Original Research Paper
Central Eur J Paed 2023;19(2):81-91
DOI: 10.5457/p2005-114.341

Mental Health of Adolescents before and during the Covid-19 Pandemic

Barbara Šencaj[1, 2], Ivana Barać[2], Mirela Karšić[1], Ružica Lovrić[1], Vesna Bilić-Kirin[1, 3], Mirjana Grebenar Čerkez[3, 4], Vedrana Lanc Čurdinjaković[3, 5], Jelena Kovačević[3, 6]

[1]Department of School Medicine, Teaching Institute of Public Health for the Osijek-Baranya County, Osijek, Croatia; [2]Nursing Institute "Professor Radivoje Radić", Faculty of Dental Medicine and Health Osijek, Josip Juraj Strossmayer University of Osijek, Osijek, Croatia;[3] Faculty of Medicine Osijek, Josip Juraj Strossmayer University of Osijek, Osijek, Croatia, [4]Clinical Hospital Centre Osijek, Osijek, Croatia, [5]Department of Epidemiology, Institute of Public Health of the Vukovar-Srijem County, Vinkovci, Croatia, [6]Institute of Emergency Medicine of the Vukovar-Srijem County, Vinkovci, Croatia

Correspondence: *dr.kovacevic.jelena@gmail.com;* Tel.: + 385 99 6041707; Fax.: + 385 32 300 500.

Received: August 31 2023; **Accepted**: October 30 2023

Abstract

Objective – The objective of the research was to examine the mental health of Croatian high-school students before and during the COVID-19 pandemic with regard to gender, age, school, residence, family structure, and parents' education. **Materials and Methods –** Total of 211 15-year-old first grade high-school students completed the YP-CORE questionnaire in the 2020, just before the lock-down enforced due to the COVID-19 pandemic. In 2022, now being 17-year-olds, 3rd-grade high-school students filled out the YP-CORE questionnaire once again during the COVID-19 pandemic. Socio-demographic data were collected from the participants' health charts. **Results –** The median YP-CORE score significantly increased from 7 in 2020 to 11 in 2022. A significant increase in psychological distress was determined, from 11% of adolescents in the pre-pandemic period to 23% of adolescents in the pandemic period. Significantly higher rates were reported by girls in both periods. Students from the School of Applied Arts and Design reported psychological distress significantly more often than students from the Electrical Engineering and Traffic School and the Grammar School before and during the pandemic. Family structure was significantly associated with YP-CORE scores only in the pre-pandemic period. **Conclusion –** The study showed that the COVID-19 pandemic had negative impact on mental health of Croatian adolescents, with certain sociodemographic risk factors being associated with poorer mental health outcomes.

Key Words: Adolescents ▪ Psychological Distress ▪ Mental Health ▪ COVID-19 Pandemic ▪ YP-CORE.

Introduction

In 2019, one in eight people suffered from a mental health disorder, with anxiety and depression being the most common ones (1). In the global population, one in six people is an adolescent (2). Worldwide, one in seven adolescents aged 10 to 19 experiences a mental health disorder, constituting 14% of all diseases in this age group (3, 4). The prevalent mental health disorders in adolescents are anxiety and depression at 43%, conduct disorders at 20%, and attention disorders at 19% (3). Based on literature data, depression has emerged as a major cause of disability in children and youth, and suicide ranks as the fourth leading cause of death among those aged 15 to 29 (4). The prevalence of mental health disorders in Croatia's youth aged 10 to 19 is 11.5%, implying that approximately 49000 boys and girls are grappling with some form of mental health issue (4).

The COVID-19 pandemic has led to an increase in the number of people grappling with mental health disorders, particularly a 26% rise in anxiety and a 28% increase in depression in its

inaugural year (5). In China, social isolation amplified the occurrence of depression and anxiety during the pandemic, with over half of the population reporting a detrimental impact of the COVID-19 pandemic on mental well-being (6). Research conducted in Croatia during the pandemic identified depressive and anxious symptoms in 9% of students, and posttraumatic stress disorder symptoms in 15% of students (7). Despite the prevailing notion that the youth are more resilient to the effects of COVID-19, epidemiological measures have negatively impacted their mental health (8). Various studies have underscored the impact of the pandemic on the mental health of children and adolescents (8, 9, 10). Preschool children reacted to the crisis with defiance and rebellious behavior, whereas adolescents displayed psychological problems (11). Changes in school routines, such as online education, mask-wearing, social distancing, restrictions on gatherings and socialization, and the absence of extracurricular activities, have adversely affected the mental well-being of students (11).

