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Age, period and cohort effects on child mental health

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Abstract

This study estimated age, period and cohort (APC) effects on average levels of prosocial behaviour and mental health problems using repeated cross-sectional data on 9620 children and adolescents (50.7% female) aged 2–18 years living in Siberian regions of Russia. Mental health measures were collected using the Strengths and Difficulties Questionnaire during 23 time periods from 1999 to 2021 in cohorts born between 1983 and 2020. The results showed curvilinear trends, with an overall increase in emotional symptoms and peer problems, and decrease in hyperactivity and prosocial behaviour from early childhood to late adolescence. Across time period and birth cohort, there was an overall decrease in emotional symptoms, peer and conduct problems and total difficulties; hyperactivity and prosocial behaviour were higher in later-born cohorts. There were significant gender differences and APC interactions. Parents whose children were born during the 1992-99 economic crisis reported higher levels of all mental health problems, except emotional symptoms, over and above age and period effects, but also steeper decreases in peer problems and increases in prosocial behaviour over time. The cohort born during the 1914-15 economic crisis had lower levels of internalising problems and total difficulties. During the pandemic, parents reported inclines in all mental health problems and declines in prosocial behaviour. The findings provide the basis for further research into the drivers of time changes in child and adolescent mental health.

1. Introduction

Decades of repeated cross-sectional and longitudinal surveys of children and adolescents allowed the researchers to explore secular trends in developing mental health. Recent reviews have documented a general trend of worsening child and adolescent mental health in the 21st century, however, findings from different countries are often inconsistent and there is a lack of evidence from non-Western cultures and parts of the world where the majority of children and adolescents live (Bor et al., 2014; Collishaw, 2015; Collishaw & Sellers, 2020). Thinking about time trends in child and adolescent mental health, it is important to distinguish age, period and cohort (APC) effects (Bell, 2020).

Chronological age is a marker of internal developmental processes; period is a marker of external, environmental influences of contemporary time, whereas cohort refers to the calendar time of birth (Suzuki, 2012), related to the concept of generation, that is, children who experienced the same environmental influences at the same age, especially in the formative developmental stages (Costanza et al., 2023). APC effects are three ways in which people can change over time (Bell, 2020), therefore, each of them needs to be examined in its own right. However, APC are linked together mathematically (period = cohort + age), which makes it inherently impossible to separate the three effects (Bell, 2020).

Current evidence on the prevalence of mental health problems is largely based on cross-sectional studies (Polanczyk et al., 2015) where age is confounded with birth cohort, whereas evidence on developmental trajectories comes from longitudinal cohort studies (McLaughlin, 2014; McNicholas et al., 2024) where age is confounded with period (Bell, 2020). Multicohort longitudinal studies and repeated cross-sectional surveys (Bongers et al., 2003; Suzuki, 2012) can help to disentangle, to some extent, over-time changes in child and adolescent mental health by age, time period and birth cohort. However, most repeated child and adolescent mental health studies include only two or three time points (Patalay & Gage, 2019) or cover a narrow age range (Degli Esposti et al., 2023), making it difficult to separate period and cohort effects.

The present study uses repeated cross-sectional data collected over 23 years in community samples spanning a wide age range from early childhood to late adolescence to examine age, period and cohort trends in developing mental health. Specifically, we aim to investigate whether age effects on child and adolescent mental health measures were similar or different across genders, time periods and cohorts. We also aim to examine period trends and possible moderating effects of gender, age and birth cohort. Finally, we aim to investigate cohort or generational differences in average levels of child mental health and whether these are similar or different across genders, ages and time periods.

1.1 Age trends and gender differences

Although the overall prevalence of mental disorders in children and adolescents may not show age differences (Polanczyk et al., 2015), many specific mental health problems show distinctive age-related trends (Maughan & Collishaw, 2015). It is also important that developmental trajectories of child and adolescent mental health differ by gender (Martin & Hadwin, 2022). A number of population-based studies used parent-report dimensional instruments such as the Child Behavior Checklist (CBCL; Achenbach &

Rescorla, 2007) and the Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001) to examine age and gender differences in child and adolescent mental health.

International findings (Achenbach & Rescorla, 2007; McNicholas et al., 2024; Ortuño-Sierra et al., 2016; Rescorla et al., 2011) suggest that emotional problems (anxiety and depression symptoms and psychosomatic complaints) increase with age, particularly among adolescent girls, whereas conduct problems (oppositional, aggressive and rule-breaking behaviour) decrease with age, especially among boys; hyperactivity and attention problems are higher among boys and decrease with age in both genders. In most countries, internalising problems are higher in girls and the gender difference is widening with age; externalising problems are higher in boys and the gender difference is narrowing with age (Achenbach & Rescorla, 2007; McNicholas et al., 2024). However, age and gender differences in problems scores are much smaller than differences among societies and not uniform across diverse cultures (Achenbach & Rescorla, 2007; Rescorla et al., 2011).

Evidence about age-related changes and gender differences in children's social relationships is more limited and less clear. On the CBCL, parent-reported social problems among 6-16-year-olds from 31 countries decreased with age, there were no differences between boys and girls (Rescorla et al., 2007). On the SDQ, multicultural findings for parent-reported peer problems are much less consistent (Ortuño-Sierra et al., 2016). In many countries, parent-reported total problems are higher among boys than girls, whereas the direction of age trends remains uncertain (Bongers et al., 2003; Ortuño-Sierra et al., 2016; Rescorla et al., 2007; 2011). Studies broadly concur in showing higher levels of prosocial behaviour in girls and older children, with a decline in late childhood and early adolescence, although the effects of age and gender may differ depending on methodology and culture (Eisenberg et al., 2015; Malti & Speidel, 2024; Ortuño-Sierra et al., 2016).

1.2 Time period effects

These result from external influences that occur during specific historical times and impinge on all individuals in the society (McLaughlin, 2014). Examples are wars, economic crises and epidemics as well as introduction of digital technology and other societal changes. The new millennium has seen considerable changes in children's proximal and distal environment and lifestyle that may explain secular trends in youth mental health (Collishaw & Sellers, 2020), but there is a lack of evidence on time period changes across domains, ages and countries. Existing research suggests that emotional problems increased globally, particularly among adolescent girls; conduct problems decreased in many parts of the world, while attention and social problems remained relatively stable (Bor et al., 2014; Collishaw, 2015; Collishaw & Sellers, 2020; Keyes & Platt, 2024). Over-time changes in other domains such as social problems and positive qualities are less clear.

Most research on period changes has focused on adolescents and used self-reports (Bor et al., 2014; Collishaw, 2015). However, data from different informants may yield diverse and complementary findings (Achenbach & Rescorla, 2007). Recent reviews and meta-analysis (Newlove-Delgado et al., 2023; Wolf & Schmitz, 2024) found negative impacts of the COVID-19 pandemic on child and adolescent mental health, although the evidence was mixed across domains, genders, ages and informants. The evidence suggested a worsening of self-reported internalising problems, but not parent-reported; there were also increases in externalising problems and hyperactivity-inattention, especially among boys and younger children, a decrease in self-reported conduct problems and a slight deterioration in peer problems and prosocial behaviour (Newlove-Delgado et al., 2023).

Economic crises, such as the global recession of 2007-09, have also been shown to have a negative impact on child and adolescent mental health, although some studies have not found significant changes, suggesting that feelings of uncertainty, family functioning and parenting may be more important than economic conditions per se. (Hiilamo et al., 2021; Schneider et al., 2015). Current evidence is equivocal about whether exposure to adversity is related positively, negatively or not at all to prosocial behaviours, with inconsistency partly depending on the type of adversity and developmental timing (Malti & Speidel, 2024). The effects of economic crises may also vary across countries.

