Journal of Health Sciences

RESEARCH ARTICLE Open Access

The impact of COVID-19 pandemic on consumption of psychotropic drugs in central region of Bosnia and Herzegovina

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ABSTRACT

Introduction: The COVID-19 pandemic significantly influenced mental health worldwide. This study assessed the use of antidepressants, anxiolytics, antipsychotics, and mood stabilizers in Sarajevo Canton across three periods: before, during, and after the pandemic.

Methods: The data used in this study were taken from the database of the production system of the Public Institution "Apoteke Sarajevo," Bosnia and Herzegovina. The database contains a total of 1,764,582 records on the sale of individual drugs, i.e., 2,361,059 original packages of drugs that are the subject of this research. Prescription data for psychotropic medications in the adult population were analyzed and compared between the pre-pandemic, pandemic, and post-pandemic phases.

Results: Antidepressant use increased by 2.76% during the pandemic and by an additional 3.82% afterward. Anxiolytics showed a reduction of 5.29% during the pandemic and a further 18.14% decline post-pandemic. Antipsychotic prescriptions increased by 5.26% during the pandemic but decreased by 8.65% in the following period. Mood stabilizers increased by 6.8% during the pandemic and fell by 5.57% afterward. The most commonly used drugs were escitalopram among antidepressants, lamotrigine among mood stabilizers, bromazepam and diazepam among anxiolytics, and sulpiride, haloperidol, and promazine among antipsychotics.

Conclusion: The pandemic was associated with a rise in antidepressant and mood stabilizer use, likely reflecting heightened psychological stress and social isolation, whereas anxiolytics declined and antipsychotics fluctuated. These findings underline the lasting impact of the pandemic on community mental health and the need for improved preventive and therapeutic strategies.

Keywords: COVID-19 pandemic; psychotropic drugs; mental health

INTRODUCTION

The coronavirus pandemic caused profound and wide-ranging disruptions in daily life across the world, affecting not only physical health systems but also psychological well-being at the population level. The emergence of new challenges at both personal and professional levels, uncertainty regarding the duration and intensity of public health measures, lack of predictability in social and economic functioning, as well as strict movement restrictions, represented major stressors that significantly increased the risk of mental health disorders and exacerbated pre-existing psychiatric conditions (1-5). In addition to the global burden, similar patterns were observed across Europe and neighboring countries, including the Western Balkans and European Union member states, where comparative studies have shown marked but heterogeneous increases in mental health service utilization and psychotropic drug prescribing trends, reflecting differences in healthcare system organization, pandemic response strategies, and access to psychiatric care services.

According to the World Health Organization, mental health is defined as a state of well-being in which an individual realizes their abilities, can cope with normal life stressors, works productively, and contributes to society. Mental health is therefore recognized as an essential component of overall health rather than merely the absence of disease. In

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Submitted: 23 September 2025/Accepted: 18 July 2026

DOI: https://doi.org/10.17532/jhsci.2026.2935

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this context, and in response to the growing global burden of mental disorders, mental health was formally recognized as a public health priority, leading to the adoption of the Declaration on Achieving Mental Health Equity for the 21st Century in 2018 (6). Large-scale crises such as pandemics represent stressors that exceed the scope of everyday life challenges and can profoundly disrupt psychological balance. During the COVID-19 pandemic, fear of infection, uncertainty about the future, social isolation, and changes in lifestyle significantly intensified stress responses and influenced individual coping mechanisms (7-10).

Comparative evidence from international literature indicates that the COVID-19 pandemic led to a substantial increase in mental health burden across many countries, including European Union member states and countries in the Western Balkans region. However, the magnitude and temporal dynamics of these changes varied considerably depending on national public health policies, availability of mental health services, socioeconomic conditions, and pre-existing healthcare system capacities. In several European countries, including those with well-established psychiatric care systems, increased rates of anxiety, depressive disorders, and stress-related conditions were reported, alongside measurable changes in psychotropic medication consumption. These trends not only reflect increased psychological distress but also adaptations in prescribing practices and healthcare-seeking behavior during and after the pandemic period (11-13).

