

Features of adolescent psychiatric hospitalizations before and after the onset of COVID-19

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UNIVERSITY OF RIJEKA

FACULTY OF MEDICINE

**INTEGRATED UNDERGRADUATE AND GRADUATE UNIVERSITY STUDY OF
MEDICINE IN ENGLISH**

Macha Natacha Bogdanovic

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BEFORE AND AFTER THE ONSET OF COVID-19**

GRADUATION THESIS

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List of abbreviations and acronyms

ADHD: Attention Deficit Hyperactivity Disorder

CHC: Clinical Hospital Centre (in Croatian lang.: *Klinički Bolnički Centar*)

COVID-19: Coronavirus Disease 2019

ICD-10: International Classification of Disease, 10th Revision

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2

WHO: World Health Organization

1. Introduction

1.1 COVID pandemic

The rapid spread of the infection by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) led to the declaration of COVID-19 pandemic on the 11th of March 2020 (1). The growing numbers of deceased due to the viral infection has brought fear into people as well as concern for their loved ones. Government-led restrictions have obliged people to isolate from each other, leading to reduced social contact between people. Both the fear of getting infected, and the lack of social interactions had a great impact on people. Children and adolescents had to attend school online and put their extra-curricular activities on pause as well as peer interactions. In Croatia, the governmental response to the rising number of infected people was the closure of schools from the 16th of March 2020 (2). There had been changes in the educational system throughout the year of 2020, and children and adolescents were following classes remotely or in person, depending on the epidemiological situation (3). The second wave of COVID-19 led again to the closure of both primary and secondary schools in December 2020 (3). In the Primorsko-Goranska County, the hybrid model of education was used until May 2021 (4). Younger children were less affected by these changes, while adolescents were more often required to follow classes remotely (4).

1.2 Mental disorders in adolescence

1.2.1 Adolescence

Adolescence is the transitional period between childhood and adulthood. This period of life starts with puberty, and reaches the end when acceptance of the identity and behaviour is achieved (5). Puberty can be defined as physiological changes marked by the development of sexuality, primary and secondary sexual characteristics as well as hormonal changes (6). However, adolescence refers to psychosocial changes in relation to puberty (6). The onset of adolescence usually overlaps with the onset of puberty, leading to psychological adaptation to puberty and to new internal and external conditions that the adolescent faces (6). This is a period during which adolescents gain autonomy, and gradually begin to separate from their parents, creating individual relations with their environment (7).

According to Peter Blos, adolescence can be divided into five phases: preadolescence, early adolescence, middle adolescence, late adolescence and post-adolescence (6).

Preadolescence occurs between 10 and 12 years of age. In both sexes, regressive behaviour is dominant during this phase. Another characteristic of this phase is revival of interest towards the body, anatomical differences, sexual curiosity and masturbation (6). The main conflicts in boys are the castration fear related to the mother, exhibitionism, as well as phallic narcissism which is demonstrated through the overvaluation of their phallus (symbolic representation of penis, symbol of power)_as a source of self-respect (6). As a mean of defence, boys tend to connect with peers of the same sex, giving this phase also the name of “homosexual stage”. Similarly, in girls, there is a reactivation of the ambivalent conflict with their mother, and just like in boys, a need for exhibitionism (6).

Early adolescence starts at 12 years of age and lasts until 14. During this period, regression and narcissistic features are prominent (6). Menarche begins in this stage in girls, and first ejaculations in boys, which give a sense of loss of control of adolescents in this period. They have an ambivalent relationship with their parents, having a need of dependence with them, but also looking for autonomy (6). Adolescents in this period usually look for peers having a similar personality to their own, also known as the narcissistic object choice (6).

Middle adolescence lasts from 14 until 16 years of age. In this phase, relationships outside the home are more significant, adolescents are searching for a heterosexual object, and the first experience of falling in love occurs. Middle or true adolescence has two tasks, which are the final separation from early objects representing love, and the final resolution of the Oedipal conflict (6).

Late adolescence occurs from 17 until 20 years. It is the phase of consolidation, meaning stability and autonomy, but also of the ending of sexual orientation (6).

Finally, postadolescence represents the continuation of consolidation. Other features of this phase are the integration of the personality, assumption of the role in society, marriage and parenthood (6).

According to psychosocial stages of development by Erik Erikson, the fifth stage is pertaining to adolescence, which is described as a balance between positive and negative outcomes of this developmental crisis: identity versus role confusion (8). During this stage, the developmental task of the adolescent is to find their own identity and singularity in the group of their peers, that would be acceptable for them, but also for the society (8, 9). The failure of successfully resolving respective challenges in each stage of life results in reappearance of psychological issues later in life (10). Identity crisis is part of Erikson’s fifth stage of

psychosocial development and is described as a normal event in the adolescent's life. When role confusion prevails in this stage, delinquency, gender-related identity disorders and borderline psychotic episodes can occur (11). It is important to note that different psychological symptoms can occur during this period as a response to the identity crisis, and not all of them will result in the formation of a disorder in adult life.

1.2.2 Classification of mental disorders

Diagnoses of mental disorders in adolescents, as in adult patients, are established based on diagnostic guidelines. In Croatia, the 10th version of the International Classification of Diseases (ICD-10), issued by the World Health Organization (WHO), is used to diagnose patients. Chapter V of the ICD-10 provides diagnostic guidelines and a classification of Mental and Behavioural disorders (12). We will use it to briefly describe different groups of mental disorders as well as their coding. When talking about mental and behavioural disorders, they are coded with a single letter F followed by two numbers, the first number describing the group of disorders, and the second letter referring to a particular disorder of that group. We will not focus on specific disorders, but rather on the distinct groups of disorders. The first block of disorders coded from F00 to F09 consist of organic, including symptomatic, mental disorders. F10 to F19 include disorders related to the use of one or more psychoactive substances. F20 to F29 comprise mainly schizophrenia, but also schizotypal and other delusional disorders. Disorders from F30 to F39 contain mood disorders, where the main features are changes in affect or mood, therefore containing depression and bipolar disorders. F40 to F49 consist of neurotic, stress-related and somatoform disorders comprising different types of phobias, reactions to stress as well as dissociative disorders. F50 to F59 contain disorders associated with physiological disturbances and physical factors such as eating, sleep and sexual disorders. F60 to F69 consist of disorders of adult behaviour and personality. This block contains personality disorders, habit disorders as well as disorders of sexual preference. The block F70 to F79 is related to different levels of mental retardation. F80 to F89 and F90 to F98 are specific for childhood and adolescence. F80 to F89 contain disorders of psychological development such as speech and language disorders or autism. F90 to F98 is a broad block of disorders containing behavioural and emotional disorders with onset occurring in childhood and adolescence (12).

In the ICD, diagnoses other than the "F group" are described, and commonly diagnosed in patients with psychiatric disorders, because they can have a connection with psychiatric

disorders. Z55 to Z65 include potential health hazards related to socioeconomic and psychosocial circumstances (12). The block from X60- X84 is pertaining to intentional self-harm by any means (12).

