from the Health Behaviour in School-aged Children Study, collected in four Nordic countries (Finland, Iceland, Norway, and Sweden) in 2022 ($N = 22\,366$, ages 9–19), were analyzed using the Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA) approach. Participants were nested within 168 strata defined by their multiple social positions.

Results: Of the additive contributions of individual social positions, female gender was most strongly associated with poorer well-being across all outcomes. Interaction effects indicating more favorable well-being than expected based on additive main effects were identified across all outcomes for non-immigrant girls aged 9 to 12 perceiving high family socioeconomic status. Unexpectedly, non-immigrant boys aged 15 years and older from nuclear families with low perceived family socioeconomic status reported better well-being levels than anticipated. In contrast, interaction effects demonstrating less favorable well-being were observed for older, non-immigrant girls from nuclear families with high perceived family socioeconomic status, who reported poorer outcomes than expected. Several other subgroups also displayed significant deviations from anticipated outcomes in specific well-being domains.

Conclusions: The findings reveal significant intersectional disparities in well-being, notably in psychosomatic complaints and problematic social media use. The same social positions can form different patterns of advantage and disadvantage for individuals across different subgroups.

1. Introduction

Well-being is a broad concept that encompasses not only the absence of symptoms or illness but also the subjective experience of happiness, positive affect, the pursuit of meaning in life, and overall psychological functioning (Kusier and Folker, 2020; Ryan and Deci, 2001). A concerning decline in adolescent well-being is reflected both in the Nordic

countries and globally (Cosma et al., 2025). Over the past two decades, there has been a significant increase in psychosomatic health complaints among adolescents, with symptoms such as low mood and frequent headaches becoming more common across Nordic nations (Cosma et al., 2023). This trend appears to be relatively consistent across these countries (Stattin and Eriksson, 2024). Compounding this issue, the onset of the COVID-19 pandemic in the spring of 2020 has further

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exacerbated the crisis surrounding adolescent well-being (Cosma et al., 2025; Kauhanen et al., 2023). Globally, the proportion of adolescents experiencing recurring psychosomatic complaints rose from 33 % in 2014 to 36 % in 2018, and further increased to 44 % in 2022 (Cosma et al., 2023). Notably, this upward trend appears to continue, as evidenced by the increasing prevalence of health symptoms and the rising number of adolescents seeking care for these issues in certain Nordic contexts (Helenius et al., 2025; Socialstyrelsen, 2024). Although positive dimensions of adolescent well-being have been less studied (Shao et al., 2024), evidence from the Nordic region also indicates a decline in mental well-being over time, particularly among girls (Kiviruusu et al., 2024; Uvhagen et al., 2025).

In addition to traditionally studied well-being outcomes, there is growing apprehension regarding the adjustment challenges and functioning of youth in the digital age, particularly concerning problematic media use, also referred to as social media addiction (Boer et al., 2020). This psychological condition refers to an unhealthy reliance on social networking sites, which can manifest as emotional and behavioral addiction symptoms, such as experiencing negative emotions when access to social media is restricted (Chen, 2019). In addition, problematic social media use involves prioritizing social media over other interests and activities, persisting in use despite negative consequences, and experiencing significant distress in personal and social contexts due to social media engagement (Van den Eijnden et al., 2016). The criteria for problematic social media use closely align with the recognized addiction criteria for gaming and gambling disorders (Moretta and Wegmann, 2025), as outlined in diagnostic manuals (American Psychiatric Association, 2013; World Health Organization, 2022). Importantly, recent longitudinal evidence indicates that problematic social media use is a distinct psychopathological condition that may operate independently of other traditional well-being outcomes, such as depressive and anxiety symptoms (Tullett-Prado et al., 2023).

Various dimensions of well-being among young people differ across social contexts and are influenced by several social determinants, including gender, age, ethnicity, and socioeconomic status (SES; Campbell et al., 2021; Peverill et al., 2021). As society has become increasingly diverse, individuals have access to a broader array of social identities and positions (Manzi et al., 2024). Research recognizing that individuals belong to multiple social categories and how these categories shape their experiences and outcomes has led to the development of two primary perspectives: the multiple identities approach (Ashmore et al., 2004) and the intersectionality framework (Crenshaw, 1989). The multiple identities approach emphasizes the organization and ranking of identities within an individual, suggesting that each person has a distinct hierarchy of identities, with certain identities becoming more prominent depending on the context (Ashmore et al., 2004). Evidence supporting this approach indicates that, for children and younger adolescents from diverse backgrounds, gender identity is often ranked higher than racial or ethnic identity (Rogers and Meltzoff, 2017). While the multiple identities approach acknowledges the existence of various identities, it often adopts an additive perspective, focusing on the effects of individual identities rather than exploring their interactions.

On the other hand, intersectionality theory emphasizes how overlapping and interacting social categories create unique experiences for individuals, including variations in well-being outcomes. Originally formulated by Kimberlé Crenshaw (1989), this theory describes the complex interplay of various social categories (e.g., gender and immigrant status) and systems of oppression (e.g., racism and sexism) that contribute to marginalization and privilege. By highlighting the limitations of focusing solely on single social categories, intersectionality underscores the need to consider diverse social locations and the distinct life experiences of subgroups defined by multiple intersecting characteristics (Sen et al., 2009). Thus, individuals occupying certain social positions may encounter distinct advantages or disadvantages unique to their contexts, resulting in potentially unexpected well-being patterns (Bauer et al., 2021). Initially focused on the experiences of Black women

in the United States (Crenshaw, 1989), intersectionality has expanded to include a range of social identities reflecting a hierarchy of social power. Bauer et al. (2021) identify additional social positions typically of interest in quantitative intersectional studies, including socioeconomic status, sexual orientation, age, immigrant status, disability, geography, discrimination, and family status. However, empirical studies have often focused on only two or three of these social positions at a time.

While critical qualitative research has been at the forefront of applying an intersectionality framework, quantitative research on well-being inequalities still lacks consensus on methodologies and guidance for studying intersectionality (Bauer et al., 2021; Evans et al., 2024; Wilkes and Karimi, 2024). Common statistical methods, such as descriptive analyses and single-level regression (with or without interactions), often struggle to model interactions across multiple social dimensions (Evans et al., 2018, 2024). The intersectional Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA; Evans et al., 2018, 2024) marks a significant advancement in applying an intersectional lens in quantitative research, effectively modeling a broader range of interactions. This method enables researchers to compare observed outcomes for specific subgroups (or “strata”) with expected outcomes derived from the additive contributions of single social categories (Evans et al., 2018). This study utilized the MAIHDA approach to explore inequalities in well-being outcomes across multiple social positions, including gender, age, immigrant background, family structure, and perceived family SES in four Nordic countries.

