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Changes in the number and characteristics of tertiary hospital psychiatric admissions in south Croatia before and during the COVID-19 pandemic: a retrospective study

Tea Vukićević[1,2], Tonka Borovina Marasović[3], Andrea Botica[2,3], Tonći Mastelić[3], Toni Utrobičić[3], Trpimir Glavina[2,3], Livia Puljak[4*] and Svjetlana Došenović[5]

Abstract

Background There is mixed evidence on the impact of the Coronavirus disease (COVID-19) pandemic on psychiatric hospital care for people with severe mental diseases, possibly due to regional differences. There is a significant gap in knowledge regarding the specific impact of the COVID-19 pandemic on mental health in Croatia, a country in South-Eastern Europe. Our study aimed to evaluate the number and characteristics of psychiatric hospitalizations in the year before and during the first year of the COVID-19 pandemic in a tertiary hospital in south Croatia.

Methods This was a retrospective study of adult psychiatric hospitalizations at the University Hospital of Split, Croatia. Sociodemographic and clinical data of inpatients during the first year of the COVID-19 outbreak (March 1, 2020 – March 1, 2021) and the year before the pandemic (March 1, 2019 - February 29, 2020) were compared. Incidence rate ratio (IRR) was used to compare the number of hospitalizations; while sociodemographic and hospitalization characteristics were compared between the two periods with the Mann-Whitney U test or chi-squared test, as appropriate.

Results A significant reduction in hospitalization rate was observed during the COVID-19 pandemic (IRR = 0.72, 95% confidence interval 0.67–0.78, $P < 0.0001$). Compared to the year before the pandemic, hospitalizations due to suicidality increased almost 3 times, while hospitalizations due to both autoagression and heteroagression increased almost 4 times ($P = 0.000$). The proportion of hospitalized patients diagnosed with schizophrenia, schizotypal, and delusional disorders was significantly higher during the pandemic (61% vs. 52%), while neurotic, stress-related, and somatoform disorders decreased significantly (5.9% vs. 10%, $P = 0.001$). Furthermore, inpatients during the COVID-19 year were younger ($P = 0.004$), more educated ($P = 0.040$), had a higher prevalence of personal history of psychiatric diseases ($P = 0.024$), and experienced longer hospital stays ($P = 0.002$).

Conclusions The COVID-19 pandemic caused a significant reduction in the psychiatric hospitalization rate at a tertiary university hospital in Croatia, with an increase in patients presenting with suicidality, aggression, and severe

*Correspondence:
Livia Puljak
livia.puljak@gmail.com; livia.puljak@unicath.hr

Full list of author information is available at the end of the article

mental illnesses such as schizophrenia, schizotypal, and delusional disorders. These findings could help healthcare systems better adapt to the needs of the most vulnerable patients and address challenges in maintaining continuity of psychiatric care during public health crises.

Keywords COVID-19, Mental health, Psychiatric hospitalization, Schizophrenia, Suicidality, Severe mental illness

Background

The Coronavirus disease (COVID-19) pandemic emerged as a public health emergency with profound physical and mental consequences. The psychiatric services played an important role during this mental health crisis [1]. Strategies introduced by governments to reduce the spread of COVID-19, such as physical distancing and restricted travel, made it more difficult for patients to obtain treatment and acquire medicines [2]. The Croatian government also implemented a series of public health interventions to mitigate viral transmission in March 2020 [3]. Croatia's response to the COVID-19 pandemic was in line with the broader European approach [4].

Inpatient psychiatric services worldwide were reorganized and modified or turned into COVID-19 wards. Most day hospital services and day therapy programs for psychiatric patients were temporarily closed, and many nurses and physicians were displaced to other clinical wards [5, 6]. The University Hospital of Split, Croatia, with its emergency psychiatric services remained operational throughout the lockdown but adopted several preventive measures and restrictions. These measures included COVID-19 screening of all patients presenting to the psychiatric emergency unit. Outpatient services were restricted to urgent cases, non-urgent appointments were conducted via telephone or online, and psychiatric bed capacity was temporarily reduced in response to the pandemic.

The impact of the COVID-19 pandemic on psychiatric hospital admissions was investigated in many countries, such as Germany [7, 8], Italy [9, 10], Portugal [11], South Korea [12], and Australia [13]. The results showed a decline in psychiatric hospital admissions due to the COVID-19 outbreak. In contrast, studies from Sweden [14] and the UK [15] showed no reduction in psychiatric admissions, but a difference in the characteristics of admission diagnoses and/or admission mode. Data about the acute mental health admissions in Croatian hospitals during the COVID-19 pandemic (2020–2022) indicated there was a considerable decline in admissions of psychiatric patients: a 28% decrease in admissions to both secondary and tertiary hospitals, and an 11% decrease to special psychiatric hospitals [4].

Current data on the effect of the pandemic on psychiatric hospital care for people with severe mental diseases are mixed, possibly due to regional differences. Distinct cultural, economic, and healthcare-specific factors may impact mental health differently in different regions. There is a significant gap in the literature on the impact of the COVID-19 pandemic on psychiatric hospitalizations in Croatia, a country located in South-Eastern Europe. Specifically, there is no data available in the literature about the impact of the COVID-19 pandemic on psychiatric hospitalizations in south Croatia. Our study aimed to fill this gap by analyzing the number and characteristics of psychiatric admissions at the University Hospital of Split, Croatia, during the first year of COVID-19 outbreak, and comparing them to the data from the year preceding the pandemic.

By examining the full spectrum of psychiatric admissions over an extended period, the study could offer a unique insight into the region-specific effects of the pandemic, including changes in patient characteristics, and the role of COVID-19 as a potential trigger for mental health crises. These findings could assist healthcare systems in adapting to the needs of vulnerable patients during future disruptions in mental healthcare and offer valuable data for global comparisons.