1.3 Cohort effects

Much of the work on cross-cohort comparisons of child mental health is based on studies of same-aged children and adolescents assessed some years apart, where cohort is confounded with time period (Collishaw, 2015; Degli Esposti et al., 2023; Patalay & Gage, 2019). It should be noted, however, that external events occurring at a specific time might engender both period and cohort effects (Bell, 2020). Thus, although economic recessions generally have a negative effect on mental health of all, those brought up during recessions might have better mental health throughout their lives (Bell, 2014).

Evidence for cohort effects on child and adolescent mental health, apart from age and period effects, comes from repeated cross-sectional studies. Keyes et al. (2019) found that increases in US adolescent boys' depressive symptoms from 1991 to 2018 were slower among younger cohorts born after 2001; among girls, cohort effects were minimal. A recent review concluded that an increasing trend in adolescent depression over the last three decades was driven by period rather than cohort effect (Askari et al., 2024). In another study by Keyes et al. (2018), decreases in adolescent boys' conduct problems from 1991 to 2015 were steeper among cohorts born after 1992; girls' conduct problems did not show period or cohort trends.

Few studies have compared birth cohorts at multiple time points to establish cohort differences in mental health trajectories. Armitage et al. (2023) has shown that parent-reported emotional problems in UK children born in 2000-02 were higher than in those born in 1991-92 from around age 9; cross-cohort differences were largest at age 14. McNicholas et al. (2024) found broadly similar developmental patterns for emotional, conduct and hyperactivity problems in 5-18-year-olds born in 1998, 2000-02, 2004-05 and 2008 in Ireland and the UK, although childhood emotional problems in Ireland were higher than in the UK.

It is important to note that different conceptual definitions of a cohort effect and different statistical methods may lead to differing results (Keyes et al., 2010). One approach proposes that a cohort effect is the interaction of age and period, emphasising that external changes may differentially influence people according to the developmental stage (McLaughlin, 2014). Another approach focuses on unique characteristics of cohort confounded by age and period effects (Askari et al., 2024; Keyes et al., 2010). This approach is in line with much research on generations, that is, particular groups of birth cohorts supposedly distinct from one another (Bell, 2020; Costanza et al., 2023). These broad groupings of cohorts are given specific labels, which, along with the boundaries between different generations, are a matter of controversy.

21st century children and adolescents belong to the three generations appearing in some form in the literature. Those born in the last two decades of the of the previous century are described as Millennials or Generation Y; the next generation, born around the first decade of this century, is labeled 'Zoomers' or Gen Z, whereas the youngest generation, born after 2010, is referred to as 'Alpha' (Twenge, 2023). Although the concept of generation is widely used in trend research (Bell, 2020; Collishaw & Sellers, 2020), studies provide no evidence of clear boundaries and differences between generations (Costanza et al., 2023). One reason for this could be variation across countries in impactful events and environmental changes. It is probably even more important to understand what external factors have the largest effect, at which developmental stage and in which domains.

1.4 The present study

The present study examines age, period and cohort trends in the mental health of children and adolescents aged 2–18 years using repeated cross-sectional samples of parent reports collected from 1999 to 2021. One study of adolescent mental health over 23 years using self-report SDQ (Privodnova et al., 2024) found that emotional and conduct problems increased with age; peer problems decreased with age, whereas hyperactivity, total difficulties and prosocial behaviour did not show significant age effects in 11-18-year-olds. Girls reported higher levels of prosocial behavior and mental health problems than boys, with the exception of peer and conduct problems. Period trends in prosocial behavior and all types of mental health problems, except hyperactivity, differed by gender. From 1999 to 2021, emotional and peer problems inclined; prosocial behaviour declined, but only among girls; conduct problems showed curvilinear trends with an opposite pattern for boys and girls; hyperactivity-inattention showed a quadratic trend, peaking around 2009-10.

This study did not find significant effects of the pandemic over and above time period changes, with the exception of inclines in hyperactivity, and demonstrated that period trends in adolescent mental health were associated with national indicators of wealth (Privodnova et al., 2024). From 1999 to 2021, the gross national income (GNI) per capita in this country showed an overall increase from 1999 to 2021 (https://data.worldbank.org/). Recent decades have seen recession and economic crises in 1990-99, 2008 and 2014-15, which, although differing in their origin, similarly manifested in decreased household income and feelings of uncertainty (Voronin et al., 2023). Despite family policy implementation (Zyryanova & Popova, 2021), families with children live in relative poverty (Roschina, 2017) and are most affected by economic crises, which, in addition to period effect, may also have long-lasting cohort effect (Bell, 2020).

The use of parent reports in the present study provides unique and complementary information on over-time changes in child mental health in the 21st century. Inclusion of the wide age range from early childhood to late adolescence and multiple time points, makes it possible to capture curvilinear age and period trends and to test generational differences. Drawing upon previous research findings, we hypothesised that emotional problems would increase with age, especially in girls, whereas conduct problems and hyperactivity

would decrease with age. We also expected that levels of mental health problems would decrease with time period and in successive cohorts and that economic crises and the pandemic would have a negative effect on mental health. Because of the scarce data, no hypotheses were made about the interactions of age with period and cohort in the prediction of child and adolescent mental health, and about generational differences and similarities.

2. Method

2.1 Participants and procedures

Data were from repeated cross-sectional studies on child and adolescent mental health conducted in urban and rural areas of Siberia and nearby regions on a yearly basis. Between 1999 and 2021, 9620 children and adolescents aged 2–18 years were assessed using, amongst other measures, the parent-report SDQ. Items on demographic characteristics included child's gender, age and/or date of birth, and the date questionnaire completed. A variety of methods were used to recruit participants: 64% of the caregivers were recruited from 86 schools, 17% from 25 kindergardens, 3% from healthy child clinics and family counseling centers, 1% from summer/vacation camps, sport and art schools; 6% were recruited online and 9% were recruited in person including snowball sampling. Most questionnaires (89%) were completed by mothers, 8% by fathers, 2% by grandparents and 1% by other close adults. In 1999–2019, data were collected in paper format; during the COVID-19 pandemic in 2020–2021, questionnaires were administered online. Most participants (69%) lived in a large city, the remainder were from smaller cities, towns and villages. The study was approved by the Institutional Ethics Committee.

Table 1 presents demographic characteristics of the study sample by single year period of data collection. Around 90% of children were from urban areas, although in 2006–2007 and 2013, participants were predominantly rural. The gender distribution across year periods was mostly similar, with 49% of children being male and 51% being female; however, in 2006 and 2011, the proportion of boys was lower than in the total sample. Sixteen of 23 single year periods covered a wide age range from 2–5 to 15–19 years; three year periods covered school ages 6–7 to 17, the 1999 subsample included only 13-15-year-old adolescents; the remainder three year periods covered smaller age ranges of 2–9, 2–12 and 2–15 years. The mean age of the total sample was 9.8 years ranging from 6.9 to 14.0 in different year periods. The study covered 38 birth cohorts spanning 1983 to 2020.