Certain population groups were particularly vulnerable to the psychosocial consequences of the pandemic. Individuals with pre-existing mental disorders represented a high-risk group, as they faced additional challenges in accessing healthcare services during lockdowns and periods of healthcare system reorganization. Moreover, patients with severe psychiatric disorders such as schizophrenia and bipolar disorder were at increased risk of infection and poorer clinical outcomes, partly due to comorbid somatic conditions, reduced self-care capacity, and cognitive impairments. These factors contributed to more severe disease courses and, in some cases, increased mortality during the COVID-19 infection (14).

Emerging evidence also suggests that COVID-19 infection itself may be associated with the development of new psychiatric manifestations in previously healthy individuals. Reported neuropsychiatric complications include delirium, encephalopathy, agitation, depression, anxiety disorders, and acute or chronic psychotic episodes (12). These findings further highlight the complex interaction between infectious disease and mental health outcomes during the pandemic period.

From a pharmacological perspective, psychiatric medications are generally classified into four main groups used in adult populations: Antidepressants, anxiolytics, antipsychotics, and mood stabilizers (15). Antidepressants are primarily used in the treatment of depressive disorders and exert their effects through modulation of neurotransmitter systems, including serotonin, norepinephrine, and dopamine, which play key roles in mood regulation. Antipsychotics are mainly indicated for psychotic disorders such as schizophrenia, schizoaffective disorder, and bipolar disorder, and act primarily through dopamine receptor antagonism, particularly at D2 receptors, whereas atypical antipsychotics additionally influence serotonergic pathways. Anxiolytics are used for the treatment of anxiety disorders and exert their effects mainly by enhancing gamma-aminobutyric acid activity, resulting in sedative and anxiolytic effects. Mood stabilizers are primarily used in bipolar disorder and require sustained administration to achieve full therapeutic effect, reducing both manic and depressive episode frequency and severity. In clinical practice, combinations of these drug classes are often required for the management of complex psychiatric conditions (15).

In summary, although these pharmacological classes differ in mechanisms of action, therapeutic targets, and side effect profiles, they are frequently used in combination to achieve comprehensive symptom control in psychiatric patients.

Within this context, monitoring psychotropic drug utilization provides an important indirect indicator of population mental health trends and healthcare system response. Therefore, the aim of this study was to investigate the impact of the COVID-19 pandemic on mental health at the population level by analyzing the consumption of drugs affecting the central nervous system before, during, and after the pandemic period.

METHODS

The data used in this study were taken from the database of the production system of the Public Institution "Apoteke Sarajevo," Bosnia and Herzegovina. A new relational database was created for the needs of this research and consists of four tables: Details_data (transaction table), products (codebook of drugs), atc_inn (codebook of ATC codes and generics) and manufacturers (codebook of drug manufacturers). The database contains a total of 1,764,582 records on the sale of individual drugs, i.e., 2,361,059 original packages of drugs that are the subject of this research. The data are placed in a transaction table and contain records of the sale of drugs for the period from 2018 to 2023. The data were grouped into three groups, namely the period before the coronavirus, i.e., 2018 and 2019, then the period of the coronavirus pandemic, i.e., 2020 and 2021 and finally the period after the end of the coronavirus pandemic, i.e., 2022 and 2023. Drugs for psychiatric diseases, that is, drugs that act on the nervous system, are divided into four main groups of drugs used to treat adults. These are antidepressants, anxiolytics, antipsychotics and mood stabilizers. In addition to these four groups, we also analyzed a fifth group where we classified other drugs that were not classified into the first four main groups.

The study was conducted by the Declaration of Helsinki (last revised in 2008) on the rights of patients involved in biomedical research, approved by the Ethical Committee of the "JU Apoteke Sarajevo" number 01-01-1169/25.

A retrospective observational study was provided with comparative analyses across 3 time periods. Dependent variables used in the study were prevalence and quantity of prescribed psychotropic drugs (expressed as percentages and ratios). Independent variables in this study were the time period (pre-, during, and post-COVID-19 pandemic).

In this study, both descriptive and inferential statistical methods were applied to analyze patterns of psychotropic drug consumption across three defined time periods.

Descriptive statistics were used to present the basic characteristics of the data, including absolute frequencies, percentages, and proportions of consumption for each drug class (antidepressants, anxiolytics, antipsychotics, mood stabilizers, and other drugs acting on the nervous system) within each observed period. Results were expressed as total numbers of dispensed packages and the relative share of each drug class in overall psychotropic drug consumption.