Sociodemographic variables, such as age, gender, living situation, parental education, exposure to and appraisal of COVID-19, psychotherapy before COVID-19 and parental mental health were associated with mental health of children and adolescents during the pandemic (11). Living together with both parents and higher parental education was associated with mental health problems in preschoolers and school-children (11). Recent systematic review of mental health problems in children and adolescents during the COVID-19 pandemic investigated sociodemographic factors and found that age was not a significant factor, but found male sex to be a protective factor. The review concluded that there is a small number of studies on this matter and that further research is needed (9).

Considering epidemiological measures undertaken during the COVID-19 pandemic, the Republic of Croatia was among countries with moderate to mild approach. Epidemiological measures at the beginning of the pandemic were strict and ranged from total lock-down with cessation of all economic activities, schools and nurseries closure, restrictions on social gatherings to the level of nuclear family, followed by the on-line education and reactivation of economy. Toward the end of the pandemic education was conducted in schools with masks and social distance, social gatherings were less restricted and ranged from 50 to 100 people, with allowed sports and extracurricular activities.

As part of its national public health strategy, the Republic of Croatia introduced mental health screening as an element of preventive systematic examination in the first grade of high school, piloting it during the academic year 2019/2020 (12). The primary objective of this national screening program was to identify early mental health risks in young people and to intervene promptly. Literature data underscores that early onset of mental health disorders increases the risk of comorbidity and mental health problems in adulthood. In contrast, children and youth without mental health problems experience improved health outcomes throughout their lives (13).

This mental health screening laid the groundwork for investigating the effects of the COVID-19 pandemic on the mental well-being of adolescents both before and during the pandemic, constituting the focus of this study.

Therefore, the aim of the study was to investigate the mental health of Croatian adolescents before and during the COVID-19 pandemic, and to determine the socio-demographic characteristics of adolescents that are associated with their mental health status.

Materials and Methods

The research was conducted in the School Medicine Department of the Teaching Institute of Public Health for Osijek-Baranya County in Croatia. The participants were Croatian high-school students recruited from the following secondary schools: Electrical Engineering and Traffic School, Grammar School, and School of Applied Arts and Design in Osijek, Croatia. The measurements were taken in two time points. The first measurement was taken during the systematic examination in the 1st grade of secondary school before the onset of the COVID-19 pandemic in Croatia. That was in

the academic year 2019/2020, during January and February of 2020. The second measurement was taken in the 3rd grade of secondary school during March and April of 2022. In Croatian schooling system, 1st grade high-school students are about 15 years old, while in the third grade they are about 17 years old. During the first measurement in 2020, the pandemic had not yet started in Croatia and school education proceeded normally. During the second measurement in the 2022, the COVID-19 pandemic had been in the decline in Croatia, the strictest measures, such as on-line education, restrictions on gatherings and socialization, absence of extracurricular activities were abandoned, and the high-school education was performed in the school using masks and social distance. At both time-points, the measurements were done in person in the school premises.

At both time points, the participants completed a standardized questionnaire, called YP-CORE, used to assess mental health risks. Sociodemographic data were collected from their health charts and these included gender, age, place of residence, type of high school, family structure, and parents' education level.

Out of 369 3rd-grade high-school students in these three schools, 255 completed the YP-CORE questionnaire. The inclusion criteria were as follows: completion of the YP-CORE questionnaire from the 1st grade, fully completed questionnaires, and signed informed consent by the parents/guardians. These criteria were met by 211 students.

The YP-CORE is an instrument designed to measure psychological distress in children and youth (14). It was translated into Croatian and approved according to the CORE System Trust protocol (15, 16, 17). The questionnaire consists of 10 items that assess anxiety, depression, trauma, physical difficulties, functioning, and the risk of auto-aggressive behavior over the past 7 days. The response options range from "never" and "very rarely" to "sometimes," "often," and "almost always." Each answer is scored from 0 to 4, and 3 items are reverse-scored. A higher score indicates higher psychological distress. The cutoff values for psychological distress and mental health risk were as follows: for males, YP-CORE score ≥17 or answering "I had thought of self-harm"; for females, YP-CORE score ≥20 or answering "I had thought of self-harm" (18). According to literature data, the YP-CORE is a reliable scale with Cronbach alpha index for all components of 0.85 (95% CI: 0.82 to 0.88).

The Cronbach alpha index was 0.83 (95% CI: 0.77 to 0.88) for boys and 0.85 (95% CI: 0.81 to 0.88) for girls. The reliability was also satisfactory across all age groups (14). Other studies also found high reliability of this scale (17).