It is important to note that the diagnoses given in adulthood, can be given to children and adolescents, therefore the same classification is used. However, there is an exception related to personality disorders which can be diagnosed only after a certain age due to the development of the child's personality. Regarding the diagnoses of personality disorders, they are not diagnosed in adolescents younger than 18 years, with an exception of antisocial personality disorder which can be diagnosed in child's and in adolescents younger than 18 years (6). As already mentioned, F90-F98 disorders are disorders diagnosed specifically in children and adolescents, and F70-F79 and F80-F89 groups of disorders are most commonly diagnosed during the developmental age.

1.2.3 Etiology

In the past, etiopathogenesis of mental disorders and diseases were divided in two categories, endogenic and exogenic. Endogenic theories suggested that psychological disorders were formed due to the development and inner state of the child, whereas exogenic theories pointed that the disorders would come from child's environment (6). Nowadays, the aetiology of mental disorders is explained as multifactorial, including biological, psychological and social factors (6). Risk factors are defined as factors increasing the risk of acquiring a disorder, while protective factors are those diminishing the chance of development of a disorder (6). Risk and protective factors can be divided into individual and social factors (6). Some of the risk factors for developing mental health disorders in adolescence are external, or social factors such as low socioeconomic status, poor living conditions, inadequate relationship with peers, different forms of violence at home and in school, personal losses, absent parenthood as well as disturbed interactions and communication within the family (6). Protective social factors would be opposite to the risk factors. Individual risk factors can be genetic vulnerability, prenatal and perinatal brain damage, disorganized attachment style and deficient psychological structure (6). On the other hand, individual protective factors would be higher intelligence, a good temperament and coping style, a secure attachment style, prosocial behavioral and a more pronounced ego. The more risk factors are present in the life of the adolescent, the more prone they are to develop mental health conditions (13).

1.2.4 Epidemiology

According to the World Health Organization (WHO), around 14% of adolescents between 10 and 19 years of age have some kind of mental health condition (13). Mental health of children and adolescents should not be neglected, since half of all mental disorders develop until the age of 14, and three quarters of disorders are acquired until the age of 20 (6, 14). Emotional disorders such as anxiety and depression are the most common disorders found in adolescents. Anxiety has a prevalence of 9.4 to 11,9% in children, and is therefore the most common disorder in childhood (6). It has been shown that before puberty, the prevalence of anxiety stays the same in both girls and boys, but after puberty, the prevalence of anxiety disorders is two times higher in girls (6). An American study showed that the prevalence of depression in adolescence increased from 12.7% in 2015 to 16.9% in 2020, in the United States (15). Depression can lead to suicide, which is the fourth leading cause of death in older adolescents (13). Depressive disorder is also closely related to self-harm. 67 000 adolescents die each year of consequences of self-harm, and it is estimated that around 10% of adolescents have self-harm behaviors (6). Behavioral disorders such as attention deficit hyperactivity disorder (ADHD) or conductive disorders are more commonly present in younger adolescents between 10 and 14 years of age. Different mental conditions include psychosis as a syndrome, which comprises hallucinations and delusions. These are more common among older adolescents and young adults (13). Even though the importance of mental health is becoming more and more emphasized, only 10 to 30 percent of children with mental disorders seek help from health workers (6).

1.2.5 Psychiatric hospitalization of adolescents

Exacerbation of certain mental health condition sometimes require inpatient admission. Absolute indications for hospitalization in psychiatric settings are the risk of suicide or homicide, acute psychotic states, incapability of the patients to provide themselves nutrition and a home, and the necessity for diagnostic procedures (16).

A study made in Netherlands in 2021 showed that the main reasons for referral as well as admission of young patients at the psychiatric department were risk of suicide and self-harm, followed by psychosis and aggressivity towards others (17). The patients' sex also plays a role in the different reasons of hospitalization. Girls were shown to be more likely to be

hospitalized due to depressive symptoms, whereas male patients were more prone to aggressive conduct leading to admission (18).

1.3 Impact of COVID pandemic on the mental state of adolescents

Anxiety and depression disorders are the most common mental health disorders. A systematic review study has been made regarding the global prevalence of depressive and anxiety disorders, showing an increase of these disorders in young people, during the COVID-19 pandemic (19). An review study has shown the increase of symptoms of depression and anxiety in the youth (20). It was also shown that COVID-19 related stress led to increased use of substances such as alcohol and marijuana in youth (21). Another study showed an increase in the total number of hospitalized adolescent patients in the unit for adolescent psychiatry during the COVID-19 pandemic, in comparison to the pre-pandemic period, in the United States and France (22). The results showed an increase in the total number of hospitalizations of adolescents, with a higher proportion of female patients in the pandemic period. The main diagnoses associated with hospitalization were anxiety, depression and suicidality or self-injury (22). However, other studies showed a decrease in the number of hospitalizations during the first year of pandemic period (23, 24). A deterioration of mental health was observed in patients with pre-existing psychiatric disorders, especially in emotional and behavioral symptoms (25).

2. Aims and objectives

The aim of the study was to identify differences in hospitalization features at the Department of Child and Adolescent Psychiatry before and after the onset of the COVID-19 pandemic.

We compared the number of hospitalizations, proportion of first hospitalizations, hospitalizations according to patients' sex, age, social characteristics, reason for admission, given diagnoses at admission, and main diagnosis at discharge from hospital.

The goal of the research is to compare different features of hospitalizations and hospitalized patients, in order to contribute to a better understanding of the complex impact of the COVID-19 pandemic on the mental health of adolescents.

3. Materials and Methods

In this retrospective study, we analyzed the data related to inpatient admissions of adolescents between 12 and 18 years of age who were hospitalized at the Department of Child and Adolescent Psychiatry, at Clinical Hospital Centre (CHC) Rijeka. The Department of Child and Adolescent Psychiatry in Rijeka is an open unit department, with a total capacity of 8 beds (two rooms with 4 beds each). When it was impossible to hospitalize a patient at the open unit, due to uncooperativeness, suicidality, or psychosis, two beds were available at the closed unit on the department for adult psychiatric patients. Those beds were used only for short observation until the patient was able to be transferred to the open unit, or to the psychiatric hospital for minors in Zagreb.

Data were collected from medical documentation, from the CHC) Rijeka software IBIS. Three one-year periods were analyzed: from the 1st of January until the 31st of December 2019, before the pandemic had been pronounced, and in 2021 and 2022 during the same periods of time, after the onset of the pandemic. The year 2020 was not analyzed due to the pandemic situation in Croatia, where the Department for Child and Adolescent Psychiatry was closed for two months due to the lockdown. After the department had been open again, the number of hospitalizations was reduced due to epidemiological reasons. Therefore, it would be difficult to compare the results from 2020 to the results from 2021 and 2022.

Different features of hospitalization and hospitalized patients were analyzed in this study. We studied the total number of hospitalizations before and after the onset of the COVID-19 pandemic, as well as the age and sex of the hospitalized patients. Sociodemographic data were included such as the place of residence of the patients and the marital status of their parents. Since a certain number of patients had already been hospitalized before the observed period, we were interested in the number of patients who had been hospitalized for the first time in the respective years, comparing them to the ones who had been already hospitalized before. We concentrated on the reason of hospitalization, but also on the set diagnoses, that were extracted from the patients' admission and discharge medical documentation.