Table 1
Demographic characteristics of the study sample

Year	Sample N	Urban area, %	Boys N (%)	Girls N (%)	Age M (SD)	Age range	Year of birth range
1999	24[a]	100%	16 (70%)	7 (30%)	14.0 (0.4)	13–15	1984–1986
2000	109	90%	55 (50%)	54 (50%)	12.0 (2.4)	6–17	1983–1993
2001	484	100%	228 (47%)	256 (53%)	10.9 (2.5)	6–17	1984–1995
2002	99	100%	50 (50%)	49 (53%)	6.9 (4.9)	3–17	1984–1999
2003	813	90%	424 (52%)	389 (48%)	11.5 (4.1)	2–19	1984–2001
2004	1974[a]	93%	924 (48%)	1022 (52%)	13.3 (4.2)	2–19	1985–2002
2005	530	59%	279 (53%)	251 (47%)	11.6 (3.4)	7–17	1987–1998
2006	95[a]	0%	**33 (36%)**	**60 (64%)**	10.3 (4.9)	2–17	1988–2003
2007	58	38%	27 (47%)	31 (53%)	9.7 (4.0)	3–16	1991–2004
2008	48	94%	26 (54%)	22 (46%)	12.6 (1.8)	4–18	1990–2004
2009	111	100%	57 (51%)	54 (49%)	7.3 (1.1)	2–9	2000–2007
2010	522[a]	100%	264 (51%)	257 (49%)	7.2 (2.2)	2–17	1992–2009
2011	425	98%	**177 (42%)**	**248 (58%)**	9.6 (3.7)	2–18	1992–2010
2012	235[a]	86%	108 (49%)	113 (51%)	11.0 (3.8)	2–17	1995–2010
2013	83	30%	45 (54%)	38 (46%)	11.2 (3.4)	3–15	1997–2010
2014	350	100%	179 (51%)	171 (49%)	8.1 (3.9)	2–18	1996–2011
2015	411	92%	187 (46%)	224 (54%)	7.3 (2.4)	2–15	2000–2013
2016	384	100%	203 (53%)	181 (47%)	7.1 (3.2)	2–17	1998–2014
2017[a]	895	80%	419 (47%)	470 (53%)	8.0 (1.9)	2–12	2004–2015
2018	88	100%	47 (53%)	41 (47%)	12.8 (2.2)	5–15	2003–2013
2019	6	100%	4 (67%)	2 (33%)	8.5 (2.3)	5–12	2006–2013
2020	103	99%	57 (55%)	46 (45%)	9.6 (4.8)	2–17	2003–2019
2021	1773	90%	913 (52%)	860 (48%)	7.3 (3.8)	2–18	2002–2020
Total	9620[a]	89%	4722 (49%)	4847 (51%)	9.8 (4.3)	2–19	1983–2020

[a]Missing gender included. Bold type indicates significant difference from the total sample distribution ($p < 0.05$).

2.2 Measures

The Strengths and Difficulties Questionnaire (SDQ, Goodman, 2001) is a brief internationally recognised measure for assessing common areas of mental health problems and prosocial behaviour of 2-18-year-olds. The SDQ has been shown to have good reliability and validity in studies from around the world (http://www.sdqinfo.org). The Russian version of the SDQ has been validated in a stratified random sample of schoolchildren (Goodman et al., 2005). The SDQ consists of 25 items that describe the characteristic behaviour of the child in the last six months. These items are divided into five subscales: emotional symptoms (e.g. 'often seems worried'; 'often unhappy or tearful'), peer relationship problems (e.g. 'tends to play alone'; 'bullied by other children'); conduct problems(e.g. 'often has temper tantrums'; 'Often fights with other children'); hyperactivity-inattention (e.g. 'Restless, overactive'; 'easily distracted') and prosocial behaviour (e.g. 'shares readily with other children'; 'often volunteers to help'). Response options for each item are: not true, somewhat true and certainly true, with scores of 0, 1 or 2. The 20 problem items are summed to form a total

difficulties scale. In community samples, it is recommended to use the internalising scale including emotional symptoms and peer problems and the externalising scale including conduct problems and hyperactivity.

Age was assessed in years and obtained from the questionnaires or calculated from date of birth and the date questionnaire completed. If both age and date of birth were missing, we imputed child age with the mean value in the class. Cohort was measured by year of birth or calculated from child age and the study year. Period was measured by the year of study from the date questionnaire completed or the year of data collection.

2.3 Preliminary analyses

Gender was missing for 51 children (0.5%). Missing responses on the SDQ varied between 0.5% and 2.2% per item; 90.8% of the participants completed all 25 SDQ items. The subscale scores were missing for less than 0.22% of the total sample. Given the very low level of missing data, all analyses used listwise deletion.

To examine the impact of cluster sampling of children from educational institutions, we estimated design effects for the SDQ measures. First, we used SPSS Mixed Models to calculate the intraclass correlations coefficients (ICC) and the average cluster size. Then we calculated design effects using the formula: design effect = 1 + (average cluster size – 1)*ICC (West, 2008). The mean design effect was 1.86 (range 1.64–2.12); only one of eight measures (prosocial behaviour) showed the value above the conventional threshold of 2 (Lai & Kwok, 2015). This suggests that the non-independence in the data was not strong, so educational institution was not included as a variable in our subsequent analyses.

2.4 Main analyses

For data visualisation, we first plotted mean SDQ scores in boys and girls against age, period and cohort separately, with 10–20 points on the x-axis and group sizes ≥ 100. Then we tested time effects in a series of hierarchical multiple regressions. In the first set of models, we evaluated linear and curvilinear time trends in child mental health across age, period and cohort separately. Polynomial regression models included gender (coded – 1 = male, 1 = female), the linear, quadratic and cubic time terms and the corresponding time-by-gender interactions. To avoid multicollinearity, we centered age around its mean (9.81 years), period around the mean year of data collection (2011) and cohort around the mean year of birth (2001) before creating power and interaction terms. To avoid very small regression coefficients resulting from very large variable values, we divided all time variables by their respective standard deviations (Landau & Everitt, 2003). In all models, we included urban/rural status as a control variable.

Explanatory power was assessed by percentage of variance explained, the R-squared increase for the predictors in the model. To control for multiple testing, alpha level was corrected using false discovery rate procedure (Benjamini & Hochberg, 1995). For model selection, we used the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), with smaller values indicating better model fit. AIC and BIC differences ≥ 6 indicate considerable evidence for the model with the lower criteria values (Fabozzi et al., 2014). After removing non-significant effects, we tested the second set of models including two of the APC variables, age with period or cohort, significant polynomials, time-by-gender interactions and the interactions of the included APC variables. Age-by-period and age-by cohort interactions allowed us to examine whether age trends in child and adolescent mental health differ across time periods and cohorts, and also whether period and cohort effects differ across childhood and adolescent age range.

For graphical analysis, we used classical APC plots (Bell, 2020; Carstensen, 2007;), presenting mean SDQ scores in four different ways: 1) against age, with the data grouped by periods; 2) against period, with the data grouped by age; 3) against age, with the data grouped by cohorts; 4) against cohort, with the data grouped by age. Age, period and cohort groupings were based on group size and theoretical considerations. We grouped child age into six groups: early childhood (ages 2–4, N = 1145), preschool years (ages 5–6, N = 1164), primary school years (ages 7–8, N = 1915), middle childhood (ages 9–10, N = 1530), early adolescence (ages 11–14, N = 1830) and late adolescence (ages 15–19, N = 2036). Study years were grouped into five period groups: 1999–2003 (N = 1529), 2004-07 (N = 2657), 2008-13 (N = 1424), 2014-19 (N = 2134) and 2020-21 (N = 1876). Children's birth years were grouped into five cohort groups: 1983-91 (N = 2725), 1992-99 (N = 1590), 2000-07 (N = 2567), 2008-13 (N = 1673) and 2014-20 (N = 1065).

Based on the graphical analysis and the explanatory power, we chose between age-period and age-cohort models and then selected the best fitting model for each outcome. Finally, we tested the third set of models adding dummy variables for the pandemic period (N = 1876), cohorts born at the time of the 1992-99 (N = 1590), 2008 (N = 426) and 2014-15 (N = 492) economic crises and generations born in 1983–2000 (N = 4491) and 2001-10 (N = 3531). Interactions of dummy variables with gender and age were also included.

3. Results

Figures 1–3 present mean levels of mental health problems and prosocial behaviour in boys and girls by age, period and cohort respectively. Tables S1-S6 present results from the first set of regression models for separate linear and curvilinear effects of age, period and cohort. Figures S1-S4 present four APC plots for mean levels of mental health problems and prosocial behaviour in boys and girls stratified by age and period and by age and cohort. Tables S7-S10 present results from the selected regression models for main and interactive effects of age and period/cohort.

