

# Russian adolescent mental health in 2002, 2015 and during the COVID-19 pandemic in 2021

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**Background:** Adolescent mental health is a global concern, however, time trends and the COVID-19-related restrictions vary across countries. This study examined changes in adolescent mental health and substance use in Russia between 2002, 2015 and during the pandemic in 2021. **Methods:** Cross-sectional school-based surveys of 12- to 18-year-olds were carried out in a Siberian city in 2002 ( $N = 713$ ), 2015 ( $N = 840$ ) and 2021 ( $N = 721$ ) using the Strengths and Difficulties Questionnaire, data on tobacco, alcohol and drug use and socio-demographic information. We examined the effect of cohort, gender, family composition and parental occupation on mental health and substance use. **Results:** There were increases in emotional symptoms and internalising problems ( $B = 0.93$ ,  $p < .001$ ) and decreases in substance use over 19 years ( $B = -.73$ ,  $p < .001$ ). Changes in adolescent mental health and substance use were substantial from 2002 to 2015 and nonsignificant from 2015 to 2021. Increases in mental health problems were evident only among girls; a decrease in alcohol use was larger among boys. Family composition and parental occupation did not account for these changes. **Conclusions:** These results suggest that the mental health of Russian adolescent girls has worsened in the 21st century; the gender gap in mental health has widened; the gender gap in alcohol use was reversed in 2021. The findings highlight the need for research into gender-specific factors and for effective interventions. The lack of changes in Russian adolescent mental health and substance use from 2015 to during the pandemic in 2021 suggests successful coping; however, more research is needed.

## Key Practitioner Message

- Research in western high-income countries has shown a substantial increase in adolescent depression and anxiety over the past 30 years, especially among girls, and a decrease in adolescent substance use; the COVID-19 pandemic is associated with increased risk of adolescent mental health problems.
- This study suggests that there were increases in Russian adolescent internalising problems and total difficulties, and decreases in substance use from 2002 to 2015, but no changes from 2015 to during the pandemic in 2021.
- Future research is needed to understand the determinants of adolescents' resilience and vulnerability during the COVID-19 pandemic.
- The widening of the gender gap in adolescent mental health, with girls reporting more problems, and the closing of the gender gap in substance use suggest the potential value of gender-specific interventions.

**Keywords:** Mental health; adolescents; substance use; gender difference; prosocial behaviour

## Introduction

The COVID-19 pandemic and associated restrictions have led to unprecedented changes in everyday lives of adolescents around the world. Social restrictions may be particularly harmful for adolescents because peer relationships are pivotal for their well-being and health (Blakemore & Mills, 2014). Accumulating evidence suggests that the COVID-19 pandemic is associated with increased risk of adolescent mental health problems,

particularly with higher levels of depression and anxiety symptoms among females (Jones, Mitra, & Bhuiyan, 2021; Samji et al., 2022). However, this negative impact is by no means always the case. Thus, studies of Chinese adolescents and Hispanic/Latinx adolescents from the United States found decreases in internalising and total mental health problems during and after the COVID-19-related lockdown (Penner, Ortiz, & Sharp, 2021; Yang, Harrison, Huang, Liu, & Zahn, 2021). Research also suggests that adolescent

substance use decreased during the COVID-19 pandemic, but the findings are inconsistent (Dumas, Ellis, & Litt, 2020). There is evidence that an initial increase in mental health problems may be followed by a decrease, reaching pre-pandemic levels during the later stages (Robinson, Sutin, Daly, & Jones, 2021). However, there is currently not enough information to reliably describe time trends in adolescent mental health during the pandemic.

The robust detection of changes associated with the pandemic is only possible if comparable measures are available for earlier time periods and if time trends are taken into account. Research in western high-income countries has shown a substantial increase in adolescent depression and anxiety over the past 30 years, especially among girls; rates of neurodevelopmental disorders remained relatively stable, whereas conduct problems decreased in many but not all countries (Bor, Dean, Najman, & Hayatbakhsh, 2014; Collishaw & Sellers, 2020). There is also evidence for a decrease in adolescent tobacco, alcohol and drug use in many but not all countries (Ma et al., 2021; Schulenberg, Patrick, Maslowsky, & Maggs, 2014). Most studies on adolescent mental health and substance use have been conducted in the more affluent westernised countries, although the vast majority of the world's adolescents live in lower income countries with a high burden of disease and injury (Azzopardi et al., 2019). Different living conditions and rapid societal changes are likely to lead to variations in adolescent mental health and substance use trends (Azzopardi et al., 2019; Kraus et al., 2018; Ma et al., 2021). The pandemic-related restrictions also varied considerably across countries (World Health Organization, 2021). Therefore, to inform scientific understanding, policy and practice, it is essential to obtain data from a range of countries differing in political, educational and health systems.

The present study provides evidence about changes in adolescent mental health and substance use in Russia between 2002, 2015 and during the COVID-19 pandemic using cross-cohort comparisons. The pandemic-related restrictions in the Russian Federation varied across regions; this study used data from Novosibirsk, Russia's third largest city, located in Western Siberia. During-pandemic data were collected in Spring 2021, a year after the stay-at-home order, when many restrictions have been lifted and schools were reopened. The first aim was to examine cohort differences in levels of adolescent prosocial behaviour and mental health problems and rates of substance use between 2002, 2015 and 2021. The second aim was to establish whether cross-cohort changes varied by gender. The third aim was to test whether changes in adolescent mental health and substance use might be accounted for by socio-demographic factors, such as family composition and parental occupation.