1.1. Well-being inequalities across single social positions

Numerous studies investigating differences in adolescent well-being (e.g., depression, mental distress, life satisfaction, and self-rated health) based on social positions—while focusing on the additive contributions of individual social categories—have identified several key factors associated with poorer outcomes. For example, these include female (as opposed to male) gender (Campbell et al., 2021), being older (Cosma et al., 2025), and reporting lower (family) SES (Peverill et al., 2021). Moreover, in contrast to those living in traditional nuclear family structures—typically defined as residing with two biological parents (Harcourt et al., 2015)—adolescents in non-nuclear family arrangements, such as those living with a single parent, stepparents, or in foster care, tend to report poorer well-being (Delaruelle et al., 2021). Although the types and number of social positions examined have varied, research in the Nordic region has shown that gender is more strongly associated with well-being than other positions (Gustafsson et al., 2025; Kozák et al., 2023).

In addition, European evidence has shown that children and adolescents of immigrant origin tend to exhibit poorer well-being, including higher rates of psychosomatic complaints, compared to their non-immigrant peers (Delaruelle et al., 2021). More recently, research differentiating between migrant generations has shown that first-generation immigrant adolescents (i.e., those who had migrated from one country to another) tend to report poorer well-being in terms of depression (Abdulhamed et al., 2025) than subsequent generations and non-immigrants. In contrast, the immigrant paradox—primarily observed in the U.S. context (Zhang et al., 2021)—suggests that first-generation immigrants adapt better than subsequent generations and non-immigrants. The well-being of immigrants can also be influenced by their country of origin. A recent review (Lievrouw et al., 2024) revealed mixed findings in Europe, with some studies indicating that adolescent immigrants from European countries experience a well-being advantage, while others suggest they may encounter disadvantages compared to their non-European counterparts.

While problematic social media use has received less attention than traditional well-being outcomes, research suggests a weak association with female gender (Boer et al., 2020; Boniel-Nissim et al., 2024) and older age among adolescents (Boer et al., 2020). In addition, most

existing evidence suggests no link between family SES and problematic social media use (Favini et al., 2024; Geurts et al., 2022). A recent analysis encompassing 40 countries found no significant association between family affluence and problematic social media use among adolescents in 75 % of these countries, including those in the Nordic region (Boniel-Nissim et al., 2024). Moreover, problematic social media use has been found to be more prevalent among first- and second-generation immigrant adolescents than their non-immigrant counterparts in the Nordic region (Gustafsson et al., 2025).

1.2. Well-being inequalities across multiple social positions

Interactions between multiple social positions may create unique experiences that cannot be fully understood by examining each social category in isolation (Bauer, 2014; McCall, 2005). Research on adolescent well-being related to intersectional effects has highlighted two types of effects. Exacerbation effects, also known as synergistic effects (Bauer, 2014), suggest that social minority statuses or disadvantaged positions can interact to amplify their impacts, resulting in individuals with multiple minority statuses experiencing significantly greater harm than those affected by any single status alone (Raver and Nishii, 2010). In inurement effects, or antagonistic effects (Bauer, 2014), a minority status may overshadow or mitigate the others, resulting in less detrimental outcomes than if each status were experienced in isolation (Raver and Nishii, 2010). Importantly, many individuals occupy social positions that encompass both privileged and marginalized domains, leading to a complex interplay of co-constituted positions (Bauer, 2014).

Empirical research on well-being across combined social positions using the MAIHDA approach has yielded mixed findings, although most studies suggest that well-being is more strongly influenced by the additive main effects of social positions rather than their intersections (Balloo et al., 2022; Evans and Erickson, 2019; Kern et al., 2020; Lorthé et al., 2023). For example, both Evans and Erickson (2019) and Balloo et al. (2022) found no significant intersectional effects on depression and mental distress across social positions such as gender, race/ethnicity, immigration status, and SES.

Similarly, Kern et al. (2020) examined the interplay of gender, immigration background, and family affluence across 33 European countries and found no significant intersectional effects on psychosomatic complaints and life satisfaction. However, these effects varied by country-level immigration and integration policies, income equality, and gender equality. In countries with inclusive immigration policies and higher income equality, adolescents from privileged groups (e.g., high-SES non-immigrant boys) reported poorer well-being than expected, while those from disadvantaged groups (e.g., low-SES immigrant boys and girls) experienced better outcomes.

In another study, Lorthé et al. (2023) identified significant intersectional effects for non-immigrant girls aged 6–11 and 12–17 with highly educated parents and stable financial situations. The younger group reported lower-than-expected health-related quality of life, while the older group reported higher-than-expected quality of life based on parent or self-reports.

In conclusion, empirical research indicates a mixed understanding of how combined social positions are linked to adolescent well-being, potentially stemming from differences between countries' social policies, cultural contexts, and economic conditions. Notably, most previous studies on adolescent well-being using the MAIHDA approach have overlooked age groups, family structure, and the diverse origins of individuals with immigrant backgrounds as key social positions. This represents a significant limitation, as these factors have been shown to contribute individually to inequalities in well-being, including problematic social media use (Boer et al., 2020; Cosma et al., 2025; Delaruelle et al., 2021; Lievrouw et al., 2024). This study focuses on a Nordic sample from Finland, Iceland, Norway, and Sweden, which share notable similarities in heritage (Rynning et al., 2010). These commonalities include a strong public sector role in providing essential services

and policies to reduce social inequalities in well-being (Martela et al., 2020), a strong commitment to gender equality (Greve, 2016), and similar educational systems (Frønes et al., 2020). Thus, the Nordic region offers a valuable context for studying the interaction of various social positions and how they shape well-being.

1.3. Aims of this study

This study aimed to investigate how multiple social positions based on gender, age, immigrant background, family structure, and perceived family SES shape patterns of inequality in three well-being outcomes—psychosomatic complaints, mental well-being, and problematic social media use—among adolescents in four Nordic countries. Analytically, the aim was to assess the extent to which intersectional social positions, compared to the additive effects of individual social positions, account for variations in well-being.

The study contributes to the field by: 1) expanding the focus from a limited number of social positions to a broader range of structural inequalities through the MAIHDA approach—an area largely unexplored in Nordic countries except for Kern et al. (2020); 2) considering age groups and family structure as social positions in the MAIHDA analysis; 3) emphasizing the experiences of immigrant adolescents by considering their country of origin, often overlooked in prior research; and 4) expanding well-being measures to encompass positive indicators of mental well-being and emerging dysfunctions like problematic social media use, which have received less attention in intersectional literature.

It was hypothesized that intersectional social positions would account for some of the variance in well-being, while additive main effects would explain a larger portion of the variance in the outcomes. Among the individual social positions, it was anticipated that gender would be most strongly linked to the outcomes. As social positions are regarded as contextual-level variables that interact with one another from an intersectional perspective, and given that no prior study has explored this combination of intersecting social positions in the Nordic region, no specific hypotheses were established regarding which strata would report the highest or lowest levels of well-being.