To assess statistically significant differences in drug consumption between time periods, inferential statistical methods were applied. The primary method used was the Chi-square (χ^2) test of independence, which was employed to examine differences in the distribution of categorical variables, specifically the proportions of drug classes across the 3 time periods (pre-COVID-19, COVID-19, and post-COVID-19 periods).

In cases where expected cell frequencies were below 5, Fisher's exact test was used to provide a more accurate estimation of statistical significance for small sample sizes. To further evaluate temporal patterns and identify trends over time, the Cochran–Armitage trend test was applied. This test was used to assess the presence of a statistically significant linear trend in proportions across ordered time categories. It enabled the evaluation of whether there was a consistent increase or decrease in the consumption of specific drug classes across the three sequential periods (pre-pandemic, pandemic, and post-pandemic). This approach allowed for a more detailed assessment of the direction and consistency of changes in drug utilization over time.

In addition, temporal trends were quantified using percentage change calculations between consecutive periods, allowing for the measurement of relative increases or decreases in drug consumption across time intervals.

All statistical tests were two-sided, and $p < 0.05$ was considered statistically significant.

All analyses were performed using standard statistical software (e.g., Statistical Package for the Social Sciences, R, or equivalent platforms), with data analyzed at the level of aggregated drug categories and predefined time intervals.

The datasets generated during the present study are available from the first author on reasonable request.

RESULTS

The results of the research will be presented comparatively in tables and graphs, where the amounts of drug consumption will be shown in quantity and percentage, classified by generics and by periods of 2 years, using descriptive and summary statistical analysis. Furthermore, the results will be presented in such a way as to show the consumption of drugs in the COVID-19 pandemic period in comparison to the period before the COVID-19 pandemic and after the COVID-19 pandemic in order to show whether there is an increase in the consumption of drugs, i.e., the possible impact of the pandemic on the mental health of people living in Sarajevo Canton by analyzing the use of drugs with effects on the nervous system before, during and after the pandemic.

Data were extracted and transformed in a manner suitable for analysis at the following levels:

- Quantity for the entire period of 6 years by drug groups (Table 1 and Figures 1-5)
- Quantity for the entire period of 6 years according to ATC-INN Anatomical Therapeutic Chemical (classification system) International Nonproprietary Name (ATC-INN) of drugs (Table S1)
- Quantities for the periods (before-COVID-19 pandemic 2018-2019, COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023) by drug groups (Table 2 and Figures 6-11)
- Quantity for periods (before-COVID-19 pandemic 2018-2019, COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023) by ATC-INN of drugs (Table 3)
- Quantity by year (entire period 2018-2023) by drug groups (Table S2)
- Quantity by year (entire period 2018-2023) by ATC-INN of drugs (Table S3).

DISCUSSION

The coronavirus pandemic caused many changes in the lives of people around the world, which affected their mental health. The aim of this paper was to investigate the consumption of psychiatric drugs in Sarajevo Canton, Bosnia and Herzegovina, before, after, and during the COVID-19 pandemic. The consumption of four main classes of drugs used to treat adults was monitored. These are antidepressants, anxiolytics, antipsychotics and mood stabilizers. The results of the research on the consumption of antidepressants showed that the consumption of antidepressants increased in the COVID-19 pandemic compared to before-COVID-19 pandemic by 2.76%, but also increased in the post-COVID-19 pandemic period compared to the COVID-19 pandemic period by 3.82%. The consumption of anxiolytics decreased in the COVID-19 pandemic period compared to the before-COVID-19 pandemic period by 5.29%, and in the post-COVID-19 pandemic period compared to the COVID-19 pandemic period by 18.14%. The consumption of antipsychotics in the COVID-19 pandemic period increased compared to the before-COVID-19 pandemic period by 5.26%, whereas in the post-COVID-19 pandemic period it decreased compared to the COVID-19 pandemic period by 8.65%. The consumption of mood stabilizers in the COVID-19 pandemic period increased compared to the before-COVID-19 pandemic period by

TABLE 1. Amount of drug consumption for the entire period of 6 years by drug groups