Ethical Considerations

Ethical approval was obtained from the Ethical Committee of the Teaching Institute of Public Health for Osijek-Baranya County (No. 381-05-22-4). Informed consent was obtained from the parents/legal guardians of all participants.

Statistical Analyses

Categorical variables were presented using absolute and relative frequencies. Numerical variables were described using median and interquartile range. Categorical variables were tested using the chi-square test. The normality of the distribution of numerical variables was assessed using the Kolmogorov-Smirnov test. Due to the non-normal distribution of numerical variables, the Wilcoxon test was employed to test two dependent groups. Differences in proportions in dependent samples were tested using McNemar's test. Differences between two independent samples of numerical variables were examined using the Mann-Whitney U test, while differences between three or more independent samples were assessed using the Kruskal-Wallis test. All p-values are two-sided, and the level of significance was set at P=0.05. The statistical software SPSS (version 22.0, SPSS Inc., Chicago, IL, USA) was utilized.

Results

The research included 211 participants, with 117 (55%) being boys and 94 (45%) being girls. The median age of the participants in the first grade of

high-school at the time of the first measurement was 15 years (interquartile range 15 to 15), ranging from 14 to 16 years. At the time of the second measurement in the third grade of high-school, the median age of the participants was 17 years (interquartile range 17 to 17), ranging from 16 to 18 years.

Sociodemographic data of the participants are presented in Table 1. The median YP-CORE score in the year 2020 was 7 (interquartile range 5 to 11), ranging from 1 to 31, while the median YP-CORE score in the year 2022 was 11 (interquartile range 7 to 17), ranging from 0 to 37. The results showed a significant increase in YP-CORE scores during the pandemic period (P<0.001) (Table 2).

In the year 2020, psychological distress was determined in 11% of participants, while in 2022, 23% of participants reported signs of psychological distress, representing a significant increase. A significant difference in YP-CORE results was found between boys and girls (P<0.001), with girls reporting more psychological distress both in the pre-pandemic and pandemic periods (Table 3).

Table 2. YP-CORE Total Scores before and during the COVID-19 Pandemic

YP-CORE score	Median (Interquartile range)	P*
2020	7 (5 – 11)	<0.001
2022	11 (7 – 17)	

*Wilcoxon test.

There was no significant difference in YP-CORE results based on the place of residence in both the pre-pandemic and pandemic periods (Table 4).

A significant difference in YP-CORE results was observed among high schools (P<0.001), with students from the School of Applied Arts and Design reporting psychological distress more frequently than students from the Grammar School and the

Table 1. Sociodemographic Characteristics of the Participants

Characteristics		N (%)
Gender	Male	117 (55)
	Female	94 (45)
Age	16 years	5 (2)
	17 years	187 (89)
	18 years	19 (9)
Place of residence	Urban	101 (48)
	Rural	110 (52)
High-school	Electrical Engineering and Traffic School	82 (39)
	Grammar School	90 (43)
	School of Applied Arts and Design	39 (18)
Family structure	Complete family with siblings	152 (72)
	Complete family – only child	18 (9)
	Divorced parents with siblings	25 (12)
	Divorced parents – only child	9 (4)
	Parent widow/er	7 (3)
Father's education level	Primary school	14 (7)
	Secondary school	147 (70)
	Bachelor of science	14 (6)
	Master of science	36 (17)
Mother's education level	Primary school	11 (5)
	Secondary school	140 (66)
	Bachelor of science	14 (7)
	Master of science	46 (22)
Total		211 (100)

Electrical Engineering and Traffic School, both in the pre-pandemic and pandemic periods (Table 5).

Significant psychological distress was reported by high school students from divorced parents in the pre-pandemic period (P=0.03), while there was no significant difference in the levels of psychological distress based on family structure during the pandemic period (Table 6).

The education level of parents was not associated with the level of psychological distress in adolescents, neither in the pre-pandemic period nor in the pandemic period (Tables 7, 8).

Thoughts of self-harm were reported by 8.5% of students in the pre-pandemic period and by 12.8% of students in the pandemic period, but the increase was not significant (P=0.16). The risk of auto-aggression increased in both genders, but it was not significant; for girls, it went from 13.8% before the pandemic to 18.1% during the pandemic (P=0.50), and for boys, it went from 4.3% before the pandemic to 8.5% during the pandemic (P=0.27) (Table 9).