In this research, descriptive analysis was used to present the results. The results were compared throughout the years, regarding the number of total hospitalizations, first hospitalization, patients' sex, and were expressed in frequency and percentage. The age of

hospitalized patients was expressed as the arithmetic mean and standard deviation to analyze the dispersion of results. The reasons for hospitalization were analyzed in frequency, counting for the main reason for hospitalization. Regarding the diagnoses set at patients' admission, the total number of diagnoses was counted, whereas for diagnoses at discharge, we counted the leading diagnosis for each hospitalization.

4. Results

4.1 Frequency analysis of number of hospitalizations, proportion of first hospitalizations, and female to male ratio of hospitalizations

In KBC Rijeka, at the Department of Child and Adolescent Psychiatry, there were 102 hospitalizations (of patients aged 12-18) in 2019, as well as in 2021, but 116 hospitalizations were noted in 2022, which represents an increase of 14%. (Table 1)

The proportion of first hospitalizations according to the total number of hospitalizations for each year, is reduced by 11.5% in 2022. In 2019 and 2021, the percentage of first hospitalizations was 52% for both years, whereas in 2022, the percentage was only 40.5% (Table 1)

From the total number of hospitalizations, during these three analyzed years, hospitalizations of female patients were predominant. Before the onset of the COVID-19 pandemic, in 2019, the percentages of hospitalizations of female and male patients were 60% against 40%, respectively. After the onset of the pandemic, in 2021, the percentage of female patients' hospitalizations increased to 75% against 25% of male patients. In 2022, 69% of hospitalized patients were female, and 31% were male. Collected data showed a slight decrease of female patient hospitalizations comparing to 2021, but there was still a higher percentage than before the start of the pandemic. (Table 1)

Table 1. Frequency of psychiatric hospitalizations of adolescents; proportion of first hospitalizations, and female to male ratio of hospitalizations in 2019, 2021, 2022

Year	2019.	2021.	2022.
No. of hospitalizations	102	102	116
No. of 1st hospitalization	53 (52%)	53 (52%)	47 (40,5%)
No. of 2 or more hospitalizations	49 (48%)	43 (48%)	69 (59,5%)
No. of hospitalizations - females	61 (60%)	77 (75%)	80 (69%)
males	41 (40%)	25 (25%)	36 (31%)

4.2 Analysis of hospitalizations according to patients' place of residence and parental marital status

Regarding the patients' place of residence (living in parental home, foster family or institution), a decrease of approximately 10% was seen in the proportion of patients living at home comparing the prepandemic year and the years 2021 and 2022. Number of hospitalizations of patients living at home was 80 (78.4% of total number of hospitalizations) in 2019, 69 (67.6%) in 2021, and 80 (69%) in 2022.

Accordingly, a significant increase was seen in the percentage of patients being hospitalized and living in an institution. That percentage increased from 16.7% (17 hospitalizations) in 2019, to 25.5% (26 hospitalizations) in 2021, and 30.2% (35 hospitalizations) in 2022. (Figure 1-3)

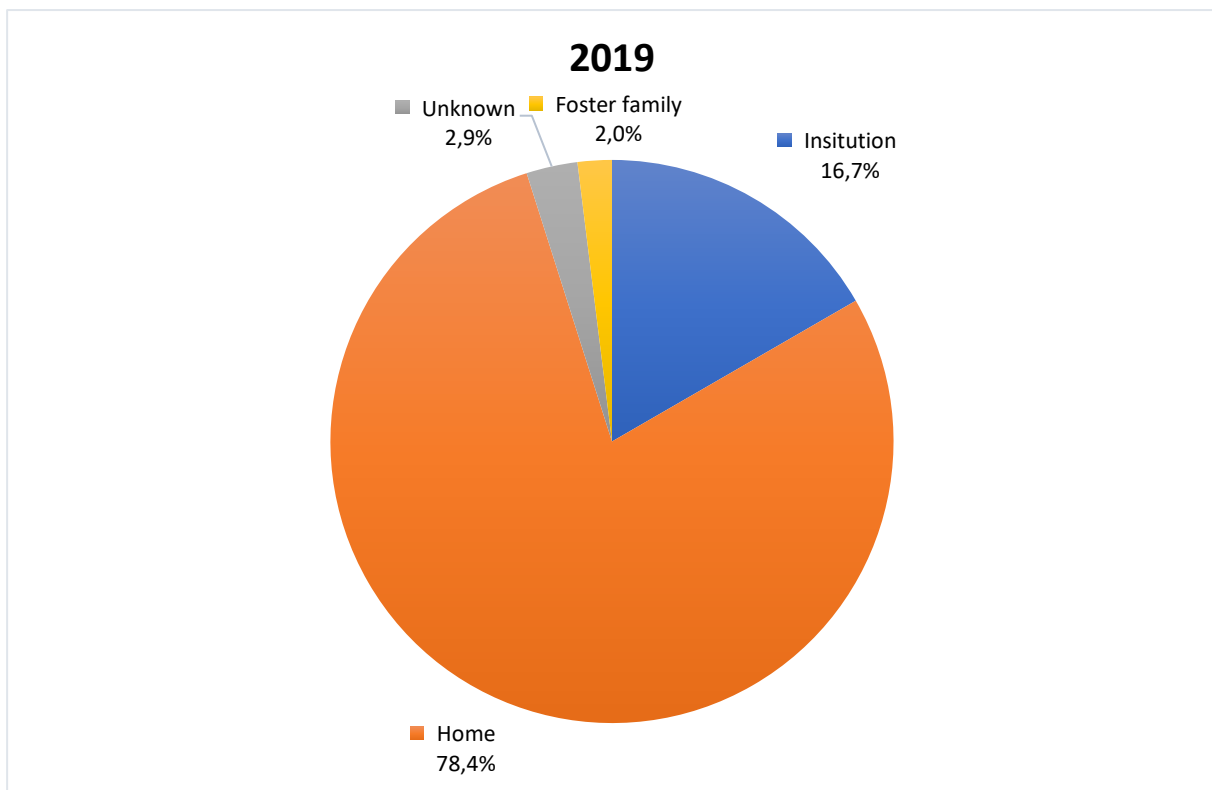


Figure 1. Percentage of hospitalizations according to patients' place of residence in 2019.