## Methods

### *Participants and procedures*

The investigation used three school-based samples of 12- to 18-year-old adolescents attending non-selective mainstream schools in Novosibirsk, Russia's third largest city. The 2002 sample ( $n = 713$  adolescents from 12 schools in eight city districts) was drawn from a representative sample of 4614

students from different educational institutions (mainstream schools, evening schools, vocational schools and technical colleges) located in the city, smaller towns and rural area of Novosibirsk region (Knyazev, Slobodskaya, Kharchenko, & Wilson, 2004). The 2015 sample ( $n = 840$  adolescents from nine schools in five city districts) was drawn from the Eurasian Child & Adolescent Mental Health Study (ECAMHS, Sourander et al., 2018), including 1601 adolescents from mainstream schools in two Siberian cities, Novosibirsk and Krasnoyarsk. The 2021 sample ( $n = 721$ ) was recruited from five public schools in four city districts, representing a range of socioeconomic backgrounds. The study was approved by the Scientific Research Institute of Neuroscience and Medicine Ethics Committee.

Data collection took place in April–May 2002, 2015 and 2021, at the end of the school year. Because of the COVID-19 pandemic, schools in Novosibirsk were closed from the beginning of April 2020 to the end of school year in June 2020. At the beginning of the next school year on 1 September 2020, schools reopened and, although there were a number of restrictions and part-time remote online learning during the 2020–2021 school year, students enrolled in schools attended in-class lessons. Following permission from the school authorities and consent from parents obtained in March 2002, 2015 and 2021, secondary school students in grades 6–11 were approached to participate. The survey was conducted on a regular school day; all students who were present in the classroom were asked to fill in an anonymous questionnaire during a school lesson. Students were told that participation was voluntary and that their responses were confidential. Data on response rates were available for the 2015 (80%) and 2021 (76%) studies. These figures indicate that, during pandemic, data were not seriously biased by non-attendance.

Socio-demographic characteristics of the samples are presented in Table 1. Participants in 2015 were younger than in 2002 and 2021. The proportion of male participants was higher in each successive cohort, possibly because in the earlier years relatively more adolescent boys attended vocational colleges. All three studies included adolescents from the full spectrum of socioeconomic backgrounds. The proportion of lone parent families increased with each successive cohort, consistent with global changes in family structure over past decades (Georgas, Berry, Van de Vijver, Kağitçibaşı, & Poortinga, 2006). The proportion of fathers who were not in the work force decreased from 2002 to 2021. Comparisons with national socioeconomic, educational and health indicators suggest that the study samples were reasonably representative of urban adolescents from many regions of the Russian Federation.

### *Measures*

**Mental health.** The Strengths and Difficulties Questionnaire (SDQ, Goodman, 2001) is a reliable and valid measure of child and adolescent mental health (<http://www.sdqinfo.org>). The Russian version has been validated in a stratified random sample (Goodman, Slobodskaya, & Knyazev, 2005). The SDQ 25 items are divided between five scales: prosocial behaviour, emotional symptoms, peer relationship problems, conduct problems and hyperactivity/inattention. Each scale consists of five items scored as 0 = not true, 1 = somewhat true and 2 = certainly true. In community samples, the use of 10-item internalising (emotional symptoms and peer problems) and externalising scales (conduct problems and hyperactivity) is recommended. The total difficulties scale is made of the 20 problem items. The impact supplement included an overall rating of difficulties and items measuring chronicity, distress and impairment in home life, friendships, classroom learning and leisure activities. These seven items were scored 0–3 and summed to generate the impact score.

**Substance use.** Participants rated the frequency of smoking, alcohol use and their experience with drugs. The 2015 and 2021 studies used identical measures from the ECAMHS questionnaire (Sourander et al., 2012, 2018); in 2002, measures were somewhat different, but comparable (Table S1, found in

**Table 1.** Socio-demographic characteristics of the samples

	2002 <i>n</i> = 713	2015 <i>n</i> = 840	2021 <i>n</i> = 721	Statistical difference
Age, mean ( <i>SD</i> )	15.5 (1.0)	14.7 (1.3)	15.2 (1.2)	$F(2,2270) = 96.34$ $p < .001$
Gender, <i>n</i> (%)				$\chi^2(2) = 11.46$ $p = .003$
Female	416 (60.6)	452 (54.1)	333 (51.9)	
Male	270 (39.4)	384 (45.9)	309 (48.1)	
Family composition, <i>n</i> (%)				$\chi^2(6) = 46.73$ $p < .001$
Dual parent	528 (74.1)	509 (61.1)	443 (63.5)	
Lone parent	111 (15.6)	158 (19.0)	159 (22.8)	
Step parent	66 (9.3)	147 (17.6)	90 (12.9)	
Non-parent (foster parent, grandparent)	8 (1.1)	19 (2.3)	6 (0.9)	
Maternal occupation, <i>n</i> (%)				$\chi^2(6) = 24.30$ $p < .001$
Professional/managerial	265 (50.4)	258 (44.4)	290 (51.3)	
Technical/skilled	66 (12.5)	82 (14.1)	107 (18.9)	
Manual/unskilled	116 (22.1)	154 (26.5)	97 (17.2)	
Unemployed/students/pensioners	79 (15.0)	87 (15.0)	71 (12.6)	
Paternal occupation, <i>n</i> (%)				$\chi^2(6) = 31.20$ $p < .001$
Professional/managerial	255 (56.7)	211 (43.7)	247 (52.4)	
Technical/skilled	33 (7.3)	33 (6.8)	45 (9.6)	
Manual/unskilled	143 (31.8)	228 (47.2)	170 (36.1)	
Unemployed/students/pensioners	19 (4.2)	11 (2.3)	9 (1.9)	

the online Supporting Information). Tobacco use was measured by the frequency of cigarette smoking (never, rarely/weekly, daily) scored 0–2. Alcohol use was measured by the frequency of drinking (never, once a month or more, once a week or more) scored 0–2. To measure experience with drugs, participants were asked whether they have tried or used any illicit drugs. Their responses were scored on a binary (0 = no, 1 = yes) scale. Tobacco, alcohol and drug use were summed to generate the substance use score.