Methods

The study was reported according to The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist [16], see Supplementary file 1. The ethics committee of University Hospital of Split, Croatia approved the study on July 26, 2022 (Class: 500-03/22–01/152; Reg. No.: 2181–147/01/06/M.S.-22-02). The informed consent was waived as data were collected retrospectively during routine hospital care. The data were stored anonymously and following the Declaration of Helsinki 2013 guidelines.

Study design and setting

This was a retrospective study of psychiatric admissions at the University Hospital of Split, Croatia. University Hospital of Split, a tertiary hospital, is a central health institution in south Croatia. About one million Croatian citizens and about half a million citizens of south Bosnia and Herzegovina, as well as half a million tourists during the tourist season, gravitate to this hospital. University Hospital of Split has 1500 acute and 30 chronic patient beds. The hospital comprises 15 clinics, 4 clinical departments, 5 departments, and 7 sections that may require psychiatric consultation. Annually, the hospital provides care for over 50 000 patients, totaling more than 450 000 inpatient days [17].

The Department of Psychiatry provides care for hospitalized patients with 82 beds (75 acute and 7 chronic beds). Due to the COVID-19 pandemic, from August 28, 2020, until June 1, 2022, the bed capacity in the Department decreased by 20%.

Data collection and definitions

Data were collected retrospectively from patients' medical records (electronic and paper). Eligible patients were at least 18 years old and hospitalized between March 1, 2019 - March 1, 2021. The study was divided into two periods: the pre-COVID-19 pandemic year (March 1, 2019 - February 29, 2020) and the first year of COVID-19 outbreak (March 1, 2020 -March 1, 2021).

The following data were extracted: admission date, socio-demographic variables (age, gender, marital status, housing status), country of origin (Croatian or foreign resident), decisional capacity (able or not), the urgency of admission (emergency or non-emergency/elective), modality of admission (ambulance, police, self-referral, within hospital transfer), the legal status of admission (voluntary or non-voluntary hospitalization), comorbidities, arrival hours (morning −8–16 h, day −16–24 h, night −24–08 h), arrival day, personal history of psychiatric disease (yes or no), family history of psychiatric disease (yes or no), previous psychiatric ambulatory care (yes or no), previous psychiatric hospital admissions (yes or no), the reason for current admission, duration of hospital stay (days), main psychiatric diagnosis at discharge, discharge date, discharge location (another institution, home care, discharged against the physicians' advice), status at discharge (recovery, improved, same, worse, dead).

Psychiatric emergencies were defined as acute disturbances of behavior, thought, or mood in a patient which, if left untreated, could lead to harm to the affected individual or person in its' surroundings [18]. Reasons for elective admissions were conditions other than life-threatening or incapacitating, such as the need for correction of pharmacotherapy, addiction treatment, and significant deterioration of patients' psychiatric condition.

Diagnoses were classified by the International Classification of Diseases, 10th Revision (ICD-10), codes F00–F79 [19]. For patients who were diagnosed with more than one psychiatric diagnosis, only the main discharge diagnosis (defined as a diagnosis contributing directly to current admission) was analyzed.

Psychiatric hospitalization was defined as hospitalization in the department of psychiatry for primary discharge diagnostic code F00-79. Hospital readmission was defined as more than one hospital readmission within the analyzed period.

The number of psychiatric emergency department visits and urgent inpatient psychiatric consultations during the study period were also collected.

Outcomes

The primary outcome was the difference in the incidence rate ratios (IRR) of psychiatric hospital admissions between the two periods. The secondary outcome was the difference in characteristics of admissions between the two periods, such as sociodemographic characteristics, decisional capacity, admission cause and modality, legal status of admission, leading psychiatric diagnosis, etc.

Data analysis

Data were presented descriptively. Categorical data were presented as frequencies and percentages, and continuous data as mean and standard deviations (SD) or median and interquartile range (IQR).

The normality of data distribution was checked by visually examining bar graphs and with the Kolmogorov-Smirnov test. Numerical variables such as age and length of hospitalization were compared with the Mann-Whitney-U-test due to non-normal distribution. Contingency tables and the chi-squared test were used to test the distribution of categorical variables between the 2 time periods, such as gender, education, marital status, etc. Post-hoc Bonferroni correction with z-tests for independent proportions was used for multiple comparisons.

The incidence rate (IR) was calculated as the number of inpatient admissions divided by the total population during the two respective periods based on the Croatian Bureau of Statistics population estimates for Split Dalmatia county [20]. The IRR was calculated as a ratio of the incidence rate for the first year of COVID-19 to the incidence rate for the pre-COVID-19 year. The 95% confidence interval (CI) limits for the IRR were estimated using the Exact Poisson method. The *P* value of a Chi-square test for the hypothesis of IRRs are equal to one (i.e., the hospitalization incidence rate during the first year of COVID-19 is equal to the incidence rate in the year before) was calculated.

A *P* value below 0.05 was considered statistically significant. Analysis was conducted in SPSS version 19, IBM Corporation, except for IRR analysis, which was performed with MedCalc [21].

Results

In the year before the COVID-19 pandemic, there were 1501 psychiatric hospitalizations, while during the first year of the COVID-19 outbreak, the number of admissions decreased to 1084. A significant decrease in case activity for psychiatric hospitalizations by 28% was observed (IRR = 0.72, 95% CI 0.67–0.78, $P < 0.0001$).

Sociodemographic characteristics and duration of hospitalization

Patients hospitalized in the psychiatry department during the COVID-19 period were slightly younger (median age=48 years, IQR 36–57) compared to the year before the pandemic (median age=49 years, IQR 38–58; $P=0.004$). Notably, a significantly higher proportion of patients with higher education levels were hospitalized during the first year of the COVID-19 pandemic (Chi-square=6.431, df=2, $P=0.04$). No significant differences between the two periods were observed in other sociodemographic characteristics, such as gender, marital status, employment status, etc. (Table 1).