Girls significantly more often considered auto-aggression than boys in both the pre-pandemic (P=0.01) and pandemic periods (P=0.02). Students from the School of Applied Arts and Design considered self-harm more often than students from the Electrical Engineering and Traffic School or

Table 3. Psychological Distress before and during the COVID-19 Pandemic

Year	Emotional distress	Males	Females	P*	N (%)	P†
		N (%)			Total	
2020	No	112 (96)	76 (81)	<0.001	188 (89)	0.0002
	Yes	5 (4)	18 (19)		23 (11)	
2022	No	97 (83)	65 (69)	0.01	162 (77	
	Yes	20 (17)	29 (31)		49 (23)	
Total		117 (100)	94 (100)		211 (100)	

*χ^2 test; †McNemar test.

Table 4. Psychological distress before and during the COVID-19 Pandemic according to Place of Residence

Year	Psychological distress	Urban	Rural	Total	P*
		N (%)			
2020	No	86 (85)	102 (93)	188 (89)	0.08
	Yes	15 (15)	8 (7)	123 (11)	
2022	No	74 (73)	88 (80)	162 (77)	0.25
	Yes	27 (27)	22 (20)	49 (23)	
Total		101 (100)	110 (100)	211 (100)	-

*χ^2 test.

Table 5. Psychological Distress before and during the COVID-19 Pandemic according to Type of School

Year	Psychological distress	*School	†School	‡School	Total	P§
		N (%)				
2020	No	78 (95)	82 (91)	28 (72)	188 (89)	<0.001
	Yes	4 (5)	8 (9)	11 (28)	23 (11)	
2022	No	69 (84)	74 (82)	19 (49)	162 (77)	<0.001
	Yes	13 (16)	16 (18)	20 (51)	49 (23)	
Total		82 (100)	90 (100)	39 (100)	211 (100)	

*Electrical Engineering and Traffic School; †Grammar; ‡School of Applied Arts and Design; §χ^2 test.

Table 6. Psychological Distress before and during the COVID-19 Pandemic according to Family Structure

Year	Psychological distress	Complete family with siblings	Complete family – only child	Divorced parents with siblings	Divorced parents – only child	Parent widow/er	Total	P*
		N (%)						
2020	No	140 (92)	17 (94)	18 (72)	7 (78)	6 (86)	188 (89)	0.03
	Yes	12 (8)	1 (6)	7 (28)	2 (22)	1 (14)	23 (11)	
2022	No	122 (80)	11 (61)	19 (76)	5 (56)	5 (71)	162 (77)	0.21
	Yes	30 (20)	7 (39)	6 (24)	4 (44)	2 (29)	49 (23)	
Total		152 (100)	18 (100)	25 (100)	9 (100)	7 (100)	211 (100)	

*χ^2 test.

Table 7. Psychological Distress before and during the COVID-19 Pandemic according to Father's Education Level

Year	Psychological distress	Primary school	Secondary school	Bachelor of science	Master of science	Total	P*
		N (%)					
2020	No	10 (71)	131 (88)	13 (100)	34 (94)	188 (89)	0.07
	Yes	4 (29)	17 (12)	0 (0)	2 (6)	23 (11)	
2022	No	10 (71)	113 (76)	10 (77)	30 (83)	162 (77)	0.77
	Yes	4 (29)	35 (24)	3 (23)	6 (17)	49 (23)	
Total		14 (100)	148 (100)	13 (100)	36 (100)	211 (100)	-

*χ^2 test.

Table 8. Psychological Distress before and during the COVID-19 Pandemic according to Mother's Education Level

Year	Psychological distress	Primary school	Secondary school	Bachelor of science	Master of science	Total	P*
		N (%)					
2020	No	10 (91)	121 (86)	14 (100)	43 (94)	188 (89)	0.30
	Yes	1 (9)	19 (14)	0 (0)	3 (6)	23 (11)	
2022	No	10 (91)	101 (72)	13 (93)	80 (83)	162 (77)	0.12
	Yes	1 (9)	39 (28)	1 (7)	8 (17)	49 (23)	
Total		11 (100)	140 (100)	14 (100)	46 (100)	211 (100)	-

*χ^2 test.