**Socio-demographic background.** Participants provided information about their age, gender, family composition and parental occupation (Table 1). Age was used as a continuous variable, gender was coded 0 = male, 1 = female. For family composition, we used three dummy variables, lone parent, step-parent and non-parent, with dual parent traditional families as the reference category. Parental occupation was coded on a 4-point scale (0 = unemployed/students/pensioners, 1 = unskilled/manual, 2 = skilled/technical, 3 = professional/managerial) and the highest code for the family was used. Three dummy codes were created for unemployed, unskilled/manual and skilled/technical occupations, with professional/managerial occupation as the reference category.

### Missing data

The percentage of participants with missing data ranged from 0.8% to 1.0% for mental health variables and from 0.6% to 1.1% for substance use variables. Gender was missing for 110 participants (4.8%), family composition for 30 (1.3%) and parental occupation was missing for 494 (21.7%). Adolescents with missing socio-demographic data did not differ from adolescents with complete data on levels of substance use, prosocial behaviour and mental health problems, but had significantly lower impact scores (Table S2). Given the small percentage of missing data on mental health and substance use and few differences between participants with complete and missing socio-demographic data, an assumption of missing at random was plausible.

### Statistical analysis

For all analyses, we used the SPSS complex samples procedures to account for the clustering in the data. First, we estimated the SDQ mean scores and rates of substance use with 95% confidence intervals (CIs) in 2002, 2015 and 2021 separately for males and females. Next, we examined the effect of cohort and

socio-demographic variables on adolescent mental health using linear regression for dimensional outcomes (SDQ and substance use scores), ordinal regression for tobacco and alcohol use and logistic regression for experience with drugs. Results for ordinal outcomes were described in terms of cumulative odds ratios (COR). In the first set of models, age, gender and two dummy variables for cohort (with 2021 as the reference category) were entered at the first step. To examine whether cohort changes differed for males and females, gender-by-cohort interactions were entered at the second step. To test the difference between 2002 and 2015, we repeated these analyses with 2002 as the reference category.

Following significant gender-by-cohort interactions, we examined cohort changes separately for males and females and gender differences separately for each cohort. Finally, we tested whether cohort effects were still significant after family composition and parental occupation had been taken into account. In the second set of models, we added three dummy variables for family composition. In the third set of models, we added three dummy variables for parental occupation. Because the analyses involved multiple tests of cohort differences, alpha level was adjusted using a Bonferroni correction for 13 outcome variables ( $\alpha = 0.05/13 = .00384$ ).

## Results

### Cohort differences in adolescent mental health

Figure 1 shows mean levels of prosocial behaviour and mental health problems by year of study and gender (see Table S3 for the SDQ mean scores and 95% CIs). Table 2 presents results of regression analyses for the SDQ scores. Prosocial behaviour decreased among girls: The difference between 2002 and 2015 was significant ( $B = 0.44$ , 95% CI 0.20–0.68,  $p = .001$ ), but the difference between 2015 and 2021 was not. Boys' prosocial behaviour did not change over time.

For emotional symptoms, time trends differed by gender, with an increase by one scale point among girls and no change among boys. Girls' level of emotional symptoms increased from 2002 to 2015 ( $B = 0.95$ , 95% CI 0.54–1.36,  $p < .001$ ), the difference between 2015 and 2021 was nonsignificant. Peer problems increased from 2002 to 2015 ( $B = 0.64$ , 95% CI 0.47–0.82,  $p < .001$ )

and decreased from 2015 to 2021. These changes were significant only among girls. Internalising problems increased from 2002 to 2021 due to an increase between 2002 and 2015, which was significant only among girls ( $B = 1.85$ , 95% CI 1.35–2.35,  $p < .001$ ).

There were no significant cohort differences for boys' and girls' conduct problems, hyperactivity/inattention and the broadband externalising problems. Total difficulties increased from 2002 to 2015 ( $B = 1.28$ , 95% CI 0.67–1.90,  $p < .001$ ); this increase was significant only among girls. Time trends in the impact score differed by gender, with an increase among girls and a decrease among boys, although these changes were nonsignificant following Bonferroni correction. After controlling for family composition (Table S4) and parental occupation (Table S5), cohort differences in prosocial behaviour and mental health problems remained unchanged.

*Cohort differences in adolescent substance use*

Figure 2 shows rates of substance use by year and gender (see Table S3 for percentages with 95% CIs). Table 3 presents the results of regression analyses. Tobacco use decreased significantly from 2002 to 2021. In 2002, 33.5% of adolescents reported smoking; in 2015, this proportion was 15.9% (COR = 2.56, 95% CI 1.77–3.70); the decrease was larger among boys than girls, both in absolute (24.6% and 12.9%, respectively) and in relative terms (64.4% and 42.0%, respectively). In 2021, smoking nonsignificantly increased to 16.1%. Alcohol use also decreased from 2002 to 2021. In 2002, 33.0% of adolescents reported monthly alcohol use and 16.6% reported weekly use; in 2015, these proportions were 13.9% and 2.3% (COR = 4.27, 95% CI 3.34–5.47). In 2021, alcohol use did not change significantly. Time trends in alcohol