The duration of hospitalization was significantly longer in the first year of the pandemic ($P=0.002$, Table 1).

Past medical history and comorbidities

The proportion of patients with a positive personal history of psychiatric diseases was significantly higher in the COVID-19 period than in the control year (Chi-sq=5.066 (df=1), $P=0.024$).

There was a decrease in the proportion of inpatients with psychiatric comorbidities during the COVID-19 period (31%), compared to the pre-COVID-19 period (40%) (Chi-sq=21.571 (df=1), $P=0.000$) (Table 2). Conversely, there were no differences between the two periods regarding positive family history, previous psychiatric ambulatory care, previous psychiatric hospital admissions, and somatic comorbidities (Table 2).

Admission time and modality

During the COVID-19 period, there was an increase in weekend admissions (Chi-sq=6.660 (df=1), $P=0.01$), as well as in afternoon and night admissions

Table 1 Sociodemographic characteristics and duration of hospitalization

Variable		Pre-COVID-19 *N*=1501 admissions	1st year of COVID-19 *N*=1084 admissions	Test statistics	*P*-value
Age, median (IQR) years		49 (38–58)	48 (36–57)	Z=-2.858	0.004*
Duration of hospitalization median (IQR) days		14 (8–22)	15 (9–23)	Z=-3.076	0.002*
Gender, *N* (%)	*N*	1499	1082	Chi-sq=1.094 (df=1)	0.296
	Male	876 (58.4)[a]	610 (56.4)[a]		
	Female	623 (41.6)[a]	472 (43.6)[a]		
Citizenship, *N* (%)	*N*	1501	1083	Chi-sq=0.191 (df=1)	0.662
	Croatian	1480 (98.6)[a]	1070 (98.8)[a]		
	Foreign	21 (1.4)[a]	13 (1.2)[a]		
Employment, *N* (%)	*N*	1096	924	Chi-sq=2.474 (df=2)	0.290
	Employed	162 (14.8)[a]	160 (17.3)[a]		
	Unemployed	592 (54)[a]	489 (52.9)[a]		
	Retired	342 (31.2)[a]	275 (29.8)[a]		
Education, *N* (%)	*N*	917	727	Chi-sq=6.431 (df=2)	0.040*
	Elementary	105 (11.5)[a]	79 (10.9)[a]		
	High school	703 (76.7)[a]	530 (72.9)[a]		
	Higher education	109 (11.9)[a]	118 (16.2)[b]		
Marital status, *N* (%)	*N*	1255	981	Chi-sq=6.215 (df=3)	0.102
	Married	434 (34.6)[a]	295 (30.1)[b]		
	Single	620 (49.4)[a]	531 (54.1)[b]		
	Divorced	146 (11.6)[a]	108 (11)[a]		
	Widowed	55 (4.4)[a]	47 (4.8)[a]		
Housing status, *N* (%)	*N*	1215	985	Chi-sq=2.627 (df=3)	0.453
	Single	236 (19.4)[a]	194 (19.7)[a]		
	With family	936 (77)[a]	759 (77.1)[a]		
	Institution	34 (2.8)[a]	20 (2)[a]		
	Homeless	9 (0.7)[a]	12 (1.2)[a]		
Decisional capacity, *N* (%)	*N*	1279	1078	Chi-sq=0.773 (df=2)	0.679
	Maintained	1189 (93)[a]	1000 (92.8)[a]		
	Withdrawn	85 (6.6)[a]	71 (6.6)[a]		
	Withdrawal in process	5 (0.4)[a]	7 (0.6)[a]		

*=statistically significant differences, Z=Mann-Whitney-U-test, Chi-sq=Chi squared test, IQR=interquartile range

[a, b]=each superscript letter indicates a subset of period categories whose column proportions do not differ significantly from each other at the 0.05 level

Due to some missing data, the total number of cases is presented for each variable

Table 2 Past medical history and comorbidities

Variable		Pre-COVID-19 *N* = 1501 admissions	1st year of COVID-19 *N* = 1084 admissions	Test statistics	*P*-value
Positive family history, *N* (%)	*N*	488	527	Chi-sq = 0.103 (df = 1)	0.748
	Yes	229 (46.9)[a]	242 (45.9)[a]		
	No	259 (53.1)[a]	285 (54.1)[a]		
Positive personal history, *N* (%)	*N*	1485	1072	Chi-sq = 5.066 (df = 1)	0.024*
	Yes	1355 (91.2)[a]	1004 (93.7)[b]		
	No	130 (8.8)[a]	68 (6.3)[b]		
Previous ambulatory care, *N* (%)	*N*	1492	1064	Chi-sq = 1.569 (df = 1)	0.210
	Yes	1341 (89.9)[a]	972 (91.4)[a]		
	No	151 (10.1)[a]	92 (8.6)[a]		
Previous hospitalization, *N* (%)	*N*	1492	1052	Chi-sq = 3.422 (df = 1)	0.064
	Yes	1209 (81)[a]	821 (78)[a]		
	No	283 (19)[a]	231 (22)[a]		
Somatic comorbidities, *N* (%)	*N*	1501	1084	Chi-sq = 2.966 (df = 1)	0.085
	Yes	555 (37)[a]	437 (40.3)[a]		
	No	946 (63)[a]	647 (59.7)[a]		
Psychiatric comorbidities, *N* (%)	*N*	1500	1084	Chi-sq = 21.571 (df = 1)	0.000*
	Yes	594 (39.6)[a]	333 (30.7)[a]		
	No	906 (60.4)[a]	751 (69.3)[a]		