3.1 Gender differences

Parents rated boys as showing lower levels of emotional symptoms and prosocial behaviours and higher levels of all other mental health problems than girls (Fig. 1 and Table S1). Gender accounted for 1% or less of the variance in emotional symptoms, peer and conduct problems, internalising and prosocial behaviour, 1.6% of the variance in total difficulties and around 3% of the variance in externalising. The largest effect size of gender (3.7% of the total variance) was that for hyperactivity (Table S2). From middle adolescence onwards, parents rated girls' emotional symptoms increasingly higher than boys'. Gender differences in levels of conduct problems, hyperactivity, externalising and total difficulties decreased in late adolescence. Gender differences in peer problems and prosocial behaviour did not change significantly across age.

Across time period, girls' emotional symptoms, peer problems and the broad-band internalising decreased more steeply than boys' (Fig. 2 and Table S3). Gender differences in hyperactivity were largest in 1999–2002 and 2015 and smallest in 2005. Across birth cohorts, gender differences in emotional symptoms were largest in the 1983-89 cohorts, then decreased and began to be reversed in cohorts born 2008 and later (Fig. 3 and Table S5). Gender differences in peer problems were smallest in the 1989-94 cohorts and largest in the 2008-13 cohort. Consequently, gender differences in the broad-band internalising were largest in children and adolescents born from 2008 onward. Gender differences in total difficulties showed an overall increase peaking in the 1990-91, 2008-10 and 2014-15 cohorts.

3.2 Age effects

From early childhood to late adolescence, there was an overall increase in emotional symptoms, peer problems and the broad-band internalising, and an overall decrease in hyperactivity, externalising and prosocial behaviours (Fig. 1 and Table S1). Emotional symptoms showed a quadratic age trend, with mean levels increasing from 2 to 12 years of age in both genders and then leveling off in girls and decreasing in boys. Hyperactivity also showed a quadratic age trend, with mean levels remaining relatively stable across childhood and decreasing in adolescence in both genders, but more so in boys than in girls. Peer and conduct problems showed a cubic age trend, decreasing in preschool years, increasing in middle childhood and decreasing in adolescence. In late adolescence, a decrease in conduct problems among boys was larger than among girls. Prosocial behaviour showed an opposing cubic age trend, increasing until primary school years, then decreasing and increasing in late adolescence. Internalising problems and total difficulties also showed a cubic age trend that changed direction, peaked around 11–13 years of age and differed by gender.

Age accounted for around 3% of the variance in emotional symptoms and the broad-band internalising and externalising, 2% of the variance in peer problems, around 1% of the variance in conduct problems and prosocial behaviours and only 0.5% of the variance in total difficulties. The largest effect size of age (6.1% of the total variance) was that for hyperactivity (Table S2).

Time period moderated the effects of age on peer and conduct problems, externalising and total difficulties (Fig. S1 and Table S7). Contrary to the overall decrease, from age 2–4 to 5–6, peer problems increased in 2004-13 and externalising increased in 1999–2007; from age 5–6 to 7–8, conduct problems and externalising increased in 2020-21; from age 11–14 to 15–19, conduct problems increased in 2014-19. In different time periods, age changes in externalising from 7–8 to 9–10 years, in conduct problems from 9–10 to 11–14 years and in peer problems from 11–14 to 15–19 years were in opposite directions.

With the exception of emotional symptoms and internalising, age effects were also moderated by birth cohort (Fig. S3 and Table S9). Contrary to the overall age trend, peer and conduct problems decreased from age 9–10 to 11–14 in the 1992-99 cohort and increased from age 11–14 to 15–19 in the 2000-07 cohort. Age trends in hyperactivity in the 2008-13 cohort substantively differed from other cohorts from age 5–6 onward. Externalising decreased from age 7–8 to 11–14 in the 2000-07 cohort and increased in the 2008-13 cohort. Age changes in prosocial behaviours during adolescence varied considerably across cohorts.

3.3 Period effects

From 1999 to 2021, there was an overall decrease in levels of emotional symptoms, peer and conduct problems, internalising and total difficulties (Fig. 2 and Table S3). Emotional symptoms and internalising showed a quadratic period trend, with mean levels decreasing until 2010-11, more prominently among boys than girls, and then increasing in boys and leveling off in girls. Externalising problems and total difficulties also showed a quadratic, but less clear-cut time period trend. Peer and conduct problems, hyperactivity and prosocial behaviour showed a cubic S-shaped period trend during the study period. From 2012-13 onwards, levels of peer problems increased among boys and decreased among girls. Period trends in conduct problems, externalising, total difficulties and prosocial behaviour did not differ significantly by gender.

Time period accounted for around 3% of the variance in emotional symptoms and peer problems, 2% in conduct problems and total difficulties, 1.4% in prosocial behaviour and only 0.3% in hyperactivity and the broad-band externalising. The largest effect size of period (4.3% of the total variance) was that for the broad-band internalising (Table S4). Period trends in emotional symptoms, hyperactivity, internalising and prosocial behaviours were broadly similar across childhood and adolescence age range (Fig. S2 and Table S7). Age moderated the effects of period on peer and conduct problems: contrary to other age groups, peer problems increased in 9-10-year-olds in 1999–2007 and in early adolescents in 2008-19, and did not change in preschoolers during the pandemic. From 1999 to 2007, conduct problems increased in preschoolers and 9-10-year-olds and decreased in 7-8-year-olds and adolescents. Externalising in preschoolers, contrary to other age groups, did not show a decrease from 1999 to 2004 and did not show a pronounced increase during the pandemic.

3.4 Cohort effects

Overall, later-born cohorts had lower levels of emotional symptoms, peer and conduct problems, internalising and total difficulties and higher levels of hyperactivity than earlier-born cohorts (Fig. 3 and Table S5). Levels of emotional symptoms and the broad-band internalising declined almost linearly, more prominently among girls than boys, whereas peer and conduct problems, hyperactivity, externalising, total difficulties and prosocial behaviour showed a cubic S-shaped trend, rising and falling in successive cohorts.

Peer and conduct problems, externalising and total difficulties were highest in the 1992-94 birth cohort. Peer problems decreased more prominently among girls than boys, with the lowest level in 2014-15 cohort; conduct problems and total difficulties were lowest in the 2008 cohort. Birth cohort accounted for around 3% of the variance in emotional symptoms, peer problems and hyperactivity, around 2% of the variance in conduct problems, 1.5% of the variance in the broad-band externalising and around 1% of the variance in total difficulties and prosocial behaviour. The largest effect size of cohort (4.4% of the total variance) was that for the broad-band internalising (Table S5).

Age moderated the effects of birth cohort on all mental health measures, except emotional symptoms and internalising. Thus, contrary to the overall decreasing cohort trend, at age 15–19, levels of peer problems and total difficulties in the 1992-99 cohort were lower than in the 2000-07 cohort, which, at age 7–14, had lower levels than the later 2008-13 cohort at the same age (Fig. S4 and Table S9). The 2000-07 cohort, compared to the earlier 1992-99 cohort, had lower levels of hyperactivity and externalising at ages 5–14 and similar levels at ages 2–4 and 15–19; in the later 2008-13 cohort, levels were higher in 11-14-year-olds and lower in 2-4-year-olds. Prosocial behaviours at age 15–19, contrary to other age groups, increased from earlier to the 1992-99 cohort and sharply decreased in later 2000-07 cohort.

3.5 Age, period and cohort effects

Age and period together accounted for around 3% of the variance in prosocial behaviour, 4% of the variance in peer and conduct problems and total difficulties, 5% of the variance in emotional symptoms and the broad-band externalising, 6% of the variance in internalising and 7% of the variance in hyperactivity (Table A8). Age and cohort together accounted for the similar amount of the variance in prosocial behaviour, peer and conduct problems, externalising, total difficulties and hyperactivity, but explained less variance in emotional symptoms (4%) and the broad-band internalising (5%) (Table S10).