2. Methods

2.1. Data and participants

This study employed cross-sectional data from the Health Behaviour in School-aged Children (HBSC) Study, collected in 2022, comprising 22 366 adolescents across four Nordic countries: Finland ($n = 3838$), Iceland ($n = 10225$), Norway ($n = 3736$), and Sweden ($n = 4567$). The target age group consisted of 11, 13, and 15-year-olds, corresponding to fifth, seventh, and ninth grades in Finland and Sweden, and sixth, eighth, and tenth grades in Iceland and Norway. While the focus was on these age groups, the sample also included some younger and older participants due to the age variations within each grade level. The survey followed a standardized protocol (Inchley et al., 2023) for sampling and data collection, utilizing cluster sampling of classes or schools to ensure representativeness. Participants voluntarily completed an online survey during school hours, with no personally identifiable information collected. Parents or guardians were informed about the study and could opt out if they preferred their children not to participate. The HBSC study adhered to the Declaration of Helsinki and received ethics approval from the relevant national review boards.

2.2. Measures

2.2.1. Social positions

Gender was assessed using a binary response option, asking participants to indicate whether they are a 1 = boy or 2 = girl.

Participants' ages were determined by their date of birth (month and

year), calculated to range from 9 to 19 years at the time of data collection. They were classified into three age groups: 1 = 9–12 years, 2 = 13–14 years, and 3 = 15 years or older. These categories were chosen based on educational transitions and key developmental milestones in pre-, early, and middle adolescence (Gilmore and Meersand, 2015; Yoon et al., 2023).

Immigrant background was assessed through three questions regarding the birth countries of the participants (one question) and their parents (two questions). In Finland and Iceland, participants received a list of specific countries, while in Norway and Sweden, options included: 1) the survey country (Norway/Sweden), 2) other Nordic countries, 3) other European countries (excluding Nordic), and 4) countries outside Europe. Participants were classified into three categories: 1 = non-immigrant background (both the participant and parents were born in the survey country), 2 = first-generation immigrant (born abroad), and 3 = second-generation immigrant (born in the survey country with one or both parents born abroad). First- and second-generation immigrants were further categorized by their or their parents' country of origin into: 1 = Nordic origin, 2 = European origin (excluding Nordic), and 3 = non-European origin.

Family structure was measured by asking participants to identify the individuals living in their primary home. Response options included: "Mother," "Father," "Mother's partner," "Father's partner," "I live in a foster home or children's home," and "Someone or somewhere else (e.g., grandparents)." Based on their responses, participants were categorized into two family structures: 1 = nuclear family (here, a heterosexual nuclear family with both a mother and a father) and 2 = non-nuclear family (single-parent family, stepfamily, same-sex parents, or foster care).

Perceived family SES was assessed using a single question: "How well off do you think your family is?" The five response options were: "not at all," "not so," "average," "quite," and "very." These responses were grouped into two categories: 1 = low SES (comprising "not at all," "not so," and "average") and 2 = high SES (comprising "quite" and "very"). This cut-off has been employed in previous empirical research (Belardinelli et al., 2022) and was further supported by the distribution of responses in this study.

2.2.2. Well-being outcomes

Psychosomatic complaints were measured using the HBSC Symptom Checklist (Haugland and Wold, 2001), a validated instrument demonstrating metric invariance across countries (Heinz et al., 2022). Participants reported the frequency of symptoms experienced over the past six months, including headache, stomachache, backache, feeling dizzy, feeling low, irritability or bad mood, feeling nervous, and difficulties in getting to sleep. Response options were: "About every day," "More than once a week," "About every week," "About every month," and "Rarely or never." Responses were reversed and computed into a mean score (range: 1–5; Cronbach's $\alpha = .85$), with higher scores indicating greater psychosomatic complaints.

Mental well-being was measured using the WHO-5 Well-Being Index (Topp et al., 2015), which assesses adolescents' subjective hedonic well-being, including positive emotions (Kusier and Folker, 2020). This index has demonstrated validity (Sischka et al., 2025; Topp et al., 2015) and metric invariance across countries (Sischka et al., 2025). Participants responded to five statements about their feelings over the past two weeks: "I have felt cheerful and in good spirits," "I have felt calm and relaxed," "I have felt active and vigorous," "I woke up feeling fresh and rested," and "My daily life has been filled with things that interest me." The response options for each item were: "At no time," "Some of the time," "Less than half of the time," "More than half of the time," "Most of the time," and "All of the time." Following the measure manual (World Health Organization, 2024), responses were summed into a continuous raw score ranging from 0 to 25 (Cronbach's $\alpha = .85$), with higher scores indicating better mental well-being.

Problematic social media use was assessed using the nine-item Social

Media Disorder Scale (Van den Eijnden et al., 2016), which has demonstrated validity (Boer et al., 2020) and scalar invariance across countries (Boer et al., 2022). Participants indicated whether they had experienced the following in the past year: regularly being unable to think of anything else but when they would be able to use social media again; regularly feeling dissatisfied because they wanted to spend more time on social media; often feeling bad when they could not use social media; attempting to spend less time on social media but failing; regularly neglecting other activities (e.g., hobbies, sports) because they wanted to use social media; regularly having arguments with others because of their social media use; regularly lying to parents or friends about the amount of time spent on social media; often using social media to escape from negative feelings; and experiencing serious conflicts with parents or siblings because of their social media use. Response options were "Yes" and "No," and all "Yes" responses were summed into a continuous score (range: 0–9; Cronbach's $\alpha = .81$), with higher scores indicating greater problematic social media use.

2.3. Statistical analysis

Statistical analyses were conducted using IBM SPSS Statistics (version 29.0.2.0). Nonresponse to survey items was present in the dataset, potentially due to factors such as respondent fatigue from the survey's length, perceptions of irrelevance or dullness, and the belief that the questions require significant cognitive effort (Aarø et al., 2022). Chi-square tests were employed to assess differences between respondents with missing data and those with complete data. Compared to adolescents with complete data on well-being outcomes, those with missing data were significantly more likely ($p < .05$) to be boys (57.4–65.7 % vs. 49.8–50.5 %), belong to the youngest age group (43.1 %–60.4 % vs. 36.4 %–36.8 %), have an immigrant background (76.9 %–77.6 % vs. 70.3 %–73.3 %), and live in a non-nuclear family (33.4 %–36.3 % vs. 27.9 %–28.3 %). Additionally, there was a significant difference ($p < .001$) in perceived SES between adolescents with missing data and those with complete data on psychosomatic complaints, as those with missing data were more likely to report higher SES (89.7 % vs. 82.0 %). Geographical differences were also noted; for example, adolescents with missing data on psychosomatic complaints were significantly more likely to be from Iceland (71.3 % vs. 44.8 %) and less likely to be from Finland, Norway, or Sweden (8.9–9.9 % vs. 16.9 %–20.8 %) ($p < .01$). Overall, this analysis largely supported the Missing At Random (MAR) assumption, justifying the use of multiple imputation for handling missing values.