*= statistically significant differences, Chi-sq = Chi squared test

[a, b] = each superscript letter indicates a subset of period categories whose column proportions do not differ significantly from each other at the 0.05 level

Due to some missing data, the total number of cases is presented for each variable

Table 3 Admission time and modality

Variable		Pre-COVID-19 *N* = 1501 admissions	1st year of COVID-19 *N* = 1084 admissions	Test statistics	*P*-value
Admission day, *N* (%)	*N*	1501	1084	Chi-sq = 6.660 (df = 1)	0.010*
	Weekend (Sat-Sun)	267 (17.8)[a]	237 (21.9)[b]		
	Weekday (Mon-Fri)	1234 (82.2)[a]	847 (78.1)[b]		
Admission time, *N* (%)	*N*	1491	1082	Chi-sq = 42.171 (df = 2)	0.000*
	Morning (8–16)	967 (64.9)[a]	564 (52.1)[b]		
	Afternoon (16–24)	421 (28.2)[a]	417 (38.5)[b]		
	Night (24 – 8)	103 (6.9)[a]	101 (9.3)[b]		
Admission mode, *N* (%)	*N*	986	930	Chi-sq = 27.701 (df = 5)	0.000*
	Ambulance	117 (11.9)[a]	78 (8.4)[b]		
	Police	198 (20.1)[a]	257 (27.6)[b]		
	Self-referring/with family/friend	406 (41.2)[a]	336 (36.1)[b]		
	Transfer within hospital	125 (12.7)[a]	93 (10)[a]		
	Ambulance and police	134 (13.6)[a]	161 (17.3)[b]		
	Transfer from another hospital	6 (0.6)[a]	5 (0.5)[a]		
Admission type, *N* (%)	*N*	1501	1084	Chi-sq = 10.330 (df = 1)	0.001*
	Urgent	1460 (97.3)[a]	1027 (94.7)[b]		
	Elective	41 (2.7)[a]	57 (5.3)[b]		
Admission legal status, *N* (%)	*N*	1490	1083	Chi-sq = 0.713 (df = 1)	0.398
	Voluntary	1440 (96.9)[a]	1043 (96.3)[a]		
	Involuntary	46 (3.1)[a]	40 (3.7)[a]		

*= statistically significant differences, Chi-sq = Chi squared test

[a, b] = each superscript letter indicates a subset of period categories whose column proportions do not differ significantly from each other at the 0.05 level

Due to some missing data, the total number of cases is presented for each variable

(Chi-sq = 42.171 (df = 2), $P = 0.000$) compared to the pre-COVID-19 period (Table 3).

We also found significant differences in the admission mode between observed periods (Chi-sq = 27.701 (df = 5), $P = 0.000$), with a decrease in the proportion of patients arriving alone or with family/friends in the COVID-19 period (41% before vs. 36% during COVID-19). On the other hand, there was a significant increase in the

Table 4 Reasons for admissions

Variable		Pre-COVID-19 *N* = 1501 admissions	1st year of COVID-19 *N* = 1084 admissions	Test statistics	*P*-value
Urgent, *N* (%)	*N*	1460	1030	Chi-sq = 477.987 (df = 7)	0.000*
	Suicidal	117 (8)[a]	245 (23.8)[b]		
	Heteroaggression	128 (8.8)[a]	325 (31.6)[b]		
	Autoaggression and heteroaggression	14 (1)[a]	44 (4.3)[b]		
	Intoxication	59 (4)[a]	25 (2.4)[b]		
	Acute stress reaction	3 (0.2)[a]	6 (0.6)[a]		
	Delirium	5 (0.3)[a]	4 (0.4)[a]		
	Acute worsening of the chronic condition	998 (68.4)[a]	348 (33.8)[b]		
	New psychiatric disease	136 (9.3)[a]	33 (3.2)[b]		
Elective, *N* (%)	*N*	41	57	Chi-sq = 0.237 (df = 3)	0.971
	Pharmacotherapy	12 (29.3)[a]	18 (31.6)[a]		
	Addiction treatment	24 (58.5)[a]	32 (56.1)[a]		
	Social reasons	2 (4.9)[a]	2 (3.5)[a]		
	Somatic reasons	3 (7.3)[a]	5 (8.8)[a]		

*= statistically significant differences, Chi-sq = Chi squared test

[a, b;] = each superscript letter indicates a subset of period categories whose column proportions do not differ significantly from each other at the 0.05 level

Due to some missing data, the total number of cases is presented for each variable

Table 5 Prevalence of main psychiatric diagnoses according to the International Classification of Diseases, 10th revision (ICD-10)

Diagnosis	Pre-COVID-19 *N* = 1501 admissions	1st year of COVID-19 *N* = 1084 admissions	Test statistics	*P*-value
Organic, including symptomatic, mental disorders (F00-F09)	88 (5.9)[a]	53 (4.9)[a]	Chi-sq = 27.771 (df = 8)	0.001*
Mental and behavioral disorders due to psychoactive substance use (F10–F19)	152 (10.1)[a]	86 (7.9)[a]		
Schizophrenia, schizotypal and delusional disorders (F20–F29)	785 (52.3)[a]	661 (61)[b]		
Mood (affective) disorders (F30-F39)	232 (15.5)[a]	154 (14.2)[a]		
Neurotic, stress-related, and somatoform disorders (F40–F48)	151 (10.1)[a]	64 (5.9)[b]		
Behavioral syndromes associated with physiological disturbances and physical factors (F50-F59)	3 (0.2)[a]	2 (0.2)[a]		
Disorders of adult personality and behavior (F60–F69)	68 (4.5)[a]	53 (4.9)[a]		
Mental retardation (F70-F79)	14 (0.9)[a]	7 (0.6)[a]		
Other	8 (0.5)[a]	4 (0.4)[a]		

*= statistically significant differences, Chi-sq = Chi squared test

[a, b] = each superscript letter indicates a subset of period categories whose column proportions do not differ significantly from each other at the 0.05 level

proportion of patients arriving with the police, and with both the police and ambulance in the COVID-19 period compared to the year prior (Table 3).