An examination of four APC plots showed that age trends in mean SDQ scores were approximately parallel for time periods (Fig. A1) and period trends were mainly parallel for age groups (Fig. S2), however, age trends for different birth cohorts were much less parallel (Fig. S3) and cohort trends appeared to differ by age group (Fig. S4). Therefore, we chose an age-period model with dummy variables for the pandemic period, cohorts born at the time of the 1992-99, 2008 and 2014-15 economic crises and generations born in 1983–

2000 and 2001-10 for the third and final set of models. Tables 2 and 3 present results from the selected models for the main and interactive effects of age, period and cohort.

Table 2

Final models predicting the Strengths and Difficulties Questionnaire scores from gender and time[a]

	Emotional symptoms		Peer problems		Conduct problems		Hyperactivity	
	B (SE)	p	B (SE)	p	B (SE)	p	B (SE)	p
Gender (female)	0.054 (0.021)	.010	-0.143 (0.019)	.000	-0.139 (0.017)	.000	-0.480 (0.026)	.000
Age (in years)	0.258 (0.023)	.000	0.224 (0.019)	.000	-0.012 (0.017)	.468	-0.662 (0.028)	.000
Period (in years)	-0.174 (0.031)	.000	-0.239 (0.021)	.000	-0.199 (0.019)	.000	-0.210 (0.028)	.000
COVID	0.296 (0.037)	.000	0.237 (0.033)	.000	0.383 (0.030)	.000	0.144 (0.044)	.001
Cohort 1992-99			0.071 (0.028)	.011	0.089 (0.025)	.000	0.186 (0.037)	.000
Age^2	-0.180 (0.021)	.000	-0.034 (0.019)	.077	0.012 (0.017)	.489	-0.323 (0.026)	.000
Age^3			-0.282 (0.044)	.000	-0.290 (0.040)	.000		
Gender x Age	0.104 (0.021)	.000						
COVID x Age							0.134 (0.036)	.000
Cohort 1992-99 x Period			-0.304 (0.057)	.000				
(continued)								

Table 2
(continued)

	Internalising		Externalising		Total Difficulties		Prosocial behaviour	
	B (SE)	p	B (SE)	p	B (SE)	p	B (SE)	p
Gender (female)	-0.088 (0.034)	.009	-0.616 (0.037)	.000	-0.695 (0.058)	.000	0.197 (0.020)	.000
Age (in years)	0.570 (0.033)	.000	-0.577 (0.037)	.000	-0.001 (0.058)	.981	-0.096 (0.020)	.000
Period (in years)	-0.419 (0.037)	.000	-0.398 (0.041)	.000	-0.822 (0.064)	.000	0.041 (0.022)	.066
COVID	0.537 (0.058)	.000	0.534 (0.065)	.000	1.075 (0.102)	.000	-0.339 (0.035)	.000
Cohort 1992-99			0.278 (0.054)	.000	0.396 (0.086)	.000	-0.035 (0.030)	.248
Cohort 2014-15	-0.345 (0.083)	.000			-0.667 (0.144)	.000		
Age^2	-0.213 (0.034)	.000	-0.317 (0.038)	.000	-0.515 (0.060)	.000	-0.131 (0.021)	.000
Age^3							0.314 (0.048)	.000
Gender x Age	0.135 (0.033)	.000						
COVID x Age			0.206 (0.052)	.000	0.337 (0.084)	.000		
Cohort 1992-99 x Period							0.219 (0.061)	.000

[a]Adjusted for urban/rural status. N = 9548–9569. B = unstandardized regression coefficient; SE = standard error.

Table 3

Fit statistics for final models predicting the Strengths and Difficulties Questionnaire scores from gender and time[a]

	Emotional symptoms			Peer problems			Conduct problems			Hyperactivity		
	AIC	**BIC**	**R^2(adj.)**	**AIC**	**BIC**	**R^2(adj.)**	**AIC**	**BIC**	**R^2(adj.)**	**AIC**	**BIC**	**R^2(adj.)**
Gender (female)	13712	13734	.002	11558	11579	.012	9500	9522	.007	17439	17460	.037
Age (in years)	13455	13484	.028	11417	11446	.027	9502	9530	.007	16938	16966	.091
Period (in years)	13401	13436	.034	11287	11322	.040	9391	9427	.019	16883	16919	.092
COVID	13338	13381	.041	11237	11280	.045	9228	9271	.035	16874	16917	.092
Cohort 1992-99				11232	11282	.046	9217	9267	.037	16851	16902	.094
Age^2	13269	13319	.048	11231	11288	046	9219	9276	.037	16698	16756	.109
Age^3				11193	11257	050	9168	9233	.042			
Gender x Age	13245	13302	.050									
COVID x Age										16686	16751	110
Cohort 1992-99 x Period				11167	11238	.052						

(continued)

Table 3
(continued)

	Internalizing			Externalizing			Total Difficulties			Prosocial behavior		
	AIC	BIC	R^2(adj.)	AIC	BIC	R^2(adj.)	AIC	BIC	R^2(adj.)	AIC	BIC	R^2(adj.)
Gender (female)	22720	22741	.005	24555	24577	.028	33104	33126	.016	12786	12807	.011
Age (in years)	22430	22459	.035	24311	24340	.053	33106	33134	.015	12765	12794	.014
Period (in years)	22303	22339	.048	24219	24254	.062	32945	32981	.032	12764	12799	.014
COVID	22221	22264	.056	24153	24196	.069	32836	32879	.043	12675	12717	.023
Cohort 1992-99				24129	24179	.071	32817	32867	.045	12675	12725	.023
Cohort 2014-15	22206	22256	.057				32797	32854	.047			
Age^2	22168	22225	.061	24061	24118	.078	32725	32789	.054	12637	12695	.027
Age^3										12596	12661	.031
Gender x Age	22153	22217	.063									
COVID x Age				24047	24112	.079	32710	32782	.056			
Cohort 1992-99 x Period										12586	12657	.033

[a]Adjusted for urban/rural status. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; R^2(adj.) = proportion of variance (adjusted)

The findings showed a significant main effect of the pandemic over and above the general period trends. Parents reported inclines in all mental health problems and declines in their children's prosocial behaviour during the pandemic. In the most parsimonious final models that included a dummy variable for the pandemic, there was a linear rather than curvilinear effect of time period, with decreasing levels of all mental health problems and increasing levels of prosocial behaviours. There was a significant interaction between age and pandemic in relation to hyperactivity, externalising problems and total difficulties. Age-related decreases in hyperactivity and externalising before the pandemic (B = -0.768, SE = .031 and B = -0.911, SE = .040, respectively, both $p < .001$), were much larger than during the pandemic (B = -0.269, SE = .066, $p < .001$ and B = -0.237, SE = .095, p = .013, respectively). Total difficulties showed a general linear decrease with age before the pandemic (B = -0.656, SE = .071, $p < .001$) and an increase during the pandemic (B = 0.565, SE = .150, $p < .001$). Notably, mean levels of hyperactivity, externalising problems and total difficulties, adjusted for urban/rural status, gender and period, declined from 5 to 7 years of age before the pandemic and inclined during the pandemic (Fig. S5).

Being born at the time of the 1992-99 economic crisis made a significant contribution to increased levels of all mental health problems, except emotional symptoms, over and above the effects of age and period. There was a significant interaction between period and 1992-99 cohort in relation to peer problems and prosocial behaviour. Parents whose children were born in 1992-99 reported steeper decreases in peer problems and steeper increases in prosocial behaviour over successive year periods (B = -1.024, SE = .169 and B = 0.793, SE = .188, p = .013, respectively, both $p < .001$) than other birth cohorts (B = -0.240, SE = .038, $p < .001$ and B = 0.098, SE = .043, p = .022, respectively), even after accounting for the effect of the pandemic in later-born cohorts (Fig. S6). Being born at the time of the 2014-15 economic crisis made a significant contribution to decreased levels of internalising problems and total difficulties, over and above the effects of age and period. Generations did not appear as significant predictors in the selected models.