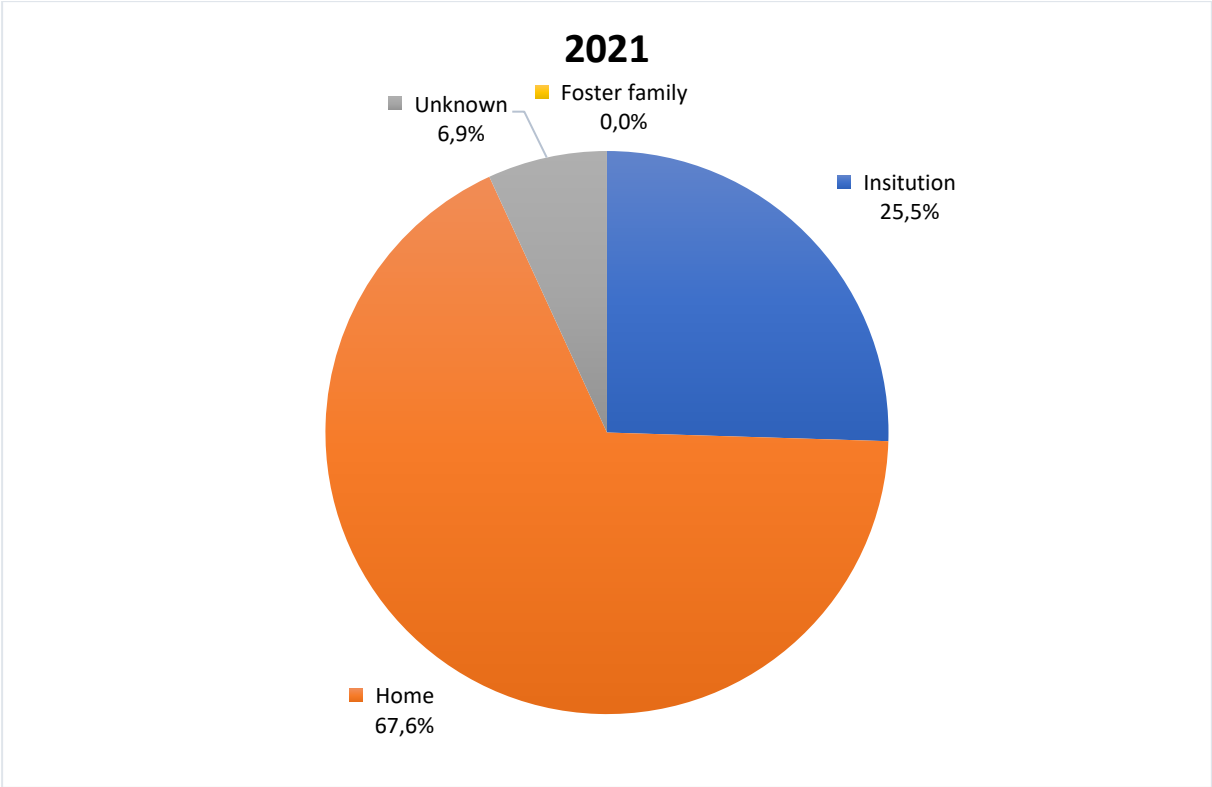


Figure 2. Percentage of hospitalizations according to patients' place of residence in 2021.

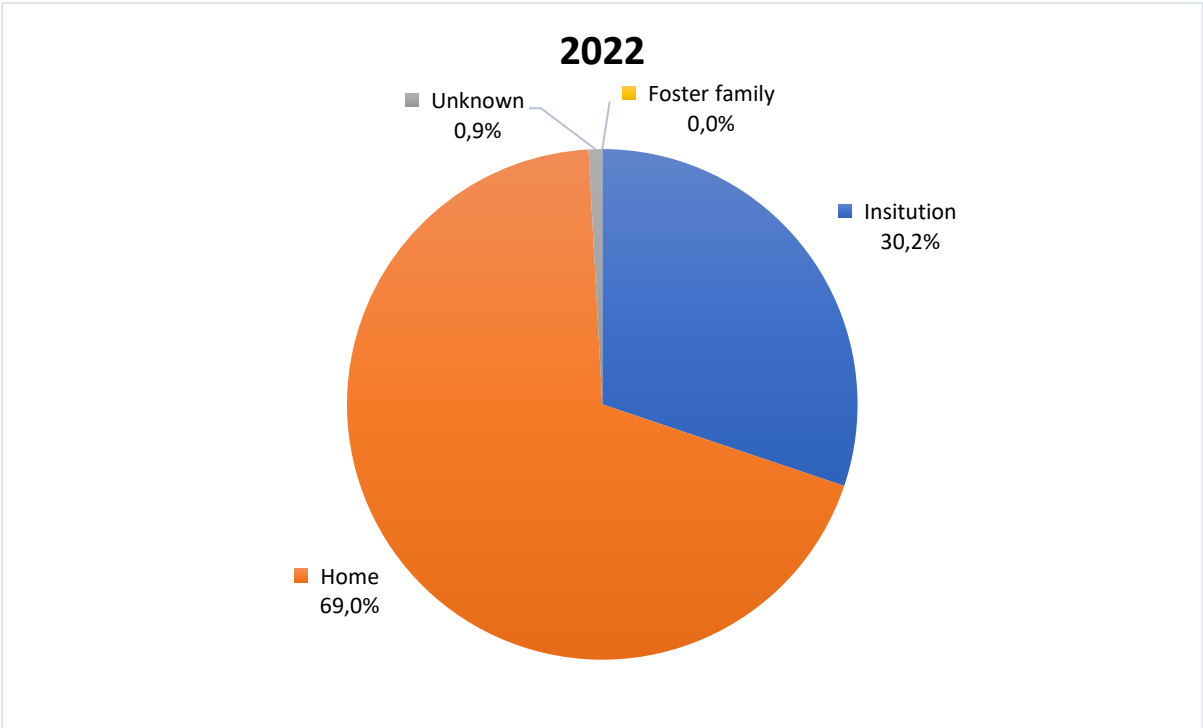


Figure 3. Percentage of hospitalizations according to patients' place of residence in 2022.

The proportion of hospitalizations of patients having divorced parents stayed approximately the same throughout the three years: 46.1% (47 hospitalizations) in 2019., 44.1% (45 hospitalizations) in 2021., and 46.6% (54 hospitalizations) in 2022. On the other hand, the proportion of hospitalizations of adolescents having married parents decreased from 24.5% in 2019 and 2021 to 15.5% in 2022.

4.3 Analysis of hospitalizations according to patients' age

The average age of patients (expressed as the arithmetic mean and standard deviation) for all hospitalizations in 2019 was 15.7±1.6 (female 15.6±1.6, male 16.0±1.7). In 2021, the average age was lower, with 15.5±1.6 (female 15.4±1.6; male 15.6±1.7), and in 2022, we noticed a further decrease of the average age, being 15.2±1.6 (female 15.2±1.7, male 15.1±1.3). Accordingly, in 2019 and 2021, majority of hospitalized patients were 16 years old, respectively accounting for 32% and 30% of all hospitalized patients during those two years. Two years after the onset of the pandemic, 14 and 15-years-old patients, were the predominant age group among hospitalized patients, accounting for 24% and 26% of all the patients respectively. (Figure 4-7)