Missing data on social positions (1–11 %) and well-being outcomes (3–17 %) were addressed using multiple imputation, enhancing the robustness of the analyses by maximizing case inclusion in each "social stratum." Five imputations were performed, incorporating social positions and country as auxiliary variables. The Chi-square test and one-way ANOVA revealed almost no significant differences ($p > .05$) between observed and imputed values, except for family structure ($p < .001$), where imputed values included 1 % more adolescents from non-nuclear families (30 % in imputed vs. 29 % in observed). Findings reflect pooled estimates across these imputed data sets.

Descriptive statistics included means (M), standard deviations (SD), and frequencies (%). Spearman's rank correlation test was used to examine possible associations between the key variables.

To explore intersectional effects, intersectional MAIHDA analysis was employed, which constructs "social strata" as analytic subgroups formed at the intersections of various social positions (Evans et al., 2018). Key considerations include selecting variables, cutoff scores, and sample distribution across potential strata (Evans et al., 2024). In this study, every combination of social positions (gender, age, immigrant background, family structure, and perceived family SES) resulted in 168 strata (see Table S1 in Supplemental File 1). Following the guidelines outlined by Evans et al. (2024), the majority (89 %) of strata had a reasonable sample size, with 149 out of 168 strata having more than ten

participants (see Table S2).

Recently, studies have shifted from employing the usual Bayesian framework of MAIHDA to frequentist models, with both yielding similar results (Mahendran et al., 2022). However, the latter offers certain advantages over Bayesian models, such as faster computation and fewer pre- and post-estimation steps in model specification, estimation options, and result preparation (Evans et al., 2024). Thus, in this study, a frequentist approach was employed, specifically using linear mixed models estimated via maximum likelihood (ML). The analysis code for the MAIHDA models is provided in Supplemental File 2.

Intersectional MAIHDA analysis involves fitting two multilevel linear regression models for each outcome (Evans et al., 2018, 2024). The first model, the null model, features a two-level hierarchical random intercepts structure, nesting individuals (level 1) within social strata (level 2). This model assesses how well social strata explain overall outcome variation and quantifies the degree of inequality between strata. The Variance Partition Coefficient (VPC), or Intraclass Correlation Coefficient (ICC), was calculated from the null model to estimate the proportion of total outcome variation attributed to the social strata. The second model, the additive main effects model, builds on the null model by adding social positions (e.g., gender, age) as fixed effects. Country of residence was included as an additional covariate. No multicollinearity was detected among the independent variables (Variance Inflation

Factor (VIF) < 2). In this model, the Proportional Change in Variance (PCV) represents the proportion of the total between-stratum variance accounted for by the additive main effects. A PCV value below 100 % suggests that interaction effects are essential for accurately capturing observed inequalities between strata (Evans et al., 2024). The complement of this value, 1 – PCV or 100 % - PCV, measures the unexplained between-strata variance attributed to interaction effects. Additionally, strata-level residuals reflect how much the predicted score for each stratum differs from the expected score based on the additive main effects, indicating the remaining unexplained interaction effect (Evans and Erickson, 2019). Negative residuals indicate lower-than-expected well-being outcomes for a stratum, while positive residuals indicate higher-than-expected levels.

Figures displaying stratum-specific interaction effects and predicted mean values of well-being outcomes were plotted using R (version 4.3.0; R Core Team, 2024) with the ggplot2 package (Wickham, 2016).

3. Results

3.1. Descriptive characteristics

Table S3 presents the descriptive characteristics of the overall sample and by country. Around half of the adolescents (49 %) were girls, with

Table 1
Parameter estimates for linear MAIHDA models of well-being outcomes.

Model	Psychosomatic complaints	Mental well-being	Problematic social media use
	B (95% CI)	B (95% CI)	B (95% CI)
Model 1 (null model)			
Intercept	2.58 (2.51, 2.65)***	14.22 (13.85, 14.58)***	2.31 (2.20, 2.43)***
<u>Random effects: Variances</u>			
Stratum-level (between-stratum variance)	0.166 (0.022)	4.678 (0.610)	0.380 (0.067)
Individual-level (within-stratum variance)	0.717 (0.008)	23.233 (0.231)	4.793 (0.049)
Variance Partition Coefficient (VPC)	18.83%	16.76%	7.35%
Model 2 (additive main effects model)			
Intercept	2.22 (2.13, 2.30)***	15.11 (14.72, 15.51)***	2.10 (1.88, 2.32)***
Gender, female (vs. male)	0.57 (0.51, 0.63)***	-2.66 (-2.91, -2.40)***	0.60 (0.46, 0.74)***
Age (ref. 9–12 years)			
13–14 years	0.19 (0.12, 0.26)***	-0.85 (-1.15, -0.55)***	0.26 (0.08, 0.43)**
15 years or older	0.23 (0.16, 0.30)***	-1.12 (-1.43, -0.81)***	-0.03 (-0.20, 0.15)
Immigrant background (ref. non-immigrant)			
First-generation immigrant (Nordic origin)	0.01 (-0.10, 0.13)	-0.11 (-0.65, 0.44)	0.22 (-0.07, 0.51)
First-generation immigrant (European origin)	-0.12 (-0.22, -0.02)*	-0.08 (-0.56, 0.40)	0.44 (0.19, 0.69)***
First-generation immigrant (non-European origin)	-0.19 (-0.29, -0.10)***	0.58 (0.13, 1.04)*	0.54 (0.29, 0.79)***
Second-generation immigrant (Nordic origin)	0.08 (-0.02, 0.18)	-0.56 (-1.06, -0.06)*	0.09 (-0.20, 0.38)
Second-generation immigrant (European origin)	-0.03 (-0.12, 0.06)	-0.33 (-0.74, 0.08)	0.28 (0.05, 0.51)*
Second-generation immigrant (non-European origin)	0.02 (-0.07, 0.10)	-0.56 (-0.94, -0.17)**	0.51 (0.26, 0.76)***
Family structure (ref. nuclear family)			
Non-nuclear family	0.15 (0.10, 0.21)***	-0.73 (-0.98, -0.47)***	0.31 (0.17, 0.45)***
Perceived family socioeconomic status (ref. low)			
High	-0.41 (-0.47, -0.35)***	2.89 (2.62, 3.16)***	-0.65 (-0.80, -0.50)***
Country (ref. Finland)			
Iceland	0.18 (0.14, 0.21)***	-0.03 (-0.22, 0.17)	-0.24 (-0.33, -0.14)***
Norway	-0.11 (-0.15, -0.06)***	0.47 (0.23, 0.72)***	-0.14 (-0.26, -0.03)*
Sweden	0.19 (0.15, 0.23)***	-0.03 (-0.26, 0.20)	-0.39 (-0.50, -0.27)***
<u>Random effects: Variances</u>			
Stratum-level (between-stratum variance)	0.013 (0.003)	0.157 (0.052)	0.073 (0.024)
Individual-level (within-stratum variance)	0.694 (0.007)	22.949 (0.244)	4.712 (0.050)
Variance Partition Coefficient (VPC)	1.85%	0.68%	1.53%
Proportional Change in Variance (PCV)	90.18%	95.95%	79.18%

Note. Multi-level models using ML estimation. Pooled estimates. Country was adjusted for as a covariate in Model 2. N = 22366. *p < .05; **p < .01; ***p < .001.

the three age groups fairly evenly represented. Most reported a non-immigrant background (76 %), lived in a nuclear family structure (69 %), and perceived a high family SES (82 %). Among the four survey countries, most adolescents were from Iceland (46 %), followed by Sweden (20 %), Finland (17 %), and Norway (17 %). The mean levels of well-being outcomes across social positions are presented in Table S4, while Table S5 shows the correlations of the key variables.