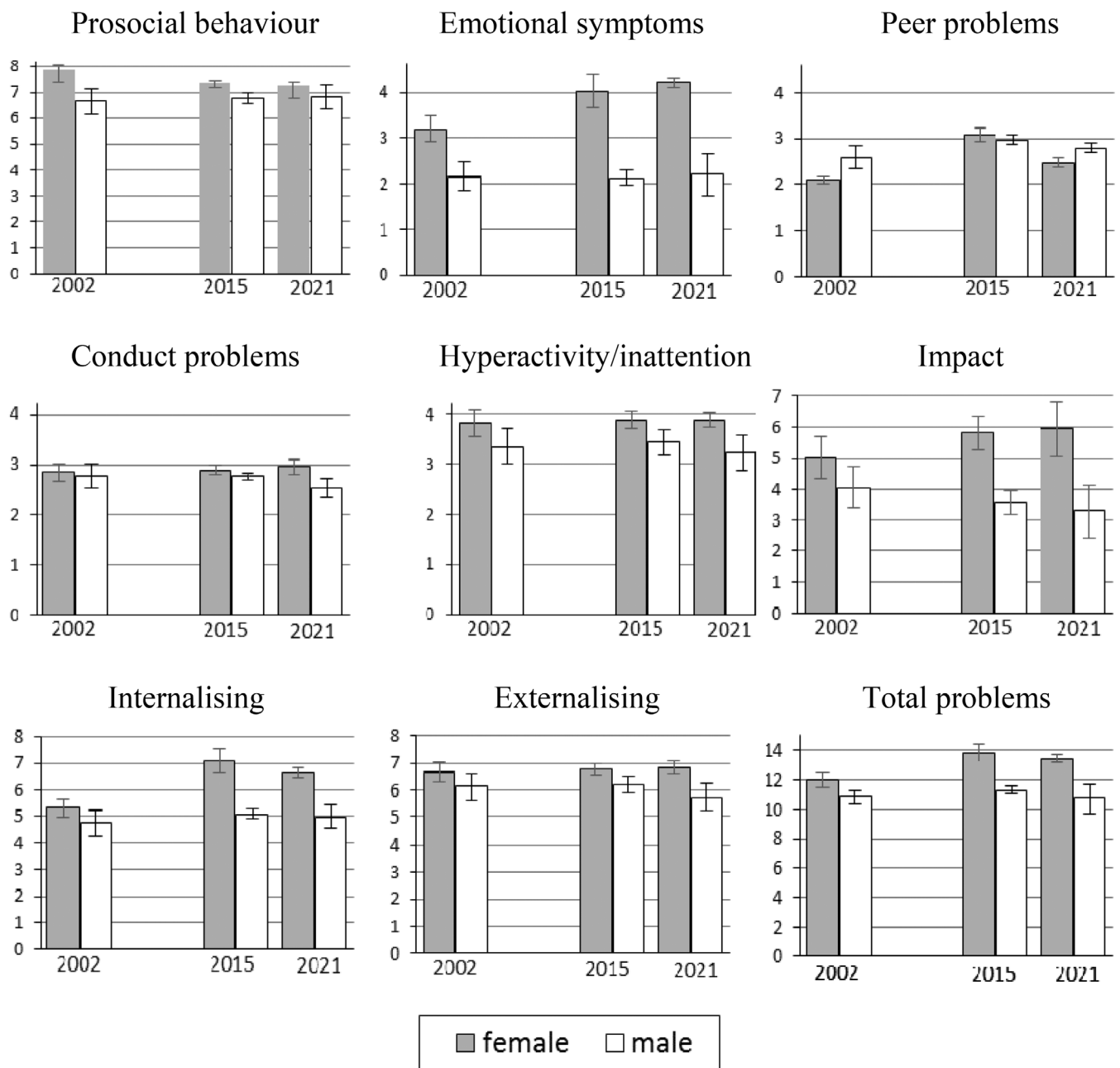


Figure 1. Adolescent scores on the Strengths and Difficulties Questionnaire in 2002, 2015 and 2021. Bars are 95% confidence intervals

**Table 2.** Regression analysis of gender and cohort on adolescent mental health<sup>a</sup>

	Prosocial behaviour		Emotional symptoms		Peer problems	
	B (95% CI)	p	B (95% CI)	p	B (95% CI)	p
Gender (female)	<b>0.60 (0.41, 0.79)</b>	<b>.000</b>	<b>1.82 (1.48, 2.15)</b>	<b>.000</b>	-0.19 (-0.35, -0.02)	.031
Cohort 2002 <sup>b</sup>	0.28 (-0.06, 0.62)	.099	<b>-0.66 (-0.96, -0.37)</b>	<b>.000</b>	<b>-0.28 (-0.43, -0.13)</b>	<b>.001</b>
Cohort 2015 <sup>b</sup>	0.04 (-0.24, 0.32)	.756	-0.10 (-0.34, 0.15)	.436	<b>0.37 (0.24, 0.49)</b>	<b>.000</b>
Gender × Cohort 2002 <sup>b</sup>	0.75 (1.44, 2.25)	.031	<b>-0.98 (-1.57, -0.39)</b>	<b>.002</b>	-0.13 (-0.38, 0.12)	.308
Gender × Cohort 2015 <sup>b</sup>	0.16 (-0.24, 0.57)	.426	-0.14 (-0.72, 0.44)	.631	<b>0.46 (0.19, 0.72)</b>	<b>.001</b>
	Conduct problems		Hyperactivity		Impact	
	B (95% CI)	p	B (95% CI)	p	B (95% CI)	p
Gender (female)	<b>0.24 (0.11, 0.37)</b>	<b>.001</b>	<b>0.54 (0.34, 0.75)</b>	<b>.000</b>	<b>2.23 (1.82, 2.63)</b>	<b>.000</b>
Cohort 2002 <sup>b</sup>	0.06 (-0.14, 0.27)	.529	0.02 (-0.28, 0.32)	.908	-0.34 (-1.32, 0.65)	.494
Cohort 2015 <sup>b</sup>	0.04 (-0.14, 0.22)	.640	0.10 (-0.19, 0.40)	.476	0.20 (-0.60, 1.00)	.611
Gender × Cohort 2002 <sup>b</sup>	-0.35 (-0.63, 0.07)	.016	-0.18 (-0.67, 0.31)	.466	<b>-1.68 (-2.40, -0.96)</b>	<b>.000</b>
Gender × Cohort 2015 <sup>b</sup>	<b>-0.28 (-0.41, 0.15)</b>	<b>.000</b>	-0.21 (-0.61, 0.20)	.313	-0.46 (-1.19, 0.28)	.214
	Internalising		Externalising		Total difficulties	
	B (95% CI)	p	B (95% CI)	p	B (95% CI)	p
Gender (female)	<b>1.63 (1.31, 1.96)</b>	<b>.000</b>	<b>0.78 (0.41, 1.11)</b>	<b>.000</b>	<b>2.43 (1.88, 2.98)</b>	<b>.000</b>
Cohort 2002 <sup>b</sup>	<b>-0.93 (-1.32, -0.54)</b>	<b>.000</b>	0.08 (-0.38, 0.55)	.712	-0.84 (-1.51, -0.18)	.015
Cohort 2015 <sup>b</sup>	0.29 (-0.04, 0.61)	.081	0.15 (-0.30, 0.60)	.514	0.44 (-0.20, 1.18)	.230
Gender × Cohort 2002 <sup>b</sup>	<b>-1.11 (-1.79, -0.42)</b>	<b>.002</b>	-0.54 (-1.18, 0.10)	.093	<b>-1.67 (-2.67, -0.67)</b>	<b>.002</b>
Gender × Cohort 2015 <sup>b</sup>	0.33 (-0.36, 1.03)	.340	-0.51 (-1.03, 0.23)	.060	-0.20 (-1.15, 0.74)	.665