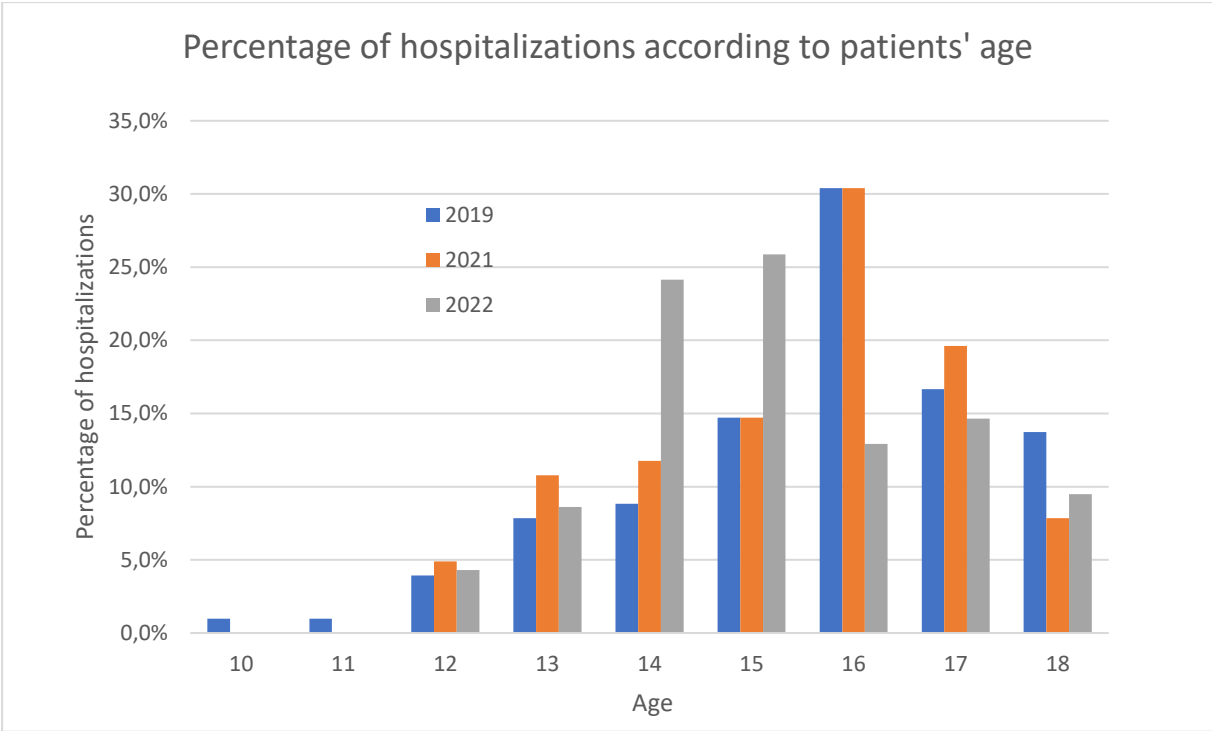


Figure 4. Percentage of hospitalizations according to patients' age

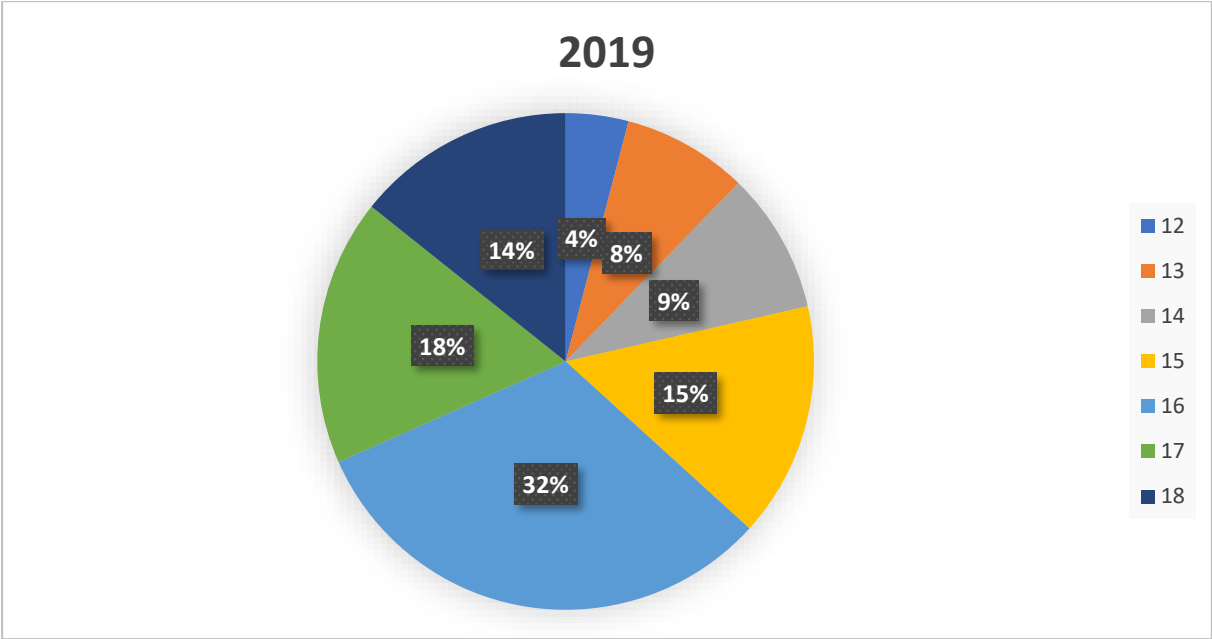


Figure 5. Percentage of hospitalizations according to patients' age in 2019.

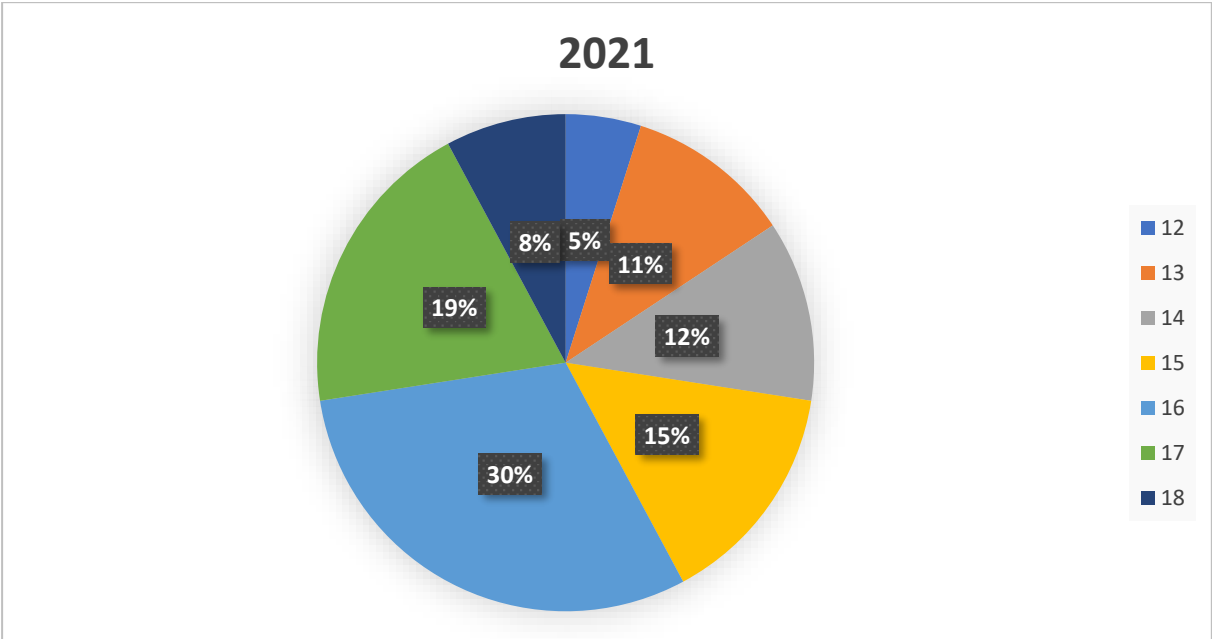


Figure 6. Percentage of hospitalizations according to patients' age in 2021.