3.2. Intersectional MAIHDA: general effects

Table 1 presents the results of the multilevel models. The VPC values in Model 1 (the null model) illustrate the overall contextual effect of the strata before accounting for additive main effects, indicating how much the clustering of social strata contributes to the total variance in each outcome. Approximately 19 % of the variance in psychosomatic

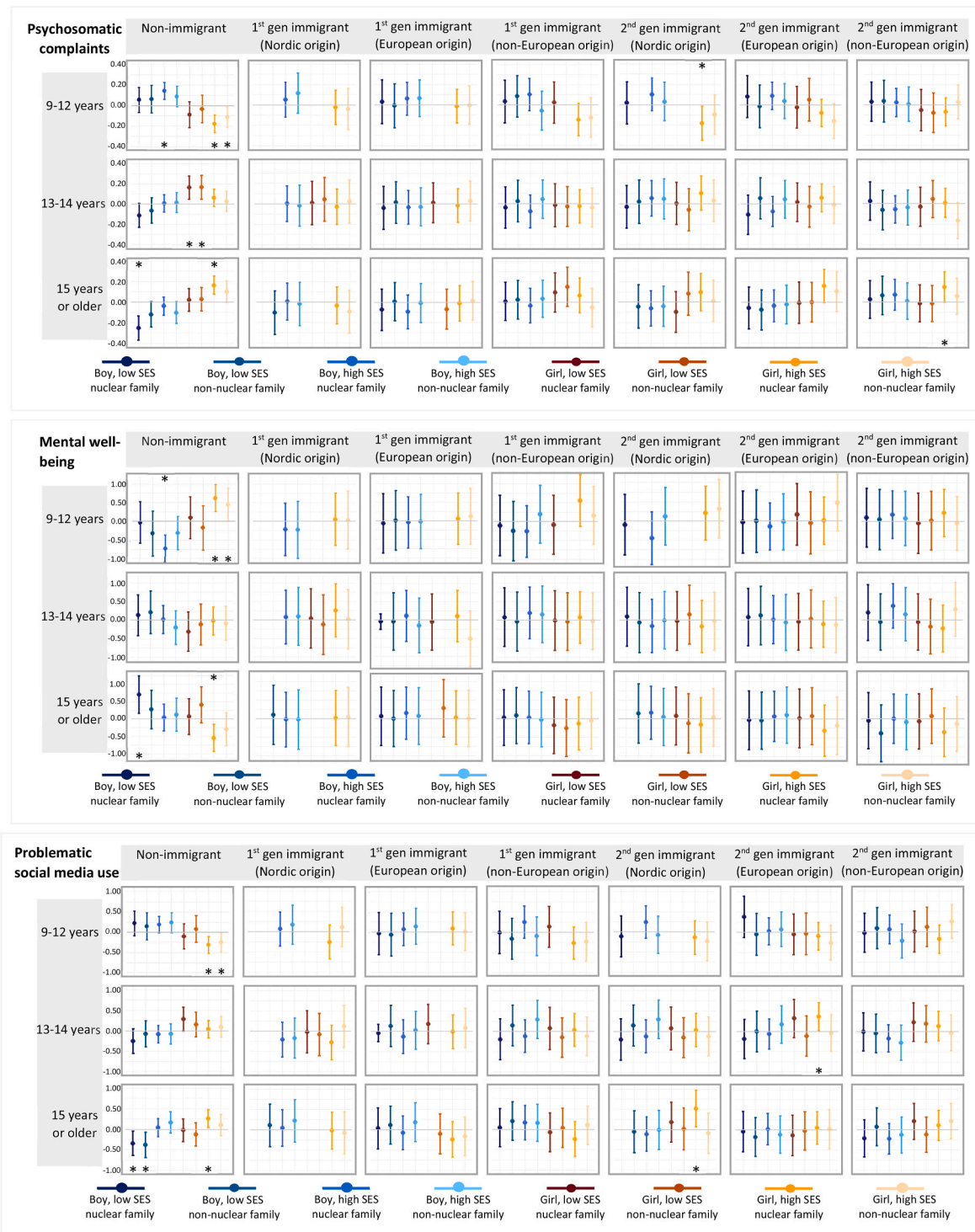


Fig. 1. Interaction effects (strata-level residuals) with 95 % confidence intervals from the additive main effects model for well-being outcomes. Note. 1st gen immigrant: first-generation immigrant; 2nd gen immigrant: second-generation immigrant; SES: perceived family socioeconomic status. Significant interaction effects ($p < .05$) are indicated by an asterisk (*). Negative residuals suggest that the level of a well-being outcome for the stratum is lower than anticipated based on the additive main effects, while positive residuals indicate that it is higher than expected. Strata with unreliable estimates due to low sample size ($n < 10$) are not shown.

complaints, 17 % in mental well-being, and 7 % in problematic social media use was attributed to this clustering.

Results from the fully adjusted Model 2 (the additive main effects model) indicated that additive main effect parameters of social positions had significant effects on well-being outcomes. Overall, girls, older adolescents, those in non-nuclear families, and individuals perceiving their families' SES as less well-off reported lower well-being. The associations related to immigrant background varied slightly by country. For example, first-generation immigrants of non-European origin reported fewer psychosomatic complaints and better mental well-being, but higher problematic social media use than non-immigrants. In addition, first-generation immigrants of European origin showed fewer psychosomatic complaints and higher problematic social media use relative to non-immigrants. Moreover, second-generation immigrants of Nordic origin experienced poorer mental well-being, while those of European origin reported more problematic social media use than their non-immigrant counterparts. Furthermore, second-generation immigrants of non-European origin reported lower mental well-being and higher levels of problematic social media use than non-immigrants.

By comparing the between-strata variance from Model 2 (the additive main effects model) to that of Model 1, the PCV value indicates how much the additive main effects explain the between-strata variance in the outcomes, with the remaining variance attributed to interaction effects. The PCV values were approximately 90 %, 96 %, and 79 % for psychosomatic complaints, mental well-being, and problematic social media use, respectively. The complement of this value, 100 % – PCV, suggests that interaction effects accounted for 10 % of the variance in psychosomatic complaints, 4 % in mental well-being, and 21 % in problematic social media use.