B = unstandardised regression coefficient; CI = confidence interval. All findings in bold are significant at Bonferroni-corrected alpha level of .0038.

<sup>a</sup>Adjusted for age.

<sup>b</sup>Reference category: 2021.

use differed by gender: an absolute decrease from 2002 to 2021 was larger among boys (41.2%, COR = 6.76, 95% CI 4.23–10.81) than girls (22.2%, COR = 2.26, 95% CI 2.01–3.42); relative decreases were 73.7% and 47.6%, respectively.

In 2002, 5.1% of adolescents reported having tried drugs; in 2015, this proportion increased to 7.0%, whereas in 2021, it decreased to 4.7%. However, these changes were nonsignificant following Bonferroni correction. From 2002 to 2021, the overall level of substance use decreased threefold among boys and twofold among girls. The decrease between 2002 and 2015 was substantial ( $B = 0.73$ , 95% CI 0.54–0.91,  $p < .001$ ); the difference between 2015 and 2021 was nonsignificant. After controlling for family composition (Table S6) and parental occupation (Table S7), cohort differences in substance use remained unchanged or became greater.

### Socio-demographic factors

Girls rated themselves higher than boys on all SDQ measures except peer problems (Table 2). For prosocial behaviour, gender differences were largest in 2002, smaller in 2015 and nonsignificant in 2021. Gender differences in emotional symptoms were smallest in 2002 and larger in 2015 and 2021. Gender differences in total difficulties and the impact score increased over time. Boys reported more tobacco, alcohol and drug use than girls in 2002, however, in 2015, these gender differences were reversed (Figure 2); in 2021, girls reported significantly higher rates of alcohol use (24.4%) than boys (14.7%; COR = 1.98, 95% CI 1.38–2.85,  $p = .001$ ).

Living in a stepfamily was associated with more mental health problems (Table S4). Family type did not contribute significantly to tobacco, alcohol and drug use (Table S6). Parental occupation did not contribute significantly to adolescent mental health and substance use (Tables S5 and S7).

### Discussion

The present study examined cohort differences in Russian adolescent mental health, as measured by the SDQ, and substance use between 2002, 2015 and 2021 using school-based samples in a large Siberian city. The 2021 data were collected a year after the onset of the COVID-19 pandemic and the related lockdown, when schools were reopened, with part-time remote online learning and a number of societal restrictions. The findings showed substantial increases in adolescent emotional symptoms and internalising problems over 19 years. These increases occurred between 2002 and 2015; levels of adolescent emotional symptoms and internalising problems did not differ significantly from 2015 to during the COVID-19 pandemic in 2021. Peer problems increased from 2002 to 2015 and decreased between 2015 and 2021. A secular increase in Russian adolescent emotional symptoms and the broadband internalising problems is consistent with findings from high-income countries (Bor et al., 2014; Collishaw & Sellers, 2020), despite differences in cultural context and medical services. Stable levels of hyperactivity/inattention and conduct problems is in line with some, but

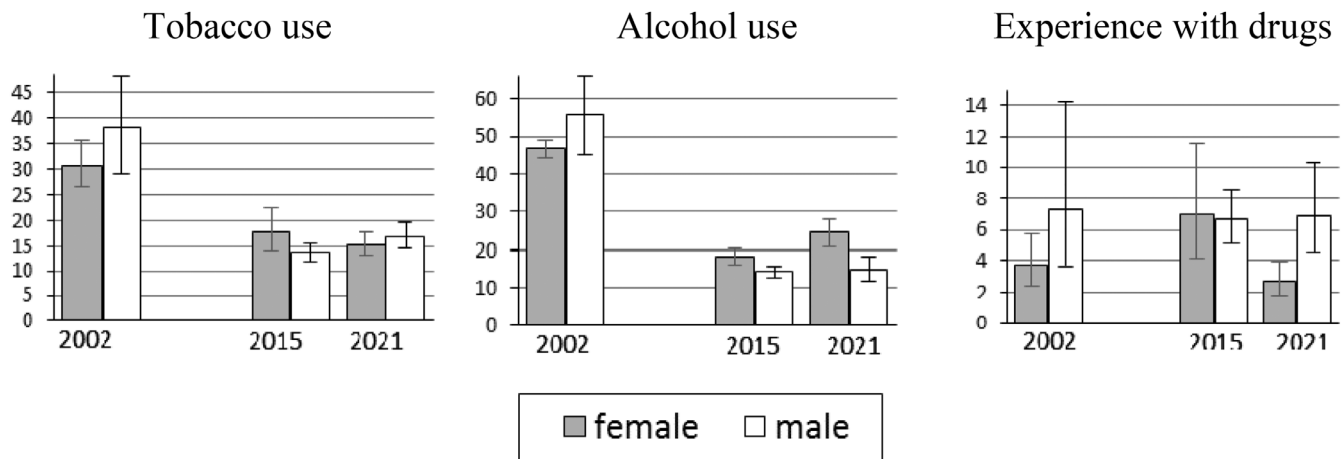


Figure 2. Proportion of adolescents who reported using psychoactive substances in 2002, 2015 and 2021. Bars are 95% confidence intervals