4. Discussion

The present study explored age, period and cohort (APC) effects on child mental health using repeated cross-sectional parent SDQ data on 2–18 year-olds from 1999 to 2021. We found curvilinear time trends, with overall age-related increases in emotional symptoms and peer problems and decreases in hyperactivity and prosocial behaviour. Across time period and birth cohort, we observed decreasing trends in emotional symptoms, peer and conduct problems, and total difficulties. Hyperactivity and prosocial behaviour showed an overall increase across cohorts. There were significant gender differences and interactive effects of the APC. During the pandemic, we found inclines in all mental health problems and declines in prosocial behaviour over and above period trends. There also were long-lasting cohort effects of 1992-99 and 2014-15 economic crises, but we did not find evidence for specific effects of generation beyond that of age, period and their interaction.

4.1 Trends in gender differences

Parents rated girls as showing higher levels of prosocial behaviours and emotional symptoms and boys as showing higher levels of all other mental health problems. Gender differences in emotional symptoms first appeared in middle adolescence and increased with age; gender differences in levels of conduct problems, hyperactivity and total difficulties decreased in adolescence, whereas gender differences in social relationships remained relatively stable. These findings are in line with expectations and previous studies based on parent reports (Achenbach & Rescorla, 2007; Bongers et al., 2003; McNicholas et al., 2024; Ortuño-Sierra et al., 2016; Rescorla et al., 2011).

Across time period, gender differences in emotional symptoms became less prominent, whereas gender differences in peer problems and the broad-band internalising became more prominent. We found a U-shaped trend for gender differences in hyperactivity, with narrowing of the gap between boys and girls around 2005-13. These findings stand in contrast to findings based on adolescent self-reports which showed the widening gender differences in emotional symptoms and the narrowing gender differences in peer problems over time period (Collishaw, 2015; Keyes & Platt, 2024; Privodnova et al., 2024). These discrepancies may reflect not only reporting biases but also variation across informants' contexts and perspectives (De Los Reyes, et al., 2015).

Across birth cohorts, gender differences in emotional symptoms decreased and were reversed in cohorts born 2008 and later, whereas gender differences in peer problems, internalising and total difficulties became more prominent in the later-born cohorts. Our findings differ from some cross-cohort comparisons of UK children that reported increasing gender differences in children's emotional symptoms and decreasing gender differences in peer problems and total difficulties across time (Armitage et al., 2023; Langley et al., 2017; Patalay & Gage, 2019; Sellers et al., 2015). These differences might well reflect differences in societal changes across time, but are also likely to reflect culture-specific reporting effects. However, gender-by-period and gender-by-cohort interaction effects were small and not included in the final models selected by AIC and BIC.

4.2 Age differences in child mental health across time

In all time periods and cohorts, parent-reported emotional symptoms and internalising problems increased from early childhood to early adolescence and then decreased, especially among boys. These age trends are in line with previous multicohort longitudinal studies from other countries (Armitage et al., 2023; Bongers et al., 2003; McNicholas et al., 2024) and suggest that increasing worries, low mood and somatic complains across childhood and adolescence are near-universal. Possible explanations include developmental maturation and accumulating environmental experiences (Maughan & Collishaw, 2015; McLaughlin, 2014), however, the processes involved are still not well understood.

We also found an overall increase in peer problems and overall decreases in prosocial behaviour, hyperactivity and externalising, consistent with some of the prior findings (Achenbach & Rescorla, 2007). The lack of overall age differences in total difficulties was also found in meta-analysis of the prevalence of child and adolescent mental disorders (Polanczyk et al., 2015) and could be due to opposing trends in the two broad-band problem domains, an increasing age trend in internalising and a decreasing trend in externalising.

Although in line with expectations, age-related changes varied depending on developmental stage, time period and birth cohort. Thus, our findings and those of others suggest that prosocial behaviour tends to decline in late childhood after an increase at earlier stages (Malti & Speidel, 2024). In different time periods, age changes in peer and conduct problems, externalising and total difficulties were in opposite directions. There were also considerable cross-cohort differences in age trends for all mental health domains, except emotional symptoms and internalising.

4.3 Time period changes in child and adolescent mental health

Parent-reported emotional symptoms, peer and conduct problems, internalising and total difficulties decreased from 1999 to 2021. From about 2011, emotional symptoms, peer problems and internalising increased among boys. Trends in emotional problems and total difficulties are in contrast to studies of adolescent trends based on self-reports (Bor et al., 2014; Collishaw, 2015; Keyes & Platt, 2024; Privodnova et al., 2024), but in line with studies of child trends based on parent reports (Pitchforth et al., 2019). Decreasing trends in conduct problems are consistent with evidence derived from both parent and self-reports (Collishaw & Sellers, 2020; Keyes et al., 2018; Takacs et al., 2025).

These findings concur with a recent meta-analysis (Takacs et al., 2025) in questioning the view that child and adolescent mental health universally declines over time and underscore the importance of gender, developmental stage, context and domain. Together, our findings indicate positive trends in parent-reported child mental health problems from 1999 to 2021. These positive changes may be due to an overall increase in household wealth (Voronin et al., 2023) and the implementation of national family policy which provided substantial financial aid to families with children (Zyryanova & Popova, 2021). Unlike the findings from self-reports (Privodnova et al., 2024), the present study did not find increases in emotional symptoms and internalising among adolescent girls over the same time period and in the same cultural context. One possible explanation for this discrepancy is that internalising problems are less observable than externalising, for which correspondence between parent and self-reports is typically higher (De Los Reyes et al., 2015). Contextual specificity and differences in values and worldviews may also play a role.

Our findings provide evidence for a negative impact of the COVID-19 pandemic on child and adolescent mental health, consistent with some findings from other countries (Newlove-Delgado et al., 2023; Wolf & Schmitz, 2024), but inconsistent with most findings from adolescent self-reports in the same region (Privodnova et al., 2024). This underlines the importance of integrating information from multiple sources. We also found interactive effects of child age and the pandemic. Thus, hyperactivity-inattention, externalising and total difficulties decreased after school entry overall, but increased during the pandemic when parents were faced with additional demands of home-schooling.

4.4 Cross-cohort differences in child mental health

Parent-reported emotional symptoms, peer and conduct problems, internalising and total difficulties decreased across cohorts, while hyperactivity increased. Cross-cohort decreases in emotional symptoms, peer problems, internalising and total difficulties were larger among girls; the direction and magnitude of cross-cohort changes varied considerably with age. In the absence of directly comparable findings, our results broadly support the conclusion of Bor et al.'s (2014) review that more recent cohorts tend to show improvements in mental health at younger ages and a worsening in late adolescence. Later cross-cohort studies of same-aged children and adolescents found similar results (Langley et al., 2017; Patalay & Gage 2019; Sellers et al., 2015), although greater decreases in child mental health problems were observed for boys than for girls. In contrast to Armitage et al.'s (2023) findings, cross-cohort differences in parent-reported emotional symptoms in our study did not vary with age. Overall, the present study adds to the evidence that time trends in child and adolescent mental health differ across countries (Armitage et al., 2025).

As expected, the cohort born during the 1992-99 economic crisis had lowest levels of mental health at all times and ages. These findings clearly show long-term negative effects of adversity experienced in the first years of life. Notably, children born in 1992-99 did not show increased levels of emotional symptoms and internalising when age and time period were taken into account. This suggests that long-term negative consequences of early socioeconomic adversity may be domain-specific, with peer relationships and behavioural conduct and attention particularly affected. It is also to be noted that the 1992-99 cohort showed steeper decreases in peer problems and steeper increases in prosocial behaviour over time compared to other cohorts, indicating possible pathways of resilient functioning.