Table 9. Risk of Self-harm before and during the COVID-19 Pandemic

Year	Answer	Total	Males	Females
		N (%)		
2020	Yes	18 (9)	5 (4)	13 (14)
	No	193 (91)	112 (96)	81 (86)
2022	Yes	27 (13)	10 (9)	17 (18)
	No	184 (87)	107 (91)	77 (82)
Total		211 (100)	117 (100)	94 (100)
P*		0.16	0.27	0.50

*McNemar's test.

the Grammar School in both the pre-pandemic (P=0.001) and pandemic periods (P=0.02). In the pre-pandemic period, adolescents with divorced parents and siblings, as well as those from complete families with or without siblings, considered self-harm more often than adolescents from complete families without siblings and those with parents who were widowers (P=0.005). In the pandemic period, family structure was not associated with thoughts of self-harm. Thoughts of self-harm were not associated with parents' education level in either of the investigated periods (Table 10).

Table 10. Risk of Self-harm according to Gender, Place of Residence, School, Family Structure and Parents' Education Level

Variable	Year	Category	Median (interquartile range)	Min – max	P
Gender	2020	Male	0 (0 – 0)	0 – 1	0.01*
		Female	0 (0 – 0)	0 – 4	
	2022	Male	0 (0 – 0)	0 – 2	0.02*
		Female	0 (0 – 0)	0 – 4	
Place of residence	2020	Urban	0 (0 – 0)	0 – 4	0.09*
		Rural	0 (0 – 0)	0 – 3	
	2022	Urban	0 (0 – 0)	0 – 4	0.41*
		Rural	0 (0 – 0)	0 – 3	
Type of school	2020	Electrical Engineering and Traffic School	0 (0 – 0)	0 – 1	0.001†
		Grammar School	0 (0 – 0)	0 – 3	
		School of Applied Arts and design	0 (0 – 0)	0 – 4	
	2022	Electrical Engineering and Traffic School	0 (0 – 0)	0 – 3	0.02†
		Grammar School	0 (0 – 0)	0 – 3	
		School of Applied Arts and design	0 (0 – 1)	0 – 4	
Family structure	2020	Complete family -with siblings	0 (0 – 0)	0 – 4	0.005†
		Complete family – only child	0 (0 – 0)	0 – 1	
		Divorced parents -with siblings	0 (0 – 1)	0 – 3	
		Divorced parents – only child	0 (0 – 0)	0 – 3	
		Parent widow/er	0 (0 – 0)	0 – 1	
	2022	Complete family -with siblings	0 (0 – 0)	0 – 4	0.40†
		Complete family – only child	0 (0 – 0)	0 – 3	
		Divorced parents -with siblings	0 (0 – 0)	0 – 4	
		Divorced parents – only child	0 (0 – 1)	0 – 1	
		Parent widow/er	0 (0 – 0)	0 – 2	
Father's education level	2020	Primary school	0 (0 – 0,25)	0 – 1	0.18†
		Secondary school	0 (0 – 0)	0 – 1	
		Bachelor of science	0 (0 – 0)	0 – 1	
		Master of science	0 (0 – 0)	0 – 1	
	2022	Primary school	0 (0 1,25)	0 – 2	0.15†
		Secondary school	0 (0 – 0)	0 – 1	
		Bachelor of science	0 (0 – 0)	0 – 1	
		Master of science	0 (0 – 0)	0 – 1	

Continuation of Table 10.

Variable	Year	Category	Median (interquartile range)	Min – max	P
Mother's education level	2020	Primary school	0 (0 – 0)	0 – 1	0.16†
		Secondary school	0 (0 – 0)	0 – 1	
		Bachelor of science	0 (0 – 0)	0 – 1	
		Master of science	0 (0 – 0)	0 – 1	
	2022	Primary school	0 (0 – 0)	0 – 2	0.41†
		Secondary school	0 (0 – 0)	0 – 2	
		Bachelor of science	0 (0 – 0)	0 – 1	
		Master of science	0 (0 – 0)	0 – 1	

*Mann-Whitney U test; †Kruskal-Wallis test.

Discussion

The objective of the research was to assess the mental health status of 17-year-old 3rd-grade high-school adolescents during the COVID-19 pandemic and compare the obtained results to their mental health status when they were 15 years old in the first grade of high school. The results revealed a significant difference in mental health status before and during the COVID-19 pandemic, indicating an increase in psychological distress among adolescents during the pandemic. Similar findings of poorer mental health and well-being among adolescents during the COVID-19 pandemic were observed in other studies as well (5, 9, 10). A study conducted in Zagreb, the capital of the Republic of Croatia, in 2021 across all primary and secondary schools with a sample of 22000 children and adolescents also obtained comparable results (7).