A significant increase in the proportion of elective admissions was found during the pandemic year compared to the control year (Chi-sq=10.330 (df=1), P=0.001). The legal status of admissions was unchanged (Table 3).

Reasons for admissions

Regarding the causes for urgent admissions (Table 4), significant differences were observed between the two periods (Chi-sq=477.987 (df=7), P=0.000). In the year before the COVID-19 outbreak, 68% of patients were hospitalized because of an acute worsening of their chronic conditions, but during the COVID-19 year, this number dropped significantly to 34%.

Admissions due to suicidality increased almost 3-fold, and admissions due to heteroagression, as well as both auto- and heteroagression increased almost 4-fold during the COVID-19 period. On the other hand, there was a decreased flow of admissions due to intoxication and new psychiatric disease in the first year of the pandemic compared to the control year.

Other urgent admission causes, as well as elective admission causes, were unchanged, as shown in Table 4.

Psychiatric diagnoses

We observed a statistically significant difference in the distribution of psychiatric diagnoses between the two periods (Chi-sq=27.771 (df=8), P=0.001), as presented in Table 5. Most hospitalizations during both periods were due to schizophrenia, schizotypal and delusional disorders (F20-29), and a significant increase from 52%

Table 6 Readmissions and discharge status

Variable		Pre-COVID-19 *N* = 1501 admissions	1st year of COVID-19 *N* = 1084 admissions	Test statistic	*P*-value
Readmission, *N* (%)	*N*	1501	1084	Chi-sq = 0.027 (df = 1)	0.870
	Yes	232 (15.5)[a]	165 (15.2)[a]		
	No	1269 (84.5)[a]	919 (84.8)[a]		
Discharge status, *N* (%)	*N*	1499	1083	Chi-sq = 147.878 (df = 4)	0.000*
	Recovery	2 (0.1)[a]	2 (0.2)[a]		
	Improved	1220 (81.4)[a]	1049 (96.9)[b]		
	Same	263 (17.5)[a]	28 (2.6)[b]		
	Worse	8 (0.5)[a]	0 (0)[b]		
	Death	6 (0.4)[a]	4 (0.4)[a]		
Discharge location, *N* (%)	*N*	1499	1084	Chi-sq = 5.042 (df = 3)	0.169
	Home care	1159 (77.3)[a]	823 (75.9)[a]		
	Other facility	303 (20.2)[a]	219 (20.2)[a]		
	Against recommendation	31 (2.1)[a]	29 (3.5)[a]		
	Death	6 (0.4)[a]	4 (0.4)[a]		

*= statistically significant differences, Chi-sq = Chi squared test

[a, b] = each superscript letter indicates a subset of period categories whose column proportions do not differ significantly from each other at the 0.05 level

Due to some missing data, the total number of cases is presented for each variable

before the pandemic to 61% during the COVID-19 pandemic was observed. On the contrary, there was a significant decrease in hospital admissions related to neurotic, stress-related, and somatoform disorders (F40-49) in the COVID-19 period (5.9%) compared to the year before (10%). Admissions for other diagnostic categories (F40-F48) were unchanged between the two periods (Table 5).

Discharge status and readmissions

There was no difference in the percentage of readmitted patients during both study periods (pre-COVID-19 15.5% vs. COVID-19 15.2%). During the COVID-19 pandemic, significantly more patients (97%) were discharged in an improved condition compared to the year prior (81%) (Chi-sq = 147.878 (df = 4), $P = 0.000$). There was no difference in the discharge location of the patients between the observed periods (Table 6).

Contacts with hospital psychiatric services: emergency department visits and urgent inpatient consultations

During the analyzed period there was an 8% decrease in psychiatric emergency department visits, from 3699 visits before the pandemic to 3403 during the first year of the COVID-19 pandemic. On the other hand, the number of urgent inpatient psychiatric consultations increased from 892 before the pandemic to 1062 during the first year of the pandemic. Overall, the number of these contacts remained similar in the two analyzed periods (4591 vs. 4465).

Discussion

This retrospective study identified a 28% reduction in psychiatric hospital admissions during the first year of the COVID-19 pandemic compared to the same period in the year before the pandemic. At the Department of Psychiatry, University Hospital of Split, Croatia, the total number of beds decreased by 20% during the pandemic's first year, and outpatient hospital services were reorganized or temporarily closed. Despite the decline in psychiatric hospitalizations, the number of contacts with hospital psychiatric services - including emergency psychiatry department visits and urgent inpatient psychiatric consultations - remained relatively stable, with 4591 contacts before the pandemic and 4465 during the first year of the pandemic. This suggests that the demand for psychiatric care remained high, but psychiatric services have changed in response to the pandemic. It is possible that some patients who would have been hospitalized in the past were not admitted due to reduced capacity in beds and medical personnel, stricter admission criteria, or concerns about coronavirus infection. As a result, these patients may have been treated in other hospital departments via psychiatric consultations or may have not received the necessary medical care.