Table 3. Regression analyses of gender and cohort on adolescent substance use<sup>a</sup>

	Tobacco use		Alcohol use	
	COR (95% CI)	p	COR (95% CI)	p
Gender (female)	0.96 (0.77, 1.19)	.883	1.23 (0.88, 1.72)	.224
Cohort 2002 <sup>b</sup>	<b>2.70 (1.89, 3.86)</b>	<b>.000</b>	<b>3.86 (2.88, 5.18)</b>	<b>.000</b>
Cohort 2015 <sup>b</sup>	1.06 (0.74, 1.50)	.762	0.90 (0.71, 1.15)	.572
Gender × Cohort 2002 <sup>b</sup>	1.29 (0.76, 2.19)	.338	<b>3.14 (1.89, 5.27)</b>	<b>.000</b>
Gender × Cohort 2015 <sup>b</sup>	0.72 (0.53, 0.97)	.032	1.55 (1.07, 2.25)	.023

	Experience with drugs		Substance use	
	OR (95% CI)	p	B (95% CI)	p
Gender (female)	0.64 (0.32, 1.29)	.208	-0.05 (-0.14, 0.05)	.325
Cohort 2002 <sup>b</sup>	1.11 (0.64, 1.93)	.708	<b>0.73 (0.54, 0.91)</b>	<b>.000</b>
Cohort 2015 <sup>b</sup>	1.64 (1.03, 2.53)	.038	-0.00 (-0.13, 0.12)	.935
Gender × Cohort 2002 <sup>b</sup>	0.76 (0.25, 2.31)	.617	-0.40 (-0.76, -0.05)	.026
Gender × Cohort 2015 <sup>b</sup>	0.37 (0.14, 0.97)	.044	-0.00 (-0.12, 0.12)	.955

B, unstandardised regression coefficients; CI, confidence interval; COR, cumulative odds ratio; OR, odds ratio. All findings in bold are significant at Bonferroni-corrected alpha level of .0038.

<sup>a</sup>Adjusted for age.

<sup>b</sup>Reference category: 2021.

not all, studies of adolescent mental health trends (Collishaw & Sellers, 2020; Sourander et al., 2012).

The findings also showed substantial decreases in adolescent substance use. Over 19 years, there was a roughly fivefold decrease in weekly drinking and a threefold decrease in daily smoking. Most decreases occurred between 2002 and 2015; adolescent tobacco, alcohol and drug use did not change significantly from 2015 to 2021. A secular decrease in Russian adolescent substance use is consistent with findings from other countries (Azzopardi et al., 2019; Kraus et al., 2018; Ma et al., 2021; Schulenberg et al., 2014), suggesting that the causes of cross-cohort changes in tobacco and alcohol use are likely to be similar. The World Health Organization Framework Convention on Tobacco Control (2003) was implemented in the Russian Federation in 2008; alcohol control measures have been introduced at the beginning of the 21st century (World Health Organization, 2019). These policies and measures provided the basis for changes in social norms and for the

promotion of a healthy lifestyle shared by later cohorts of adolescents.

An important result of this study is the lack of significant change in adolescent mental health, as measured by the SDQ, and substance use from 2015 to during the pandemic in 2021, with the exception of a decrease in peer problems. That stands in contrast not only to findings during the pandemic (Jones et al., 2021; Samji et al., 2022), but also to evidence for time changes in adolescent mental health before the pandemic (Bélanger, Patte, Leatherdale, Ganssone, & Hadad, 2021; Cosma et al., 2020) and associated increases in school stress (Högberg, 2021). Our findings demonstrate that increases in adolescent internalising problems during the last decade are not universal and suggest that school pressure and other stresses, including the COVID-19 crisis, may not have a universal impact on adolescent mental health. They also provide circumstantial evidence that universally increased digital technology usage may not lead to increases in

adolescent mental health problems. The lack of COVID-19-related impact may be explained by less stringent restrictions in the region, widespread denialism, socioeconomic conditions, medical care and also by resilience and recovery.

Contrary to some studies (Jones et al., 2021; Samji et al., 2022), we did not find that female gender increased the risk for being adversely affected by the pandemic. However, secular trends in adolescent mental health, as measured by the SDQ, and substance use differed by gender, consistent with findings from other countries (Bor et al., 2014; Collishaw & Sellers, 2020; Pape, Rossow, & Brunborg, 2018; Simons-Morton et al., 2009). A decrease in prosocial behaviour and increases in emotional symptoms, internalising problems and total difficulties were significant only among girls. A decrease in alcohol use was larger among boys, both in absolute and in relative terms. These findings suggest that the causes of a worsening of girls' mental health in the 21st century may be universal and highlight the need for research into gender-specific risk and protective factors and for effective mental health interventions.

Gender differences in adolescent mental health, with girls reporting more problems, were similar to those seen worldwide (Campbell, Bann, & Patalay, 2021). The present study found that gender differences in adolescent emotional problems, total difficulties and their impact increased over the last 19 years, whereas gender differences in prosocial behaviour decreased. Previous studies in western countries provided evidence for the narrowing of the gender gap in adolescent alcohol use in the 21st century; however, gender-specific trends varied across the countries (Kraus et al., 2018; Pape et al., 2018; Simons-Morton et al., 2009). The present findings showed the closing and reversing of the gender gap in adolescent substance use in 2015 and 2021, indicating the need to consider whether and how the gender gaps in adolescent mental health and substance use have changed across time in different countries, and what the determinants of these changes are.