In 2020, the mean YP-CORE score was 7, similar to a non-clinical sample study of pupils in Great Britain, with a mean score of 7.4 (14). During the pandemic, adolescents scored higher with a mean score of 11, indicating elevated psychological distress. Another Croatian study conducted in 2012 (16) reported even higher scores at two time points, possibly influenced by factors other than the COVID-19 pandemic. Moreover, separate research in Croatia conducted before the COVID-19 pandemic reported YP-CORE mean scores ranging from 10.5 to 16.1 across five time points throughout high school education with the peak in the second grade of high-school (17). Increase in the YP-CORE might be related to the age itself, but other authors associated the increase of YP-CORE results during education to the time periods associated with more frequent examinations potentially affecting adolescents' psychological state and to the "educational stressors theory" that links pressure of achieving success in school to the emotional state of adolescents (17).

Psychological distress was observed in 11% of the 15-year-old adolescents in the first grade of high school, while in the third grade, the percentage rose to 23% among 17-year-old adolescents, signifying a notable increase. A similar pattern of increase was identified in aforementioned Croatian research employing the same questionnaire, with rates increasing from 26% in the first grade to 55% in the third grade of high school (17).

Furthermore, this research highlighted significant gender differences, with females reporting higher scores than males in both the pre-pandemic and pandemic periods. Another study conducted in Croatia in 2020 using the same methodology also found females reporting more psychological distress during the systematic examination in the first grade of high school (19). Other studies also confirmed higher prevalence of psychological difficulties in girls compared to boys (16, 20, 21), which may be attributed to hormonal influences and social factors that encourage emotional expression in girls as opposed to boys (22, 23).

Other studies have reported age associations with mental health risks assessed by the YP-CORE

questionnaire (11, 14, 21, 24). This study could not explore the impact of age on mental health outcomes due to homogenous age of the participants. No significant differences in mental health risks among adolescents were found in relation to their urban or rural place of residence.

The study's outcomes indicated significantly higher psychological distress among adolescents attending the School of Applied Arts and Design compared to those attending the Grammar School and the School of Electrical Engineering and Traffic. This disparity could be attributed to the predominantly female student population at the School of Applied Arts and Design, where only 15% of participants were male. Conversely, only 6% of participants at the School of Electrical Engineering and Traffic were female due to its primarily male student body, while the Grammar School had a more balanced gender distribution. In contrast, other studies have shown higher mental health risks in grammar schools compared to vocational schools (16). A study exclusively among females found no difference between grammar and vocational schools but reported higher questionnaire scores overall (23).

The study also confirmed the influence of family structure on adolescents' mental health. In the pre-pandemic period, family structure significantly impacted psychological distress, though this difference disappeared during the pandemic. Some experts argue that the COVID-19 pandemic might have hindered the traditionally positive effects of social support within families due to financial and economic pressures stemming from the pandemic (25). The study found no association between adolescents' psychological distress and parents' education level, despite previous findings linking higher parental education with children's psychological distress (11).

The risk of self-harm did not significantly increase during the investigated period, fluctuating from 9% in 2020 to 13% in 2022. These rates are lower than those reported by the Croatian Institute of Public Health, where 25% of sixteen-year-old adolescents in Croatia expressed self-aggressive thoughts and 10% attempted suicide. Female adolescents exhibited a higher risk (26). This study also revealed significant differences in self-harm ideation between genders and among different schools, again potentially due to schools with predominantly female student populations. Self-harm ideation was associated with family structure in the pre-pandemic period but not during the pandemic. Parents' education level was not linked to self-aggressive thoughts in either investigated period.

The study outcomes offer valuable insights for parents, teachers, and healthcare professionals to identify the required actions to timely detect adolescents' psychological distress and provide essential support and treatment. The study also identified factors influencing adolescents' psychological distress. A different study assessing mental health in Croatia during the pandemic identified risk factors such as female sex, young and senior age, migration, infection concerns, insecurity, high-risk perceptions, media exposure, previous infections, and pre-existing conditions. Protective factors included social support, personal interactions, health literacy, access to accurate information, comprehension of information, and adherence to guidelines (25). The United Nations Children's Fund underscores the significance of identifying, understanding, and addressing risk factors for mental health problems in children and adolescents (27). The importance of parenting, supportive learning environments, and peer relationships in fostering mental health is emphasized (27). However, individual responses to various factors can differ. For instance, a school can have both protective and detrimental effects on a child's mental health. While a school can boost mental health through knowledge dissemination, personal growth opportunities, and enhanced self-esteem, it can also be detrimental if it perpetuates violence, bullying, stress, or harsh teaching methods (28). Other reported risk factors for adolescents' mental health include bullying, social isolation, inadequate physical activity, obesity, malnutrition, sedentary lifestyles, substance use, school absenteeism, early marriages, and experiences of sexual, physical, or psychological abuse (27). The COVID-19 pandemic has exacerbated mental health issues globally, warranting heightened efforts to address this public health concern (5).