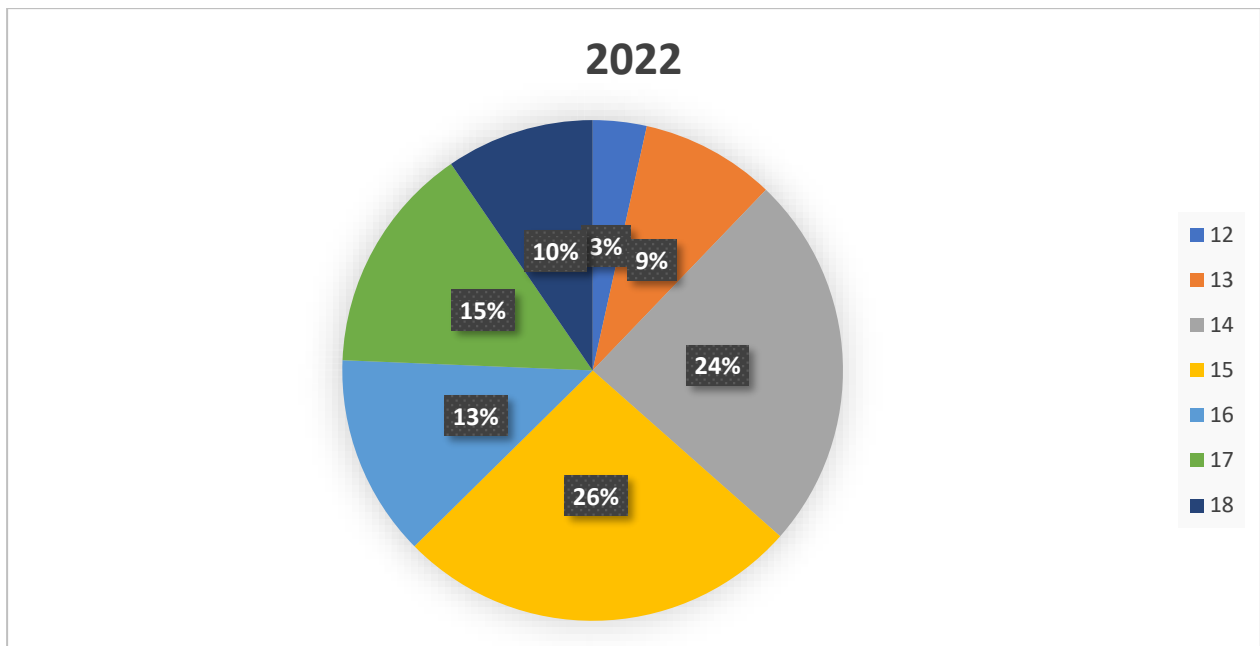


Figure 7. Percentage of hospitalizations according to patients' age in 2022.

4.4 Analysis of hospitalizations regarding their mental health-related diagnoses

We analyzed the mental-health-related diagnoses assigned to patients at their admission. (Table 2)

Out of all the categories of disorders analyzed, F90-F98 disorders were prominent in all three years. Most of the diagnoses in that category during 2019 and 2021 were conduct disorder (F91) and mixed conduct and emotional disorder (F92), together. In 2022, we noted a slight decrease in the proportion of conduct disorders (F91 and F92) in this large F90-F98 category. We can see that the general F90-F98 category of disorders was almost two times higher in 2022, compared to the year 2019. The number of patients having conduct disorder has increased from 38 in 2019, to 42 in 2021 and further to 48 in 2022. (Table 2)

It was also noticed that F10-F19 disorders related to psychoactive substance use, have increased throughout these three years. These disorders were assigned to 11 patients in 2019, 20 patients in 2021 and 27 patients in 2022. (Table 2)

Table 2. Mental health-related diagnoses in hospitalized patients at admission

	2019	2021	2022
Diagnostic category	No. of diagnosis	No. of diagnosis	No. of diagnosis
F00- F09 Organic, including symptomatic, mental disorders	1	0	0
F10- F19 Mental and behavioral disorders due to psychoactive substance use	11	20	27
F20- F29 Schizophrenia, schizotypal and delusional disorders	44	23	34
F30- F39 Mood [affective] disorders	9	18	6
F40- F48 Neurotic, stress related and somatoform disorders	23	17	20
F50- F59 Behavioral syndromes associated with physiological disturbances and physical factors	0	6	12
F60- F69 Disorders of adult personality and behavior	1	3	5
F70- F79 Mental retardation	12	2	3
F80- F89 Disorders of psychological development	15	3	5
F90- F98 Behavioral and emotional disorders with onset usually occurring in childhood and adolescence.	56	62	100
(Of that F91+F92)	(38)	(42)	(48)
Z55- Z65 Persons with potential health hazards related to socioeconomic and psychosocial circumstances	20	22	33
X60- X84 Intentional self-harm	19	17	21
Total	258	245	343

We also analyzed the main reasons for hospitalization during the three observed years. In 2019, main reasons for hospitalizations of patients were hetero-aggressivity (23.5%) and psychosis (20.6%), whereas in 2021, self-harm (17.6%) was the main cause of hospitalization of patients, together with hetero-aggressivity (16.7%), which still decreased in comparison to 2019. In 2022, two years after the onset of the pandemic, suicidal thoughts (22.4%) were the number one cause of hospitalization, with psychosis (19.0%) being the second most common cause of hospitalization. (Table 3)

Table 3. Reasons for hospitalization according to the year of hospitalization

	2019	2021	2022
Reason for hospitalization	No. of hospitalizations (%)	No. of hospitalizations (%)	No. of hospitalizations (%)
Aggressivity towards others	24 (23,5%)	17 (16,7%)	19 (16,4%)
Psychosis	21 (20,6%)	9 (8,8%)	22 (19,0%)
Worsening of depressive state	13 (12,7%)	16 (15,7%)	13 (11,2%)
Suicidal thoughts	10 (9,8%)	14 (13,7%)	26 (22,4%)
Suicide attempt	10 (9,8%)	11 (10,8%)	10 (8,6%)
Conduct disorder	8 (7,8%)	7 (6,9%)	12 (10,3%)
Self-harm	5 (4,9%)	18 (17,6%)	10 (8,6%)
Substance abuse	3 (2,9%)	0 (0%)	1 (0,9%)
Intoxication	2 (2%)	5 (4,9%)	2 (1,7%)
Eating disorder	0 (0%)	2 (2%)	0 (0%)
Other	6 (5,9%)	3 (2,9%)	1 (0,9%)
Total	102	102	116

Analyzing further the diagnoses of patients, a focus was put on the leading diagnosis of each hospitalization at discharge. (Table 4)