3.3. Intersectional MAIHDA: specific effects

To examine specific interaction effects in Model 2, stratum-level residuals were calculated after adjusting for the additive main effects and country (see Fig. 1 and Table S6). A significant interaction effect indicates that the predicted outcome for a stratum deviates from expectations based on the additive main effects. For psychosomatic complaints, nine strata exhibited significant interaction effects, while five strata showed significant interaction effects for mental well-being, and seven strata demonstrated significant interaction effects for problematic social media use.

Across all outcomes, more favorable well-being than expected was identified for the youngest high-SES non-immigrant girls from both nuclear and non-nuclear families, who reported higher levels of mental well-being and lower rates of psychosomatic complaints and problematic social media use than would be anticipated based on additive main effects. Similarly, the oldest low-SES non-immigrant boys in nuclear families exhibited better-than-expected well-being across all outcomes. Furthermore, older low-SES non-immigrant boys from non-nuclear families reported lower problematic social media use than expected. Lastly, the youngest high-SES second-generation immigrant girls of Nordic origin in nuclear families reported fewer psychosomatic complaints than expected.

Across all outcomes, less favorable well-being than expected was identified for the oldest high-SES non-immigrant girls in nuclear families, who reported lower mental well-being and higher rates of psychosomatic complaints and problematic social media use than would be anticipated based on additive main effects. Similarly, the youngest high-SES non-immigrant boys from nuclear families reported more frequent psychosomatic complaints and lower mental well-being than expected. Furthermore, low-SES non-immigrant girls aged 13–14 years reported higher rates of psychosomatic complaints than anticipated. Among high-SES girls from nuclear families, second-generation immigrants aged 13–14 of Nordic origin, as well as the oldest second-generation immigrants of European origin, displayed higher problematic social media use than expected. Additionally, older high-SES second-generation

immigrant girls of non-European origin from nuclear families reported more psychosomatic complaints than expected, while those of Nordic origin demonstrated more problematic social media use.

Fig. 2 presents the predicted mean values of well-being outcomes across the strata with significant interaction effects, illustrating the differences between predictions that consider only additive main effects and those that include both additive main effects and interaction effects.

Predicted mean values for well-being outcomes across each stratum in Model 2 (i.e., considering both additive main effects and interaction effects) are presented in Fig. 3 and Table S7, revealing considerable variability. The five strata exhibiting the most favorable well-being (see Table S8)—characterized by fewer psychosomatic complaints and higher mental well-being—mainly comprised first- and second-generation immigrant boys under 15 years old of non-Nordic origin from high-SES nuclear families. The lowest levels of problematic social media use were primarily noted among the oldest non-immigrant and second-generation boys in high-SES nuclear families. Conversely, the lowest well-being across all outcomes was observed among girls, particularly those from low-SES non-nuclear families, aged 13–14 or 15 and older, with either first- or second-generation immigrant backgrounds.

4. Discussion

This study examined patterns of inequality in the well-being of Nordic adolescents across multiple social positions. Initially, our results showed that female gender, older age, non-nuclear family structure, lower perceived family SES, and certain immigrant backgrounds were individually linked to poorer adolescent well-being. However, interaction effects revealed contrasting patterns of advantage and disadvantage. For example, while younger age, non-immigrant status, high perceived SES, and nuclear family structure were associated with poorer well-being than expected among boys, these positions seemed to benefit girls. Moreover, while older age and low perceived SES did not compromise well-being among boys, they did so among girls. Other subgroups also deviated from anticipated outcomes, highlighting the complexity of how social positions interact to shape well-being. Our findings suggest that single social positions alone cannot fully capture inequalities in well-being.

Intersectionality theory (Crenshaw, 1989) underscores how the interplay of multiple social positions shapes unique life experiences and creates distinct advantages or disadvantages. In our study, the variance due to interaction effects differed by well-being outcome. The total explained variance ranged from 7 % to 19 %, with interaction effects accounting for 10 % of this variance in psychosomatic complaints, 4 % in mental well-being, and 21 % in problematic social media use. The variance due to interaction effects for psychosomatic complaints and problematic social media use exceeded the typical 5 % (or less) observed in most MAIHDA adolescent studies (Balloo et al., 2022; Evans and Erickson, 2019; Kern et al., 2020). Our focus on Nordic adolescents and the inclusion of additional social positions, such as family structure, age, and region of immigration, may partly explain this difference. As the first study to examine intersectional social positions in problematic social media use, we found a particularly high variance (over 20 %), suggesting that the social roots of this dysfunction warrant further investigation.

Our findings indicate that when considering both interaction effects and the additive contributions of individual social positions, gender was more strongly associated with well-being than other positions, with girls reporting poorer well-being than boys. This aligns with extensive evidence showing that girls generally report worse internalizing mental health, including higher rates of depression (Campbell et al., 2021; Yoon et al., 2023). Moreover, longitudinal studies have revealed that mental distress among adolescent girls increases with age, widening the well-being gap between boys and girls over time (Yoon et al., 2023). Consistent with the equality paradox of health, gender differences are