Limitations of the Study

Several limitations of this study should be acknowledged. Firstly, the questionnaire relied on self-reporting. Secondly, the timing of measurements might not have accounted for other stress sources potentially influencing adolescents' psychological states. Thirdly, the sample did not encompass all high schools due to the start of lockdown measures before administrating YP-CORE in certain schools for the purpose of the first measurement.

Conclusion

The study showed that the COVID-19 pandemic had negative impact on mental health of Croatian adolescents, with certain sociodemographic risk factors being associated with poorer mental health outcomes. Subsequent research is needed to understand the long-term effects of the pandemic on adolescents' mental health and to explore the risk factors of mental health outcomes in adolescents, with the objective of formulating comprehensive national public health strategies.

Authors' Contribution: Conception and design: BŠ, IB, JK; Acquisition, analysis and interpretation of data: BŠ, IB, MK, RL, VBK, JK; Drafting the article: BŠ, IB, JK; Revising it critically for important intellectual content: BŠ, IB, MGČ, VLČ, JK; Approved final version of the manuscript: BŠ, IB, MK, RL, VBK, MGČ, VLČ, JK.

Conflict of Interest: The authors declare that they have no conflict of interest.

References

1. Institute for Health Metrics and Evaluation. Global Burden of Disease Results [homepage on the Internet]. Seattle: Hans Rosling Center for Population Health; [cited 2022 Jun 19]. Available from: https://vizhub.healthdata.org/gbd-results.
2. Adolescent mental health [homepage on the Internet]. Geneva: World Health Organization; [cited 2022 Jun 1]. Available from: https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health.
3. Adolescent mental health statistics [homepage on the Internet]. New York: United Nations Children's Fund (UNICEF); [cited 2022 May 31]. Available from: https://data.unicef.org/topic/child-health/mental-health/.
4. Report on the mental health of children and youth in the world [in Croatian]. [homepage on the Internet]. Zagreb: UNICEF; [cited 2022 Jun 17]. Available from: https://www.unicef.org/croatia/mediji/izvjestaj-o-mentalnom-zdravlju-djece-i-mladih-u-svijetu-0.
5. Mental Health and COVID-19: Early evidence of the pandemic's impact: Scientific brief [homepage on the Internet]. Geneva: World Health Organization; [cited 2022 Jun 19]. Available from: https://www.who.int/publications-detail-redirect/WHO-2019-nCoV-Sci_Brief-Mental_health-2022.1.
6. Gao J, Zheng P, Jia Y, Chen H, Mao Y, Chen S, et al. Mental health problems and social media exposure during COVID-19 outbreak. PLOS ONE. 2020;15(4):e0231924.
7. Buljan Flander G, Miklošić I, Redžepi G, Selak Bagarić E, Brezinšćak T. One year later: Results of the mental health screening of children in Zagreb [in Croatian]. [homepage on the Internet]. Zagreb: City of Zagreb; [cited 2022 Jun 18]. Available from: https://www.zagreb.hr/en/godinu-dana-poslije-rezultati-probira-mentalnog-zd/170767.
8. Antičević V. Effects of pandemics on mental health [in Croatian]. Druš Istraz. 2021;30(2):423-43. doi: 10.5559/di.30.2.12.
9. Chai J, Xu H, An N, Zhang P, Liu F, He S, et al. The prevalence of mental problems for Chinese children and adolescents during COVID-19 in China: A systematic review and meta-analysis. Front Pediatr. 2021;9:661796.
10. Viner R, Russell S, Saulle R, Croker H, Stansfield C, Packer J, et al. School closures during social lockdown and mental health, health behaviors, and well-being among children and adolescents during the first COVID-19 wave: A systematic review. JAMA Pediatr. 2022;176(4):400-9. doi: 10.1001/jamapediatrics.2021.5840.
11. Schmidt S, Barblan L, Lory I, Landolt M. Age-related effects of the COVID-19 pandemic on mental health of children and adolescents. Eur J Psychotraumatology. 2021;12:1901407. doi: 10.1080/20008198.2021.1901407.
12. Croatian Institute of Public Health [homepage on the Internet]. Zagreb: Croatian Institute of Public Health; [cited 2023 Aug 30]; Available from: https://www.hzjz.hr/priopcenja-mediji/odrzano-je-svecano-pokretanja-pilot-projekta-probir-rizika-u-mentalnom-zdravlju-skolske-djece/.
13. Caspi A, Houts RM, Ambler A, Danese A, Elliott ML, Hariri A, et al. Longitudinal Assessment of Mental Health Disorders and Comorbidities Across 4 Decades Among Participants in the Dunedin Birth Cohort Study. JAMA Netw Open. 2020;3(4):e203221. doi: 10.1001/jamanetworkopen.2020.3221.