Our results are in line with the study about the impact of COVID-19 on psychiatric hospital admissions in Croatia between 2020 and 2022, which reported a significant average decrease in total admissions, and a 28% decrease in the number of admissions of psychiatric patients at both secondary and tertiary hospitals [4]. A study from the largest special Psychiatric Hospital Vrapče in Zagreb, Croatia, also found a significant decline in hospitalizations during the COVID-19 pandemic [22]. Similarly, studies from Germany [7, 8], Italy [9, 10], Portugal [11], South Korea [12], and Australia [13], also indicated a decrease in psychiatric hospitalizations due to the COVID-19 pandemic. There are several explanations for the observed reduction in psychiatric hospitalizations. A

decrease in psychiatric hospital admissions was possibly due to the fear of acquiring infection in hospitals [9, 11, 22, 23]. There was widespread attention in the media on the high danger of contamination in hospitals [10], which has likely contributed to the perception of hospitals as unsafe places [24]. There might have been an increase in the stringency of the admission criteria [9, 11]. Finally, the reduction in available beds due to COVID-19-positive patients and staff shortages likely affected the hospitalization rates [11]. The reduction in available hospital beds made it harder for people with mental health problems to get the care they needed. This is an important lesson to consider when planning for future crises, where balancing infectious disease control with mental health needs will be critical [25]. Furthermore, online consultations have supplanted in-person consultations worldwide [26, 27].

Another important study finding is the shift in diagnostic categories of hospitalized patients, with a tendency to hospitalize individuals affected with more severe mental diseases during the COVID-19 pandemic. Notably, in the first year of the COVID-19 pandemic, hospital admissions due to schizophrenia, schizotypal, and delusional disorders (F20-29) increased to 61% from 52% in the year before. Multiple studies suggested lockdown measures have likely contributed to an increase in these admissions. Loneliness poses a direct risk to psychological health. Limited social interactions and possibly the break from the usual daily routines allowed vulnerable patients more time to dwell on negative thoughts, which could develop into paranoid thinking. Also, the uncertainty and fear of virus transmission from others may heighten pre-existing paranoid tendencies and deepen feelings of suspicion toward others. These factors likely exacerbated pre-existing mental health conditions, particularly in individuals with psychotic symptoms [15]. It was also proposed that COVID-19 infection could worsen existing symptoms in individuals with schizophrenia, as coronaviruses might be linked to psychotic symptoms via an immune-related process [1].

Studies from the UK [28], Italy [29], Australia [30], and Portugal [11] support this association, with a documented increase in admissions for diagnoses like nonaffective psychoses, schizophrenia, and acute transient psychosis. The COVID-19 pandemic caused significant stress, social isolation, loneliness, financial strain, and disruption of usual routines, which could have exacerbated symptoms or triggered the onset of psychotic symptoms. Also, lockdowns and restrictions disrupted access to regular mental health services, potentially leading to worsening symptoms and increased need for hospitalization [15]. There is growing evidence that COVID-19 infection might have direct neurological effects, potentially increasing the risk of developing mental health disorders [31–33]. Psychotic symptoms, such as delusions, hallucinations, and disordered conduct, can cause risky behavior, particularly violent or suicidal thoughts. These problems necessitate immediate attention, frequently involving family or legal action. However, patients with schizophrenia may find it difficult to maintain social withdrawal and protective measures, making them vulnerable to the restrictions created by the ongoing pandemic circumstances and more susceptible to decompensation [1]. A systematic review highlighted increased COVID-19 infection and mortality rates of individuals with schizophrenia spectrum disorders compared to the general population and paradoxically, access to intensive care units for this vulnerable group did not appear to be prioritized. Patients with schizophrenia spectrum disorders constitute a high-risk group requiring fair access to healthcare support during public health crises like COVID-19 and top priority in national COVID-19 immunization campaigns, as well as guaranteeing prompt access to the intensive care unit [34].

However, studies from Croatia [4], South Korea [12], and Turkey [35] reported a significant decrease in hospital admissions for psychotic disorders, including schizophrenia, schizotypal and delusional disorders during the COVID-19 pandemic. Limitations in community-based mental health infrastructure and support networks for managing individuals with psychosis might have contributed to these findings [12].

Our finding of a noticeable reduction in hospital admissions related to neurotic, stress-related, and somatoform disorders (F40-F48) during the COVID-19 pandemic is concordant with studies from the UK [15, 28], Croatia [4], Spain [36], Germany [7], and Portugal [11]. Several factors likely contributed to this finding, such as reluctance to seek professional help, potentially due to heightened anxieties and concerns about virus exposure in hospitals [37]. Furthermore, limitations on movement and potential changes in healthcare service availability could have further hampered access to mental health care during this time [11, 37].

In this study, patients hospitalized during the COVID-19 pandemic were more burdened with a positive personal history of psychiatric diseases. Similarly, a Turkish study showed higher emergency admission rates for patients with prior psychiatric history during the lockdown and pandemic [35]. In contrast, Beghi et al. reported a dramatic decrease in patients with previous psychiatric history between 2019 and the COVID-19 period [29]. The COVID-19 pandemic has interrupted mental health care, causing symptoms to worsen, and increasing the need for hospitalization among those with pre-existing psychiatric disorders [11, 38]. Supporting these findings, a multi-country study identified a link

between pre-existing mental health conditions and worsening symptoms during the pandemic [39].

According to our data, there was a significant decrease in the proportion of patients with psychiatric comorbidities hospitalized in the COVID-19 period. We were unable to find studies that confirm our results. However, during the pandemic, significantly more patients were admitted due to schizophrenia and delusional disorders, who mostly have one diagnosis; and fewer patients were admitted with diagnoses such as affective disorder, anxiety disorders, and adult personality disorder, which mainly have more than one psychiatric diagnosis. On the other hand, it is also possible that this finding was a direct consequence of the reduced quality of patient assessment due to strain on the hospital system during the COVID-19 pandemic.