Cohorts born during the 2008 and 2014-15 economic crises did not show a worsening of mental health: moreover, parents of children born in 2014-15 reported lower levels of internalising problems and total difficulties at all times and ages. Why should this be? One possible reason is that the 2008 and 2014-15 economic crises in Russia were less severe than that of 1992-99 in terms of inflation, income reduction, unemployment and poverty rate (Kotelnikova & Radaev, 2017; Voronin et al., 2023). The Russian Longitudinal Monitoring Survey showed that the proportion of people who were satisfied with their life increased from 12% in 1998 to 52% in 2013 and decreased by less than 1% in 2014 (Voronin et al., 2023). The financial support of families with children increased from the 2000s (Zyryanova & Popova, 2021). All this can explain the absence of mental health worsening in the 2008 and 2014-15 cohorts, but cannot explain mental health advantage for children born in 2014-15.

Finally, the study did not find any differences in mental health across the three generations of children born 1983–2000, 2001-10 and 2011-20 when age and time period were taken into account. This supports the view that while birth cohort is a clearly defined and useful concept, generations are probably not (Costanza et al., 2023). Future research linking external factors to time changes in child and adolescent mental health should help to identify impactful events, key domains and the groups most at risk.

5. Strengths and limitations

To our knowledge, this is a first study to test gender and age differences in multiple domains of child and adolescent mental health across time period and birth cohort in a non-Western context. Strengths of this study include a wide age range from early childhood to late adolescence, the 23-year period and 38-year birth cohort span. Year-on-year analysis of time effects allowed us to examine linear and curvilinear trends in child and adolescent mental health and to test independent effects of the COVID-19 pandemic and economic crises and differences across generations.

There are also important limitations. First, the sample was unrepresentative in a number of ways; the study would benefit from the use of more elaborated sampling methods. Second, although we used the same mental health measure at all times, during the COVID pandemic in 2020-21, unlike other time periods, it was administered online. Online mental health surveys may under-represent children from disadvantaged backgrounds, however, patterns of association and regression models are only marginally affected (Goodman, 2013). Third, the use of brief questionnaire measures produce uncertainty about whether differences in mean scores reflect real differences in population mental health or differences in reporting about mental health (Collishaw, 2015). Fourth, the findings are limited by reliance on parent reports, primarily from mothers. Although mothers are the only available informants for some young children, parent reports may provide less accurate estimates of internalising problems than self-reports, while teacher reports can provide valuable complementary information on externalising problems (Newlove-Delgado et al., 2023). Finally, we only analysed the effects of gender, age, period and cohort on child mental health; in future studies it would be desirable to include national- and individual-level data on possible explanatory factors.

6. Conclusion

This study provided evidence about gender, age, period and cohort (APC) effects on mental health of children and adolescents aged 2–18 years, as measured by the parent-report SDQ over 23 years from 1999 to 2021 in cohorts born between 1983 and 2020. We found curvilinear trends, with overall age-related increases in emotional symptoms and peer problems, and decreases in hyperactivity and prosocial behaviour. Across time period and birth cohort, there were decreasing trends in emotional symptoms, peer and conduct problems and total difficulties. Hyperactivity and prosocial behaviour were higher in later-born cohorts. There were significant gender differences and APC interactions. During the pandemic, we found inclines in all mental health problems and declines in prosocial behaviour. Parents whose children were born during the 1992-99 economic crisis reported higher levels of all mental health problems, except emotional symptoms, with steeper decreases in peer problems and increases in prosocial behaviour over time periods. The cohort born during the 1914-15 economic crisis had lower levels of internalising problems and total difficulties. There was no evidence for specific effects of generation beyond that of age, period and their interaction. The findings provide the basis for further research into the drivers of time changes in child and adolescent mental health.

Declarations

Supplementary Information

Supplementary material associated with this article can be found in the online version.

Author Contribution

HRS led the development of the conceptual framework, study design, data analysis and the writing of the article, which all other authors contributed to; in addition: EAK, AVV and IIK contributed to data collection, OSK contributed to the data analysis.

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Data Availability

The data and scripts are openly available in the Center for Open Science at https://osf.io/ekuya.

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Figures

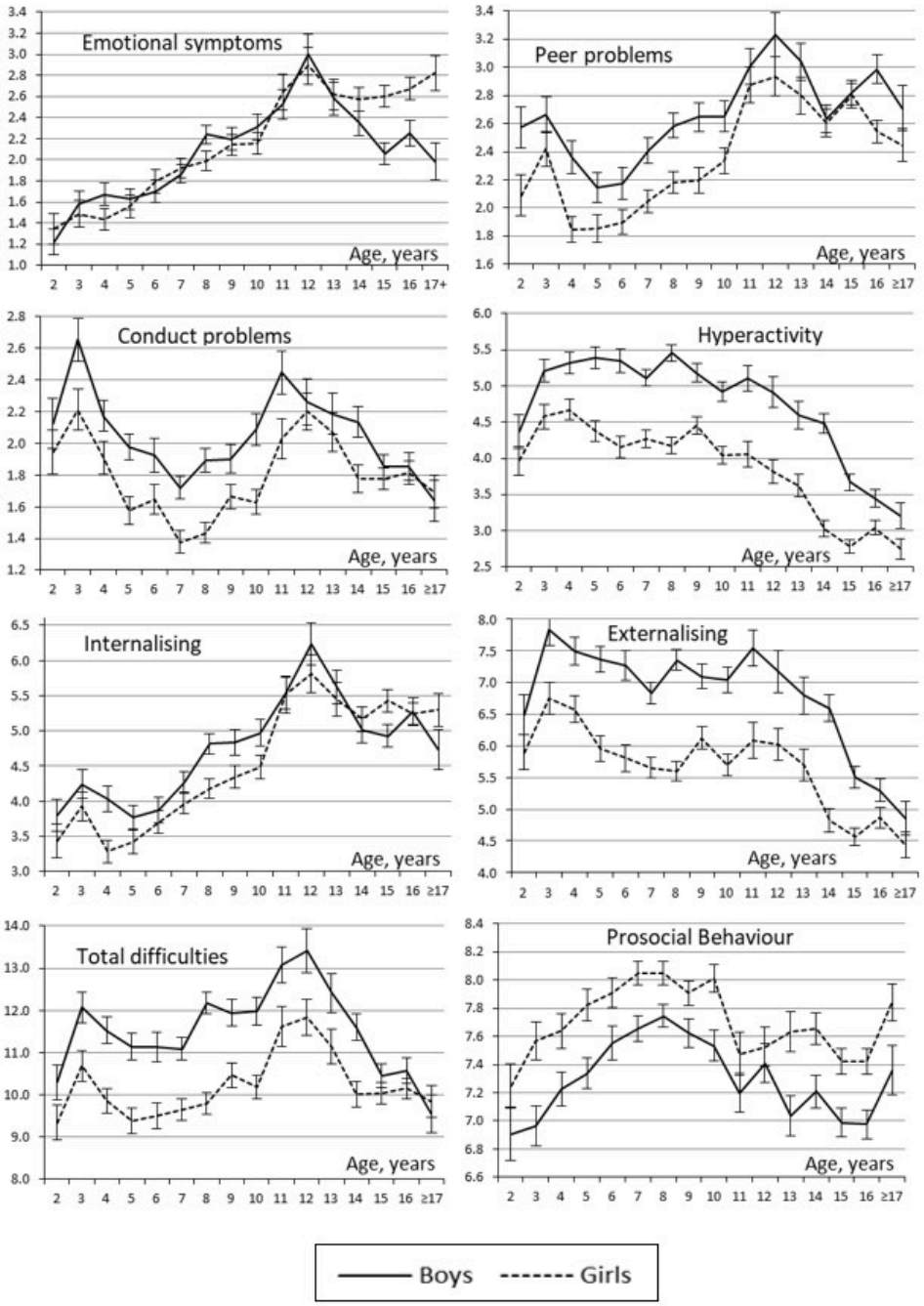


Figure 1

Mean scores on the Strength and Difficulties Questionnaire by age and gender. Bars represent standard errors