Table 4. Leading diagnoses of hospitalized patients at discharge

	2019	2021	2022
Diagnostic category	No. of diagnoses	No. of diagnoses	No. of diagnoses
F00- F09 Organic, including symptomatic, mental disorders	1	0	0
F10- F19 Mental and behavioral disorders due to psychoactive substance use	3	6	5
F20- F29 Schizophrenia, schizotypal and delusional disorders	38	11	13
F30- F39 Mood [affective] disorders	5	13	4
F40- F48 Neurotic, stress related and somatoform disorders	12	11	12
F50- F59 Behavioral syndromes associated with physiological disturbances and physical factors	0	2	2
F60- F69 Disorders of adult personality and behavior	0	0	0
F70- F79 Mental retardation	1	0	0
F80- F89 Disorders of psychological development	1	1	3
F90- F98 Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	41	58	77
F91 Conduct disorders.	35	47	58
F92 Mixed disorders of conduct and emotions			
F93 Emotional disorders with onset specific to childhood	1	3	13
F98 Other behavioral and emotional disorders with onset usually occurring in childhood and adolescence	4	5	6

An increase was seen in the number of patients having a mental disorder due to the use of psychoactive substances (F10-F19), the numbers showing us 3 patients admitted due to the diagnosis in 2019, versus 6 and 5 patients respectively in 2021 and 2022.

Further on, we noticed a decrease in patients with psychotic disorders (F20-F29), from 38 patients in 2019, against 11 and 13 patients in 2021 and 2022 respectively.

In 2021, an increase was seen in the number of patients with mood disorders (F30-F39), compared to 2019 and 2022.

Regarding behavioral and emotional disorders that have an onset before adulthood (F90-F98), an increase was seen throughout these three observed years. We can see that the number of patients has risen from 41 in 2019, to 58 in 2021, and further incline has been seen in 2022, with 77 patients being diagnosed with these disorders. (Table 4)

5. Discussion

In this study, we analyzed different features of hospitalization of adolescent psychiatric patients, throughout the years 2019 representing the pre-pandemic period, and the years 2021 and 2022 representing the pandemic period. The year 2020 was not included in the study due to the pandemic public health measures in Croatia, where the Department for Child and Adolescent Psychiatry was closed for two months. After the department had been open again in 2020, the number of hospitalizations was greatly reduced due to significantly stricter indications for hospitalization with the aim of reducing spreading of COVID among hospital employees and in-patients. Therefore, it would be difficult to compare the numbers from 2020 to the numbers from 2021 and 2022.

We first noted that the number of hospitalizations had stayed the same in 2019 and 2021, but in 2022, two years after the onset of the pandemic, the number of hospitalizations increased by 14%. These findings are in line with other studies that have shown an increase in numbers of inpatient admissions after the onset of pandemic, but already in 2021 (22). The non-rising number of hospitalizations in 2021 could be explained by a general decrease in hospitalizations during the pandemic period in 2020 and beginning of 2021 in Croatia, due to public health measures (26). Our results are in line with reported increase of hospitalizations noted in Psychiatric hospital for children and youth in Zagreb. According to their report at the thematic session of the Committee for Health and Social Policy of the Croatian Parliament, held on March 9, 2023., the number of hospitalizations increased by 35% from 2017 to 2022 (27). Most of research papers found analyzed the consequences of the pandemic on mental health of children and adolescents in 2020 and 2021, so later consequences of the pandemic should still be examined. Despite the short follow-up period, most experts express concern about the future long-term consequences of the pandemic on the mental health of young people.

We analyzed the proportions of first hospitalizations and re-hospitalizations. It was noticed that the percentage of first hospitalizations were the same during 2019 and 2021 but decreased in 2022 by 11.5%. This means that the number of re-hospitalizations has increased. We can assume that patients who had been hospitalized for the first time either had a preexisting mental health disorder with no exacerbation, or no mental health disorder prior to their first hospitalization. This finding could suggest that the COVID-19 pandemic had a delayed

negative impact on patients with preexisting mental health disorders. We can also assume that a higher proportion of re-hospitalizations is a possible consequence of poorer or unavailable adequate outpatient treatment. According to the experiences of the professionals from Department, the waiting lists for the psychiatric examination are getting longer, and the waiting time has also been extended. Unfortunately, all the above can increase the risk of re-hospitalization. A large cross-sectional study exploring the impact of COVID-19 pandemic on the mental health of Canadian children and adolescents, showed that children and adolescents with pre-existing psychiatric diagnosis experienced a higher deterioration of their mental state during the pandemic, and social isolation was shown to be the main reason for it (28). Some findings showed that patients who were hospitalized for the first time due to suicidal ideation, were more prone to stress related to isolation, while patients who had a history of psychiatric hospitalization had suicidal thoughts mainly due to the fear of getting infected by COVID-19 (29).

The percentage of female patient hospitalizations prior to the onset of the pandemic was higher than the percentage of male patients. The female to male hospitalization ratio was 60% vs. 40%. It has been noticed that the inpatient admissions of female patients were further rising after the pandemic had started (75% vs. 25% in 2021, and 69% vs. 31% in 2022) which was consistent with other studies made (11, 22-24). Findings show that female sex is a risk factor in mental health disorders, and even though the reasons for it are not clear, a few factors seem to have an influence, such as a lower self-esteem in girls, inequality between genders in society, and the impact of sex hormones (30). Other studies have shown that loneliness was connected with depressive symptoms in female patients, which could further explain the increase of mental health disorders in females during the social isolation due to the pandemic (31). A review study also hypothesized that the increasing mental health disorders in female patients could be due to sex inequities, which were worsened by the pandemic (31).

A significant increase was seen in number of hospitalizations of patients living in institutions such as detention facilities or residential institutions. The share of these hospitalizations increased from 16.7% in 2019 to 25.5% in 2021, and 30.2% in 2022, which represents an increase of 13.5% from 2019 to 2022. In some researches, this was explained by additional isolation of these adolescents, them being separated from their families, and stricter restrictions and rules within the institutions they live in (32, 33). A study conducted in Canada

also showed that a protective factor of youth mental health during the COVID-19 pandemic was spending time with family, which can add to the possible explanations of our results (34). It has also been shown that children who had been adopted, or placed in correctional facilities, have at least a 10% higher chance of acquiring an attachment disorder, which could also have played a role in the worsening of their mental state during any crises (6).

Regarding the family situation of the hospitalized patients, it was noticed that the number of patients with divorced parents did not change significantly after the onset of the COVID-19 pandemic. However, the number of patients living with both of their parents decreased after the pandemic. The percentage decreased from 24.5% in 2019 to 15.5% in 2022, and that is a 9% drop. A study made in Zagreb between 2017 and 2019, showed that dysfunctional family relations can be important risk factors in mental disorders of young persons (35). In that research, most important factors were showed to be the lack of material, emotional and organizational support from the patient's surrounding, parenting difficulties due to family stress, and mental illness of a parent (35). It has also been shown that conflicts between parents have a great impact on the adolescents' emotional state (36). Even though our results suggest that living in a core family with two parents provides security and decreases stress in adolescents', and therefore decreases decompensation of adolescents' mental health, studies have shown that an important factor in adolescents' development is the relationship with their parents, and in between the parents, rather than them living separately or together (37). However, living together with both parents, and being emotionally attached to them represents a protective family factor for children and adolescents (6).