In line with studies from other countries (Dunn, 2002; Ganong & Coleman, 2017), living in a stepfamily was associated with higher levels of mental health difficulties. However, neither family composition nor parental occupation accounted for cross-cohort changes in Russian adolescent mental health and substance use. Previous research also showed that socio-demographic factors, such as family structure and socioeconomic status, may be important for levels of adolescent mental health and substance use at each time point, but do not explain over-time changes (Collishaw, Goodman, Pickles, & Maughan, 2007). Studies examining the effect of socio-demographic factors on pandemic-related changes in adolescent mental health have reported mixed results (Hu & Qian, 2021; Stevens et al., 2021). Further research on trends in possible explanatory factors and adolescent mental health, both within and between countries, is needed.

### *Strengths and limitations*

This study used three cohorts of adolescents and a comprehensive set of comparable mental health and substance use measures to assess cross-cohort

changes, including changes from before to during the COVID-19 pandemic in 2021. Further tests examined gender differences and the contribution of family composition and parental occupation. Importantly, the data were from an under-researched cultural context. Despite these strengths, there are several limitations. Although the samples were reasonably diverse, the study would benefit from the use of more representative samples, including other regions of the Russian Federation, other educational institutions, such as vocational schools, and adolescents not attending school. To increase comparability across cohorts, it would be preferable to collect data from the same schools at each time point. The cross-cohort comparisons did not allow us to examine within-individual changes, which would be possible with longitudinal data. Obvious limitations are the brief measure of mental health and exclusive reliance on self-reports. Although the SDQ is widely used worldwide, allowing for cross-country comparisons, the study would benefit from a more detailed diagnostic assessment and the data from multiple informants. In addition, it would be useful to include more measures of family and peer relationships and wider environment.

### **Conclusions**

This study provides evidence for substantial increases in Russian adolescent emotional symptoms and internalising problems, as measured by the SDQ, and decreases in tobacco and alcohol use in a large Siberian city over the last 19 years. The changes were substantial from 2002 to 2015 and nonsignificant from 2015 to 2021. A decrease in SDQ prosocial behaviour and increases in mental health problems were evident only among girls, whereas a decrease in alcohol use was larger among boys. Family composition and parental occupation did not account for these changes. The widening of the gender gap in adolescent mental health and the closing and reversing of the gender gap in substance use highlight the need for research into gender-specific risk and protective factors and for effective mental health interventions. There was no evidence of a worsening of Russian girls' and boys' mental health, as measured by the SDQ, from 2015 to 2021, a year after the onset of the COVID-19 pandemic. This can be a sign of successful coping; however, further research with more representative samples, additional measures and sources of information about adolescent mental health and the determinants of resilience and vulnerability is needed.

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## Ethical information

The study was approved by the Scientific Research Institute of Neuroscience and Medicine Ethics Committee (25.03.2015 Ref number 3).

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## Supporting information

Additional Supporting Information may be found in the online version of this article:

**Table S1.** Descriptions of substance use measures in 2002, 2015 and 2021 studies.

**Table S2.** Comparison of participants with complete and missing socio-demographic data.

**Table S3.** Descriptive statistics for mental health variables by year of study and gender.

**Table S4.** Regression analysis of gender, family composition and cohort on adolescent mental health.

**Table S5.** Regression analysis of gender, parental occupation and cohort on adolescent mental health.

**Table S6.** Regression analyses of gender, family composition and cohort on adolescent substance use.

**Table S7.** Regression analyses of gender, parental occupation and cohort on adolescent substance use.

## References

- Azzopardi, P.S., Hearps, S.J., Francis, K.L., Kennedy, E.C., Mokdad, A.H., Kassebaum, N.J., ... & Patton, G.C. (2019). Progress in adolescent health and wellbeing: Tracking 12 headline indicators for 195 countries and territories, 1990–2016. *The Lancet*, *393*, 1101–1118.
- Bélanger, R.E., Patte, K.A., Leatherdale, S.T., Ganssone, R.J., & Haddad, S. (2021). An impact analysis of the early months of the COVID-19 pandemic on mental health in a prospective cohort of Canadian adolescents. *The Journal of Adolescent Health*, *69*, 917–924.
- Blakemore, S.J., & Mills, K.L. (2014). Is adolescence a sensitive period for sociocultural processing? *Annual Review of Psychology*, *65*, 187–207.
- Bor, W., Dean, A.J., Najman, J., & Hayatbakhsh, R. (2014). Are child and adolescent mental health problems increasing in the 21st century? A systematic review. *The Australian and New Zealand Journal of Psychiatry*, *48*, 606–616.
- Campbell, O.L., Bann, D., & Patalay, P. (2021). The gender gap in adolescent mental health: A cross-national investigation of 566,829 adolescents across 73 countries. *SSM-Population Health*, *13*, 100742.
- Collishaw, S., Goodman, R., Pickles, A., & Maughan, B. (2007). Modelling the contribution of changes in family life to time trends in adolescent conduct problems. *Social Science & Medicine*, *65*, 2576–2587.
- Collishaw, S., & Sellers, R. (2020). Trends in child and adolescent mental health prevalence, outcomes, and inequalities. In E. Taylor, F.C. Verhulst, J. Wong, K. Yoshida, & A. Nikapota (Eds.), *Mental health and illness of children and adolescents* (pp. 1–11). Singapore: Springer.
- Cosma, A., Stevens, G., Martin, G., Duinhof, E.L., Walsh, S.D., Garcia-Moya, I., ... & De Looze, M. (2020). Cross-national time trends in adolescent mental well-being from 2002 to 2018 and the explanatory role of schoolwork pressure. *Journal of Adolescent Health*, *66*, S50–S58.
- Dumas, T.M., Ellis, W., & Litt, D.M. (2020). What does adolescent substance use look like during the COVID-19 pandemic? Examining changes in frequency, social contexts, and pandemic-related predictors. *Journal of Adolescent Health*, *67*, 354–361.
- Dunn, J. (2002). The adjustment of children in stepfamilies: Lessons from community studies. *Child and Adolescent Mental Health*, *7*, 154–161.
- Ganong, L., & Coleman, M. (2017). Effects of stepfamily living on children. In L. Ganong & M. Coleman (Eds.), *Stepfamily relationships* (pp. 175–189). Boston, MA: Springer.
- Georgas, J.E., Berry, J.W., Van de Vijver, F.J., Kağitçibaşı, Ç.E., & Poortinga, Y.H. (2006). *Families across cultures: A 30-nation psychological study*. Cambridge, UK: Cambridge University Press.
- Goodman, R. (2001). Psychometric properties of the strengths and difficulties questionnaire (SDQ). *Journal of the American Academy of Child and Adolescent Psychiatry*, *40*, 1337–1345.
- Goodman, R., Slobodskaya, H.R., & Knyazev, G.G. (2005). Russian child mental health: A cross-sectional study of prevalence and risk factors. *European Child and Adolescent Psychiatry*, *14*, 28–33.
- Högberg, B. (2021). Educational stressors and secular trends in school stress and mental health problems in adolescents. *Social Science & Medicine*, *270*, 113616.
- Hu, Y., & Qian, Y. (2021). COVID-19 and adolescent mental health in the United Kingdom. *Journal of Adolescent Health*, *69*, 26–32.
- Jones, E.A., Mitra, A.K., & Bhuiyan, A.R. (2021). Impact of COVID-19 on mental health in adolescents: A systematic review. *International Journal of Environmental Research and Public Health*, *18*, 2470.
- Knyazev, G.G., Slobodskaya, H.R., Kharchenko, I.I., & Wilson, G.D. (2004). Personality and substance use in Russian youths: The predictive and moderating role of behavioural activation and gender. *Personality and Individual Differences*, *37*, 827–843.
- Kraus, L., Seitz, N.N., Piontek, D., Molinaro, S., Siciliano, V., Guttormsson, U., ... & Hibell, B. (2018). 'Are the times A-Changin'? Trends in adolescent substance use in Europe. *Addiction*, *113*, 1317–1332.
- Ma, C., Xi, B., Li, Z., Wu, H., Zhao, M., Liang, Y., & Bovet, P. (2021). Prevalence and trends in tobacco use among adolescents aged 13–15 years in 143 countries, 1999–2018: Findings from the global youth tobacco surveys. *The Lancet Child & Adolescent Health*, *5*, 245–255.
- Pape, H., Rossow, I., & Brunborg, G.S. (2018). Adolescents drink less: How, who and why? A review of the recent research literature. *Drug and Alcohol Review*, *37*, S98–S114.
- Penner, F., Ortiz, J.H., & Sharp, C. (2021). Change in youth mental health during the COVID-19 pandemic in a majority Hispanic/Latinx US sample. *Journal of the American Academy of Child & Adolescent Psychiatry*, *60*, 513–523.
- Robinson, E., Sutin, A.R., Daly, M., & Jones, A. (2021). A systematic review and meta-analysis of longitudinal cohort studies comparing mental health before versus during the COVID-19 pandemic. *medRxiv*. <https://doi.org/10.1101/2021.03.04.21252921>
- Samji, H., Wu, J., Ladak, A., Vossen, C., Stewart, E., Dove, N., ... & Snell, G. (2022). Mental health impacts of the COVID-19 pandemic on children and youth—A systematic review. *Child and Adolescent Mental Health*, *27*, 173–189.
- Schulenberg, J.E., Patrick, M.E., Maslowsky, J., & Maggs, J.L. (2014). The epidemiology and etiology of adolescent substance use in developmental perspective. In M. Lewis & K. Rudolph (Eds.), *Handbook of developmental psychopathology* (pp. 601–620). New York: Springer.
- Simons-Morton, B.G., Farhat, T., Ter Bogt, T.F., Hublet, A., Kuntsche, E., Gabhainn, S.N., ... & Kokkevi, A. (2009). Gender specific trends in alcohol use: Cross-cultural comparisons from 1998 to 2006 in 24 countries and regions. *International Journal of Public Health*, *54*, 199–208.



- Sourander, A., Chudal, R., Skokauskas, N., Al-Ansari, A.M., Klomek, A.B., Pornnoppadol, C., ... & Lehti, V. (2018). Unmet needs of child and adolescent psychiatrists among Asian and European countries: Does the human development index (HDI) count? *European Child and Adolescent Psychiatry*, 27, 5–8.
- Sourander, A., Koskelainen, M., Niemela, S., Rihko, M., Ristkari, T., & Lindroos, J. (2012). Changes in adolescents' mental health and use of alcohol and tobacco: A 10-year time-trend study of Finnish adolescents. *European Child and Adolescent Psychiatry*, 21, 665–671.
- Stevens, G.W., Buyukcan-Tetik, A., Maes, M., Weinberg, D., Vermeulen, S.T., Visser, K., & Finkenauer, C. (2021). COVID-19 and late adolescent mental health. [Preprint]. <https://doi.org/10.31219/osf.io/czwea>
- World Health Organization. (2003). *WHO framework convention on tobacco control*. Geneva, Switzerland: World Health Organization.
- World Health Organization. (2019). *Alcohol policy impact case study. The effects of alcohol control measures on mortality and life expectancy in The Russian Federation*. Copenhagen, Denmark: WHO Regional Office for Europe.
- World Health Organization. (2021). WHO coronavirus (COVID-19) dashboard. Available from: <https://covid19.who.int/measures>
- Yang, X., Harrison, P., Huang, J., Liu, Y., & Zahn, R. (2021). The impact of COVID-19-related lockdown on adolescent mental health in China: A prospective study. [Preprint]. <https://doi.org/10.2139/ssrn.3792956>

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