A worrying finding was a significant increase in admissions due to suicidality (almost 3-fold), and heteroaggresion or both autoagression and heteroagression (almost 4-fold) during the COVID-19 period. Other studies documented a concerning rise in suicidal ideation during the COVID-19 pandemic [9, 25, 40]. Beghi et al. found that admissions for suicidality and heteroaggression increased during COVID-19 [29]. Similarly, Abbas et al. reported that patients admitted for psychiatric care during COVID-19 more often exhibit potential for aggression [28]. The COVID-19 pandemic introduced a multitude of stressors known to exacerbate suicidality and aggression, including social isolation, economic strain, and domestic violence. Lockdowns and restrictions may have exacerbated existing mental health issues, leading to more urgent admissions [24, 41–43]. It was also found that individuals under lockdown or shelter-in-place orders experience an increase in suicide thoughts each month, while those without such restrictions remain stable. Addressing this issue in public health policy and routine clinical care is crucial [44]. Furthermore, a systematic review underscores the potential negative psychological effects of quarantine, including post-traumatic stress symptoms and anger. This emphasizes the need for targeted interventions to minimize the duration and psychological burden of quarantine measures, alongside clear communication and resource provision [45].

During the healthcare crises such as COVID-19 pandemic, it is crucial to focus on promoting mental wellness in the public to reduce stress, anxiety, fear, and loneliness. Traditional and social media programs should be implemented to encourage positive mental health and alleviate suffering, thus preventing the rise of suicidal ideations. Every individual plays a vital role in maintaining their mental well-being, and it is essential to prioritize self-care during these challenging times [41]. It is crucial to recognize the importance of safeguarding the mental health of vulnerable individuals as a top priority for public health. On-demand telepsychiatry has proven to be an effective solution that offers better continuity of care, while also reducing the burden on emergency departments, shortening discharge timelines, and decreasing psychiatric hospitalization rates. Additionally, it has been linked to positive outcomes and high patient satisfaction. The COVID-19 pandemic provided an opportunity to break down cultural, technological, and normative barriers that have prevented people from utilizing telepsychiatry services in the past [46].

Our results showed a lower number of admissions due to intoxication and new psychiatric disease during the COVID-19 period. The pandemic altered social behaviors, restricted access to substances, and affected mental health help-seeking. Reduced social gatherings and lockdowns likely contributed to fewer intoxication-related admissions. According to data from the European Monitoring Centre for Drugs and Drug Addiction, drug use has decreased overall during the first 3 months of the COVID-19 pandemic [47]. A study from France also found a decrease in first-episode psychiatric consultations during the COVID-19 pandemic [48], which can be partly attributed to a more stringent threshold for seeking initial mental healthcare.

The observed increase in hospitalizations for aggressive behavior during the pandemic was also reflected in the changes in the admission mode of patients. In the COVID-19 year, more patients arrived in police custody or with both the police and ambulance compared to the control year. A study from Germany also showed a significant increase in the proportion of patients brought in by police during the pandemic [25]. The rise in police involvement might reflect a higher level of crisis among patients during the pandemic. Stricter social distancing rules could have been especially challenging for individuals with schizophrenia or impulsive personality disorders, leading to more police interventions. Indeed, patients brought in by police custody often display severe symptoms like delusions, aggression, suicidal thoughts, or attempts [25].

More severe reasons for admissions and admission diagnoses observed during the pandemic could partially explain a significantly longer length of hospital stay; from 14 days before the pandemic to 15 days in the first COVID-19 year. Several studies also reported longer lengths of stay during the COVID-19 pandemic [9–11], possibly because admitted individuals had more severe conditions and required longer hospitalization [10], although opposing findings also exist [8, 25].

Our patients hospitalized during the COVID-19 year were significantly younger compared to the inpatients in the year before, although the difference was small. Australian study also showed that patients admitted during the COVID-19 period were younger [13]. Moreover, a

Korean study found that outpatients visiting during the COVID-19 pandemic were younger than those in the pre-COVID-19 period [37]. Older adults experienced lower psychological distress associated with COVID-19 due to higher levels of resilience, despite experiences of social isolation, more severe symptoms, and limited access to healthcare [49]. There was a social stigma about the elderly as they were perceived as contagious. Older age is a known independent risk factor for the severity of COVID-19 and the associated mortality [50], leading older adults to attend the hospitals less frequently due to the fear of infection.

The observation of increased hospitalizations of patients with higher education during the COVID-19 pandemic was in line with the study from Melbourne on the effects of a lockdown on inpatient admissions [13]. Those with a higher education level may have been more affected by the changes as their customs and routines have been disrupted by the pandemic [51]. People with a higher level of education mostly have a more complex structure of daily activities. Their routines, which are often closely related to academic and professional duties (like research, lectures, meetings, administrative tasks), were significantly disrupted by the transition to working from home, cancellation of conferences and events, and difficulties in conducting research. These changes probably led to increased workload, isolation, and mental health problems among people with higher levels of education, in contrast to people with lower levels of education, whose jobs were often less affected by the pandemic. Also, the pandemic caused a delay in seeking help for mental health issues among the general population. However, individuals with higher education levels might have been more likely to seek professional help during a crisis, because participants with higher education perceived more negative effects than those with lower education [52].

During the COVID-19 pandemic, patients treated at our department have been discharged from the hospital in better health condition than before the pandemic. We were unable to find studies in the literature investigating the discharge status of psychiatric patients during the COVID-19 pandemic. Prolonged hospital stays may have contributed to this increase, as patients with higher clinical severity may have been admitted during the isolation period. Only patients more likely to benefit from hospitalization were admitted, resulting in a higher discharge rate with improvement. Furthermore, clinicians may have kept patients in the hospital longer to reduce the possibility of readmission, as there was a greater chance of infection outside the hospital [9]. Finally, the proportion of readmitted patients remained unchanged between the control period and the first year of the COVID-19 outbreak (15%), similar to findings from the UK [15] and Portugal [11].