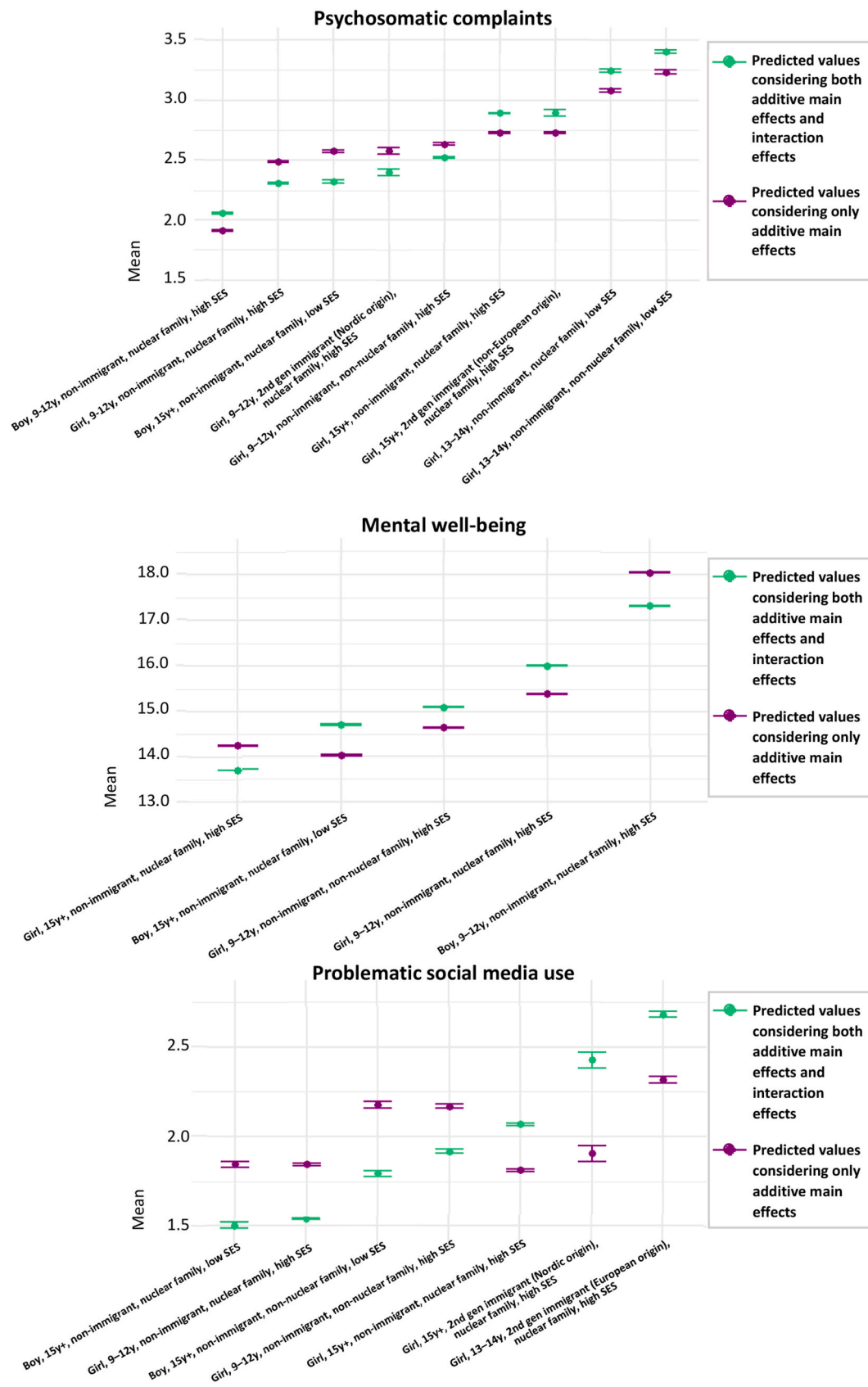


Fig. 2. Predicted mean values of well-being outcomes with 95 % confidence intervals in strata showing significant interaction effects. Note. Strata are ordered from low to high based on the predicted mean values considering both additive main effects and interaction effects. 9-12y: those aged 9-12 years; 13-14y: those aged 13-14 years; 15y+: those aged 15 years and older; 2nd gen immigrant: second-generation immigrant; SES: perceived family socioeconomic status.

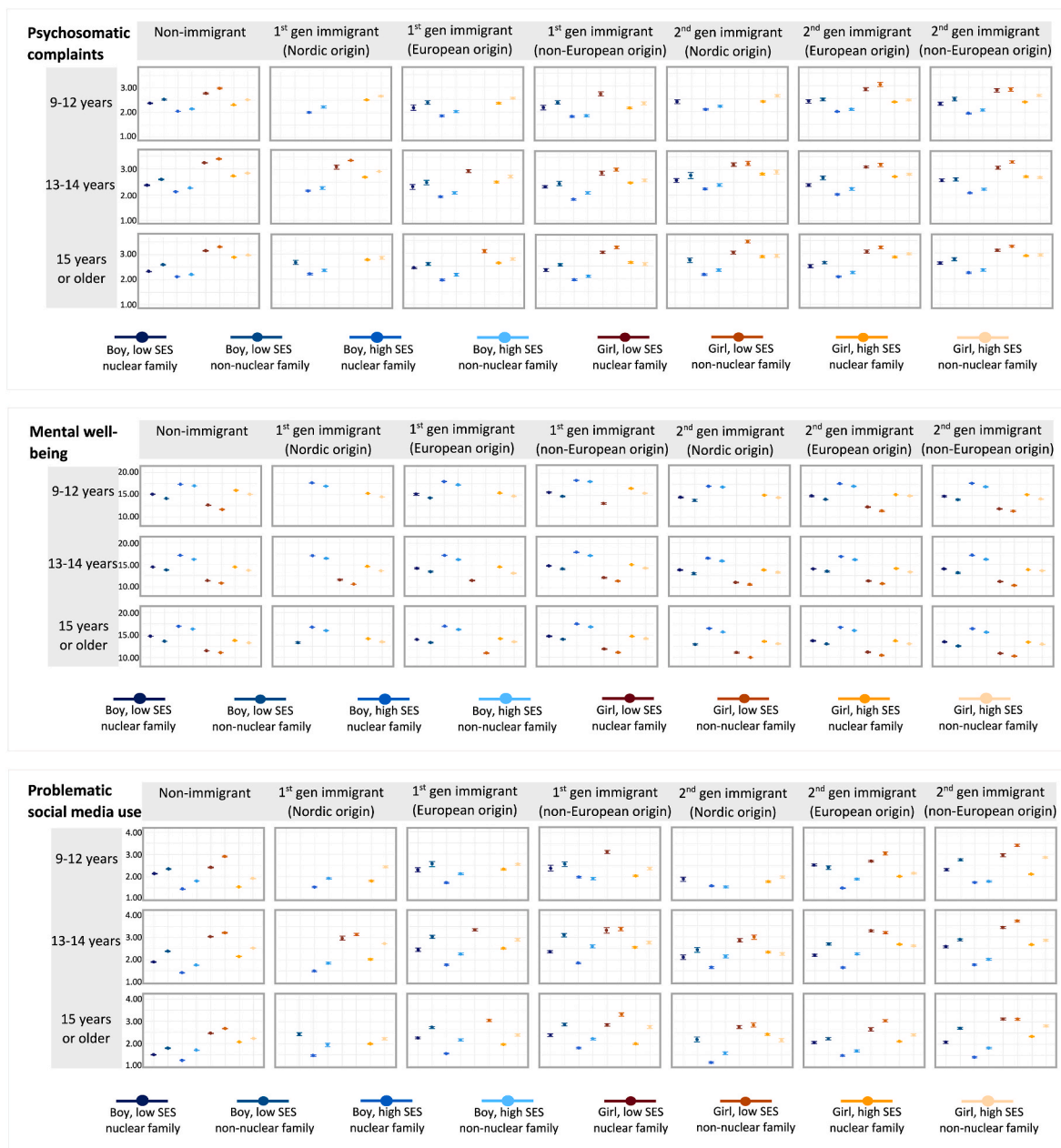


Fig. 3. Predicted mean values of well-being outcomes with 95 % confidence intervals by stratum, considering both additive main effects and interaction effects. *Note.* 1st gen immigrant: first-generation immigrant; 2nd gen immigrant: second-generation immigrant; SES: perceived family socioeconomic status. Strata with unreliable estimates due to low sample size ($n < 10$) are not shown.

often more pronounced in societies with greater gender equality, as evidenced by the significant mental health gender gaps in Nordic countries (Campbell et al., 2021).