At the Department of Child and Adolescent Psychiatry, of CHC Rijeka, children are hospitalized from the age of 12, with exceptions being younger than that. We therefore focused on children and adolescents aged from 12 to 18 years. In 2019 and 2021, the age of hospitalized patients followed a similar pattern, 16-years-old patients were predominantly hospitalized. On the other hand, in 2022 patients of 14 and 15 years of age were hospitalized in greater numbers, and a decrease was noticed in the inpatient admission of 16-year-old patients. Other studies have also found that the average age of hospitalized patients was 15 years (23, 24). A review study showed that older children were more prone to having anxiety symptoms during the pandemic, which could be explained by the fact that they were more aware of the gravity of the situation (38). A retrospective cohort study made in Israel between 2017 and 2021 showed an increase of mental health disorders in all ages during the pandemic,

but especially in 14 and 15-year-old patients, which could be due to the stress related to the pandemic, but also lack of social interactions which are important in this stage of life (30). Adolescents were more affected by mental disorders that needed inpatient admission, before and after the onset of COVID-19.

When analyzing leading diagnoses of patients at discharge, we could notice a significant difference in the number of patients having F90-F98 disorders, pertaining to behavioral and emotional disorders with onset usually occurring in childhood and adolescence, which are specific for this group of age. We can see that disorders of conduct and emotions (F91 and F92) are representing the majority of diagnoses in every analyzed year. However, the number of hospitalized patients with these disorders being their main diagnoses, has increased from 35 in 2019, to 58 in 2022. We did not find data on a similar increase in the literature. It is possible that this is a consequence of the increasing share of hospitalized children from institutions, with conduct disorders being the most common diagnosis in that population.

Our findings showed a significant increase in suicidal ideation during the pandemic period, which was the most common reason for hospitalization in that period. Suicidal ideas were the reason for 9.8% of hospitalizations in 2019, in 2021 they increased to 13.7%, and in 2022 even more - to 22.4%. A retrospective cohort study conducted in the United States and France showed anxiety, depression, self-harm and suicidality were the most common reasons for psychiatric hospitalization in youth during the pandemic period, from April 1st 2020 until April 30th 2021 (22). Our study showed an increase in suicidal thoughts and attempts in 2021, compared to 2019. A study from Rhode Island Hospital compared numbers of inpatient admissions in 2019 and 2020, and noted an increase in both suicidal ideation and suicidal attempts in year 2020 (29). The reasons for suicidal thoughts were related to financial reasons, home and family relation issues, as well as not being able to attend special events (29). According to the report from the thematic session of the Committee for Health and Social Policy of the Croatian Parliament, held on March 9, 2023, in the Psychiatric Hospital for Children and Youth in Zagreb, there is a huge increase in suicide attempts of 250% from 2019 to 2021 (27). Fortunately, our data shows a decrease in suicide attempts as a reason for hospitalization, from 9.8% in 2019, to 10.8% in 2021 and a low of 8.6% in 2022. As there were more hospitalizations due to suicidal thoughts in our sample, it is possible that these hospitalizations had a possible preventive effect on actual suicide attempts.

We found a significant increase of patients hospitalized due to self-harm in 2021, compared to the pre-pandemic period (4.8% in 2019 and 17.6% in 2021). Even though the percentage of these patients significantly decreased in 2022 compared to 2021 (to 8.6%), it remained higher compared to the pre-pandemic period. A study made in Australia during the period of March 2020 until December 2021, showed a 82% increase of paediatric hospitalizations due to self-harm during the pandemic period (11).

The main limitation of our study is small sample, which is mainly because only 8 beds are available at the department, for inpatient admission. Therefore, non-medical factors also played a role in the decision of hospitalizing a patient, such as the availability of beds. In this research, only data on hospitalizations for the year 2019 were analyzed, but a more adequate insight into the impact of the pandemic would be obtained by analyzing several years before and after the start of the pandemic.

6. Conclusions

Even though the number of hospitalizations per year, at the Department of Child and Adolescent Psychiatry CHC Rijeka, is relatively low, some conclusions could be drawn from this research.

An increase of the total number of hospitalizations was noted in 2022. Two years after the pandemic had started, the number of hospitalizations had increased by 14%.

From the total number of hospitalizations, we observed a 11.5% decrease of first hospitalizations in 2022, in comparison to 2019 and 2021.

Female patients were hospitalized in higher proportion before the onset of the COVID-19 pandemic, but we also noticed that the percentage of female patient hospitalizations rose further (60% vs. 40% in 2019, 75% vs. 25% in 2021, and 69% vs. 31% in 2022).

There was a significant increase of hospitalizations of patients living in an institution. The share of these hospitalizations increased by 13.5% from 2019 to 2022.

The hospitalizations of patients living with both of their parents decreased by 9% in 2022, in comparison to 2019 and 2021.

In 2019 and 2021, most hospitalized patients were aged 16, while in 2022, most patients were aged 14 and 15, which accounts for 50% of all hospitalizations in that year.

Analysis of diagnosis shows that disorders of conduct and emotions (F91 and F92) are representing the majority of diagnoses in every analyzed year. There is also a noticeable increase of those diagnosis (at admission and at discharge from hospital) in 2022.

Suicidal ideation was the most important reason for hospitalization in 2022, showing an increase of 12.6% in comparison to 2019.

7. Summary

In this retrospective study different characteristics of hospitalizations of adolescents were investigated, before and after the onset of COVID-19 pandemic. We analyzed the data related to inpatient admissions of adolescents (12-18 yr.) at the Department of Child and Adolescent Psychiatry, CHC Rijeka. Data were collected from medical documentation (software). Three one-year period were analyzed and compared: 2019, 2021 and 2022.

The number of hospitalizations increased by 14% in 2022, along with a 11.5% decrease of first hospitalizations. Female patients were hospitalized in a higher proportion in all three years, with an additional increase in 2021 and 2022. There was a noticeable increase by 13.5% of hospitalizations of patients living in an institution. The hospitalizations of patients living with both of their parents decreased by 9%. In 2019 and 2021, most hospitalized patients were aged 16, while in 2022, most patients were aged 14 and 15. Conduct disorders were the most frequent diagnoses in all three years, with an increase in 2022. Suicidal ideation was the most frequent reason for hospitalization in 2022, showing an increase of 12.6%.

These findings are in line with other studies that have shown an increase in numbers of inpatient admissions after the onset of COVID-19 pandemic. With the pandemic, children and adolescents had decreased social interactions, their routine was broken, which led to a great change in their lives. Most of research papers found analyzed the consequences of the pandemic in 2020 and 2021, but later consequences of the pandemic should still be examined.

Keywords: adolescents, COVID-19, hospitalization, mental health, pandemic

8. Curriculum vitae

Macha Natacha Bogdanovic was born on the 2nd of May 1997 in Evian-les-Bains, France. She integrated the French School of Belgrade in 2002 and finished elementary and high school there. In 2017 she enrolls into the integrated undergraduate and graduate study of Medicine in English at the University of Rijeka. In 2022 she starts an education in Cognitive Behavioral Therapy at SRABCT in Niš, Serbia. She fluently speaks Serbian, French and English, and has a basic knowledge of Italian language.

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