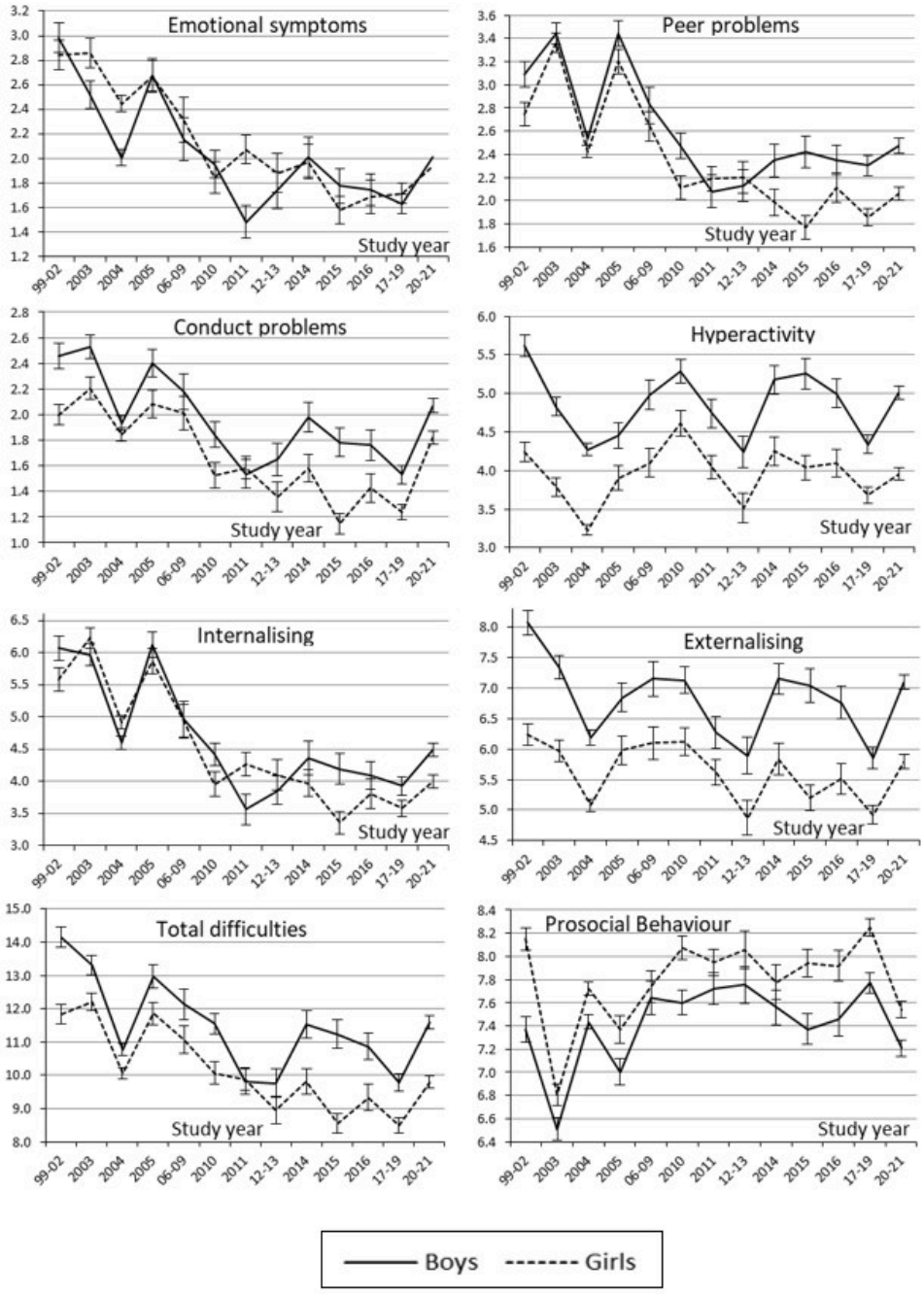


Figure 2

Mean scores on the Strength and Difficulties Questionnaire by time period and gender. Bars represent standard errors

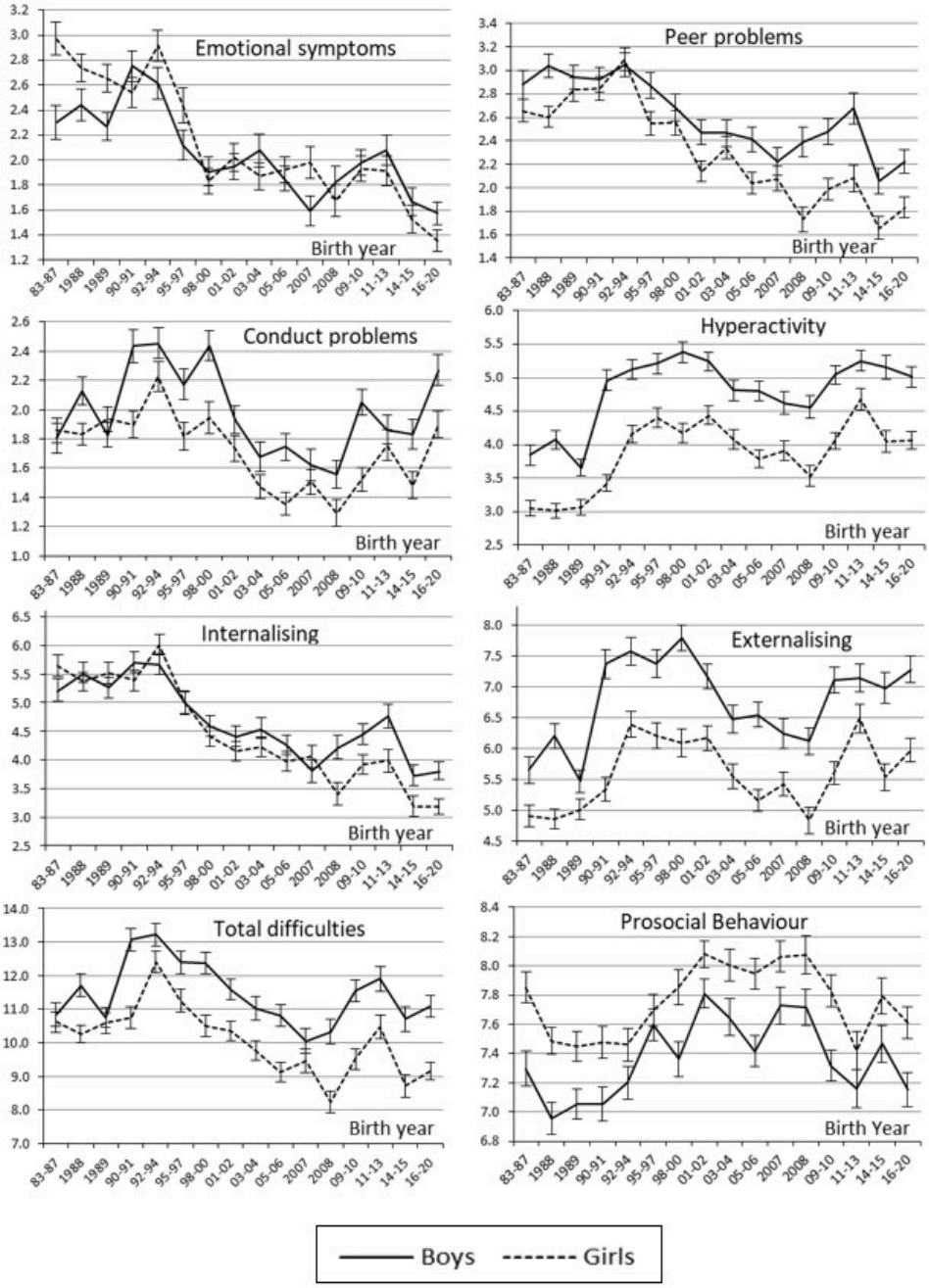


Figure 3

Mean scores on the Strength and Difficulties Questionnaire by cohort and gender. Bars represent standard errors

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