Study limitations

Our study has several limitations. First, the retrospective design could not control unknown confounders that might influence the results. Second, study generalizability is limited due to a single-center setting. Discharge diagnoses and discharge assessments were made by different psychiatrists which could introduce bias. Also, the discharge status was subjectively assessed, therefore it was not uniform and objective. Furthermore, we were unable to acquire data about readmission to other hospitals and the number of non-urgent inpatient psychiatric consultations. Most importantly, we could not estimate to what extent the reduced capacity of psychiatric beds observed during the first year of the COVID-19 pandemic influenced the reduction in the number of hospitalizations.

Relevance of the study

Of the available literature at the time of writing, no studies assessed such detailed characteristics, modality, and causes of psychiatric admissions during a year after the emergence of COVID-19 in Croatia and possibly broader. Our research covers the entire first year of the COVID-19 pandemic, while most similar studies we identified in the literature only covered the lockdown period.

This study's findings are highly relevant both regionally and internationally, despite its focus on a single institution and country. The study provides critical insights into the impact of COVID-19 on psychiatric admissions in a high-volume tertiary hospital setting, highlighting trends that may inform mental health policy in a region with few data available, it can help with future resource allocation, and emergency preparedness both regionally and in comparable settings worldwide.

Namely, Croatia is part of South-Eastern Europe, which has a distinct cultural, economic, and healthcare-specific factors that may impact mental health differently than in other regions. Thus, the study has regional relevance with broader implications. To our knowledge, similar studies from this part of the world have not been published.

Also, even though this study was conducted in a single hospital, this is a high-volume hospital serving more than a quarter of the Croatian population and a large part of Bosnia and Herzegovina. Specifically, about one million citizens of the Republic of Croatia and about half a million citizens of the southern part of Bosnia and Herzegovina, as well as half a million tourists during the tourist season, gravitate to this hospital [17].

Tertiary hospitals typically handle complex or severe cases, making this setting especially valuable for identifying trends in acute psychiatric admissions. Changes observed here may reflect the impact of the pandemic

on the most vulnerable populations with severe mental health needs. As tertiary institutions often serve as hubs of specialized care, the findings provide a concentrated view of pandemic-related challenges that are likely representative of trends in other tertiary hospitals.

Furthermore, the study has international relevance because its findings reflect broader trends in the psychological impact of the COVID-19 pandemic observed globally. The significant increase in hospitalizations for suicidality, aggression, and severe disorders like schizophrenia aligns with similar concerns documented in other regions. This makes the study applicable beyond Croatia, providing valuable insights that can inform global mental health policies and crisis preparedness, as other health systems face similar challenges in providing continuity of psychiatric care under public health crises.

The study also provides insights into immediate healthcare system adaptation during public health crisis. Internationally, healthcare leaders can use these findings to shape strategies and allocate resources toward the most vulnerable populations, emphasizing the importance of flexibility in hospital capacity, telepsychiatry, and emergency mental health response. The study findings can be a foundation for policy and resource planning; it can help guide the scaling of mental health services, especially in emergency preparedness and in setting priorities for resource distribution.

Importantly, the study provided comparative data for future studies, both within Europe and globally. This type of detailed, regional data strengthens the international body of evidence, helping researchers to better understand and prepare for the psychiatric impacts of pandemics. The study can potentially encourage similar studies in other countries or regions. This could lead to a more comprehensive, global picture of how psychiatric services were impacted by the pandemic and help identify universal and region-specific challenges.

Conclusions

This study suggests that the first year of the COVID-19 pandemic caused a reduction in psychiatric admissions at the tertiary hospital in southern Croatia. Notably, hospitalizations for suicidal ideation and aggressive behavior, as well as for schizophrenia and delusional disorders were increased during the COVID-19 pandemic. Inpatients were younger, better-educated individuals with the burden of positive psychiatric history, more often accompanied by the police, and were hospitalized longer. These results point out individuals most affected by the interruption of mental healthcare during the pandemic period. Study findings could help the healthcare system plan measures to better adapt to the needs of the most vulnerable patients in cases of future public health crises.

Abbreviations

COVID-19	The Coronavirus disease
STROBE	The Strengthening the Reporting of Observational Studies in Epidemiology
ICD-10	The International Classification of Diseases, 10th Revision
SD	Standard Deviation
IQR	Interquartile Range
IR	Incidence Rate
IRR	Incidence Rate Ratio
CI	Confidence Interval

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12888-024-06436-1.

Supplementary file 1: STROBE checklist completed

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Author contributions
TV: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing; TBM, AB, TM, TU, TG: Investigation, Writing – review & editing; LP: Methodology, Supervision, Writing – review & editing; SD: Conceptualization, Methodology, Validation, Formal analysis, Supervision, Writing – original draft, Writing – review & editing. All authors approved final version of the manuscript to be submitted and agree to be accountable for the work.

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Data availability
The data will be available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The ethics committee of University Hospital of Split, Croatia approved the study on July 26, 2022 (Class: 500-03/22 – 01/152; Reg. No.: 2181 – 147/01/06/M.S.-22-02). The informed consent was waived as data were collected retrospectively during routine hospital care. The data were stored anonymously and following the Declaration of Helsinki 2013 guidelines.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Ministry of Defence of the Republic of Croatia, Zagreb, Croatia
[2]School of Medicine, University of Split, Split, Croatia
[3]Department of Psychiatry, University Hospital of Split, Split, Croatia
[4]Center for Evidence-Based Medicine and Health Care, Catholic University of Croatia, Ilica 244, Zagreb 10000, Croatia
[5]Department of Anesthesiology and Intensive Care, University Hospital of Split, Split, Croatia

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