14. Twigg E, Barkham M, Bewick B, Mulhern, Connell J, Cooper M. The Young Person's CORE: Development of a brief outcome measure for young people. Couns Psychother Res. 2009;9:160-8. doi: 10.1080/14733140902979722.

15. Clinical Outcomes in Routine Evaluation. Approved YP-CORE translations [homepage on the Internet]. Bath: The CORE System Trust; [cited 2023 Aug 30]. Available from: https://www.coresystemtrust.org.uk/home/copyright-licensing/approved-translations/approved-yp-core-translations/.

16. Kozjak Mikic Z, Jokic-Begic N, Bunjevac T. Health difficulties and sources of concern for adolescents during adaptation to high school [in Croatian]. Psihol teme. 2012;2:317-36.

17. Kozjak Mikic Z, Mikic K, Odak H. Emotional distress and negative automatic thoughts of students during secondary school education[in Croatian]. Soc psihijat. 2021;49(1):3–23. dpi: 10.24869/spsih.2021.3.

18. Croatian Institute of Public Health. Risk screening for the mental health of schoolchildren; protocol of the organization; and implementation of the pilot project. Zagreb (Croatia) [in Croatian]: Croatian Institute of Public Health; 2019.

19. Jureša V, Posavec M, Prugovečki SL, Musil V, Majer M, Petričević TV. Adolescent mental health: analysis using YP-CORE test in School health services in Croatia. Eur J Public Health. 2020;30:924.

20. O'Reilly A, Peiper N, O'Keeffe L, Illback R, Clayton R. Performance of the CORE-10 and YP-CORE measures in a sample of youth engaging with a community mental health service. Int J Methods Psychiatr Res. 2016;25(4):324-32. doi: 10.1002/mpr.1500.

21. Twigg E, Cooper M, Evans C, Freire E, Mellor-Clark J, McInnes B, et al. Acceptability, reliability, referential distributions and sensitivity to change in the Young Person's Clinical Outcomes in Routine Evaluation (YP-CORE) outcome measure: replication and refinement. Child Adolesc Ment Health. 2016;21(2):115-23. doi: 10.1111/camh.12128.

22. Rose AJ, Rudolph KD. A review of sex differences in peer relationship processes: Potential trade-offs for the psychological and behavioral development of girls and boys. Psychol Bull. 2006;132(1):98-131. doi: 10.1037/0033-2909.132.1.98.

23. Kozjak Mikić Z, Jokić-Begić N. Emotional difficulties of adolescent girls after the transition to high school [in Croatian]. Soc psihijat. 2013;41(4):226-34.

24. Kribl M. Report on the work of the Center for Mental Health Care, Prevention, and Outpatient Treatment of Addiction of the Institute for Public Health of Osijek-Baranja County for the period from 2020 to 2022. Osijek (Croatia) [in Croatian]. Teaching Institute of Public Health for the Osijek-Baranya County; 2022.

25. Buljan Flander G, Galić R, Roje Đapić M, Raguž A, Prijatelj K. Protective and risk factors in adaptation to the COVID-19 pandemic in the Republic of Croatia [in Croatian]. Soc psihijat. 2020;48(3):285-300. doi: 10.24869/spsih.2020.285.

26. Svjetski dan mentalnog zdravlja [homepage on the Internet]. Zagreb: Croatian Institute of Public Health; [cited 2022 Jun 17]. Available from: https://www.hzjz.hr/sluzba-promicanje-zdravlja/svjetski-dan-mentalnog-zdravlja/.

27. United Nations Children's Fund. The state of the world's children 2021: On my mind – Promoting, protecting and caring for children's mental health. New York: UNICEF; 2021.

28. Ungar M. Designing resilience research: Using multiple methods to investigate risk exposure, promotive and protective processes, and contextually relevant outcomes for children and youth. Child Abuse Negl. 2019;96:104098. doi: 10.1016/j.chiabu.2019.104098.