The interaction effects identified in our study challenge traditionally reported gender differences in well-being. Our findings suggest that younger boys holding multiple privileged positions (i.e., non-immigrant status and high-SES nuclear families) may experience poorer well-being than expected based on additive main effects, while girls in the same positions report better well-being than anticipated. Moreover, certain underprivileged positions, such as low SES, may promote better well-being among boys but poorer outcomes among girls. Specifically, a combination of older age and low-SES nuclear family structure among non-immigrants was linked to better-than-expected well-being among boys, while similar positions among 13- to 14-year-old girls were associated with poorer-than-expected well-being. Thus, our findings suggest

that the well-being implications of traditionally privileged positions (e.g., high SES, non-immigrant status, nuclear family structure) may vary by gender and age group.

Among non-immigrant girls, older age combined with high family SES was linked to poorer-than-expected well-being. A previous MAIHDA analysis of European adolescents found that in countries with high gender equality, girls with higher family affluence reported lower life satisfaction than predicted by an additive model, while boys with lower family affluence reported higher life satisfaction than expected (Kern et al., 2020). Qualitative evidence from the Nordic context suggests that with age, high-SES girls may perceive additional burdens compared to their low-SES peers, facing pressures to perform well academically and in other areas of their lives (Krogh, 2022). Moreover, high-SES girls are considered at risk for poorer well-being due to higher perfectionism and body dissatisfaction (Lyman and Luthar, 2014). Future research should

further investigate the contextual factors that make this specific subgroup of adolescents more susceptible to lower well-being.

First- and second-generation immigrants have often been viewed as homogeneous groups, overlooking their diverse social and cultural experiences. We identified several interaction effects among second-generation immigrant girls that mirrored those in non-immigrant adolescents with similar social positions. For instance, the youngest second-generation immigrant girls from high-SES nuclear families, particularly of Nordic origin, reported fewer psychosomatic complaints than expected. Conversely, some of the oldest second-generation immigrant girls from high-SES nuclear families demonstrated poorer well-being than anticipated. These findings suggest that the interplay of specific social positions may provide a degree of protection from or contribute to less favorable outcomes for both non-immigrant and certain second-generation immigrant populations. Interestingly, we also observed two unique interaction effects among second-generation immigrant girls in high-SES nuclear families. Specifically, those aged 13–14 of Nordic origin and those aged 15 or over of European origin reported more problematic social media use than expected. Future research should examine the unique challenges and resilience factors of immigrants in the Nordic region, considering both their origins and those of their parents, to better understand well-being disparities among different immigrant groups.

4.1. Limitations

This study has several limitations to consider when interpreting the findings. First, we recognize that the nineteen strata (11 %) with a sample size of $n < 10$ were particularly small and may not produce precise estimates, particularly affecting first- and second-generation immigrants with low perceived SES. A larger sample size or oversampling of these groups might have revealed significant interaction effects. While most strata had sufficient sample sizes, there was potential for misclassification, as participants were assigned to strata based on their social positions rather than self-identification. For instance, we classified individuals as second-generation immigrants based on self-reports of the country of birth for themselves and their parents, without considering whether they are perceived as second-generation immigrants by themselves or by others. Moreover, we did not account for broader contexts, such as structural or institutional factors (e.g., immigration policies, gender equality), that may have influenced the well-being of youth.

There are also concerns regarding the measure of perceived family SES. Although previous research found that adolescent-reported subjective SES correlates with parent-reported subjective and objective SES (Davisson et al., 2025), only a minority of participants in our study identified their SES as low. This raises questions about children's ability to accurately assess their family's socioeconomic standing and the reference points they use for comparison, whether immediate peers, community members, or societal standards. Although alternative SES measures, such as the Family Affluence Scale, were available in our dataset, we found no significant association between this measure and the well-being outcomes examined, suggesting that it may not effectively capture the complexities of socioeconomic inequalities in the Nordic context. This highlights the need for more nuanced approaches to measuring SES, potentially incorporating multiple perspectives.

Another significant limitation is the binary classification of gender, categorizing participants exclusively as boys or girls. Although a small subsample of older participants from Finland and Sweden had an additional response option ("other"), nonbinary representation was minimal, comprising roughly 3 %. Future research should consider oversampling less common and under-reported gender categories to explore social positions in greater depth.

The age categories studied present a notable limitation, particularly the broad upper age group (15–19), which mainly represented adolescents aged 15 and 16. This may mask important within-group

heterogeneity, as older adolescents can have distinct experiences compared to their younger peers. Future research should include a larger proportion of older adolescents to explore this heterogeneity further.

Finally, our cross-sectional dataset limits our ability to capture the development of inequalities across intersectional strata over time and the causal pathways underlying these inequalities. Future studies should explore these dynamics more thoroughly.

4.2. Conclusion

This study emphasizes the need to consider the interplay of multiple social positions when assessing adolescent well-being. Our findings indicate that the same social positions can form different patterns of advantage and disadvantage for well-being among individuals across different social groups. For example, while being younger, having non-immigrant status, perceiving a high SES, and living in a nuclear family were associated with poorer well-being than anticipated when considering each position separately among boys, these positions seemed to equip girls with better well-being. Moreover, while older age and low perceived SES did not compromise well-being among boys, they did so among girls.

CRedit authorship contribution statement

Jasmine Gustafsson: Writing – review & editing, Writing – original draft, Visualization, Methodology, Funding acquisition, Formal analysis, Data curation. **Hanna Kontinen:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization. **Nelli Lyyra:** Writing – review & editing, Supervision, Data curation, Conceptualization. **Nina Simonsen:** Writing – review & editing, Supervision, Data curation, Conceptualization. **Charli Eriksson:** Writing – review & editing, Data curation. **Anne-Siri Fismen:** Writing – review & editing, Data curation. **Einar Thorsteinsson:** Writing – review & editing, Data curation. **Inga Jasinskaja-Lahti:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Conceptualization.

Ethical approval

In Finland, the University of Jyväskylä Ethics Committee granted ethical clearance, and permissions were obtained from participating municipalities and school principals. In Iceland, the study received approval from the National Data Protection Agency and the University of Iceland Ethics Committee, along with permissions from local educational authorities and school principals. In Norway, the Privacy Ombudsman at the University of Bergen confirmed compliance with privacy and confidentiality standards, while the Regional Committee for Medical Research Ethics of South East Norway approved the study. In Sweden, the Regional Ethical Review Board in Stockholm reviewed the study and classified it as exempt from human subject research.

The privacy rights of human subjects were upheld, and informed consent was obtained.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used CurreChat GPT-4-mini in order to improve readability and language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2025.118805>.

Data availability

Data will be made available on request.

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