Group	Quantity	Group share (%)
Anxiolytics	1,317,253	55.79
Antidepressants	335,379	14.20
Antipsychotics	395,723	16.76
Other drugs that affect the nervous system	175,046	7.41
Mood stabilizers	137,658	5.83
Total	2,361,059	100

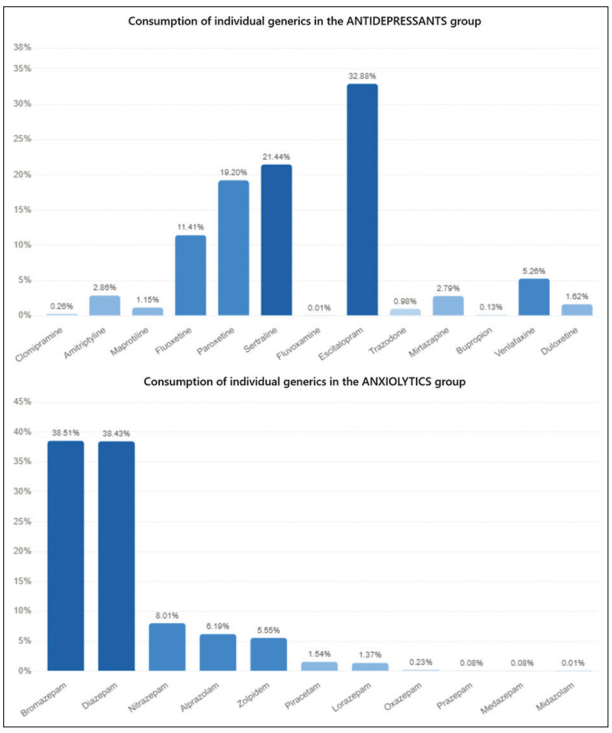

FIGURE 1. Consumption Share of individual generics in the antidepressants group.

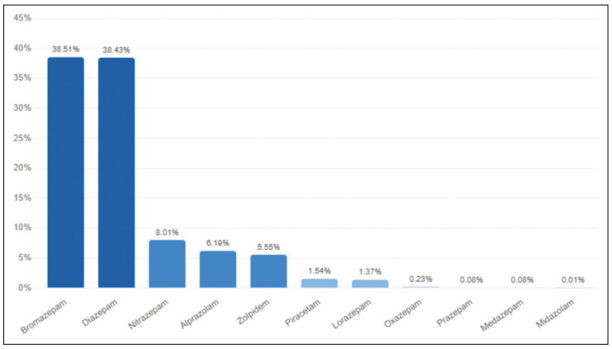

FIGURE 2. Consumption of individual generics in the anxiolytics group.

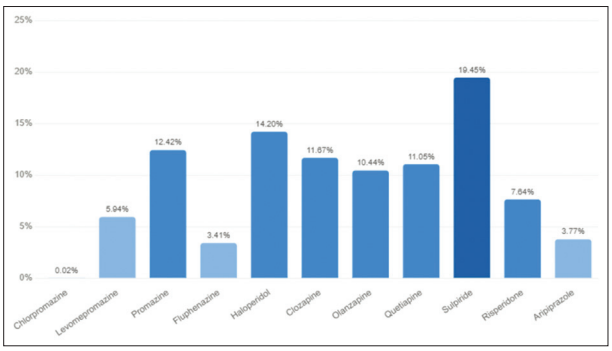

FIGURE 3. Consumption of individual generics in the antipsychotics group.

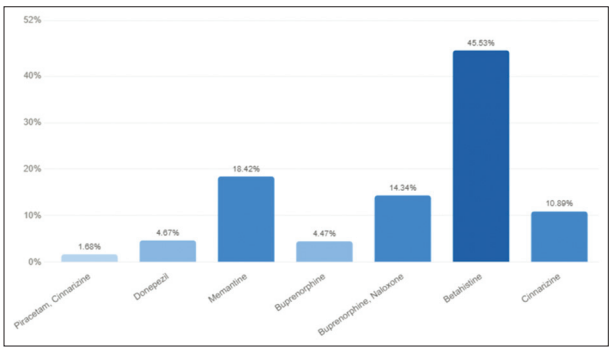

FIGURE 4. Consumption of individual generics in the group, other drugs that affect the nervous system.

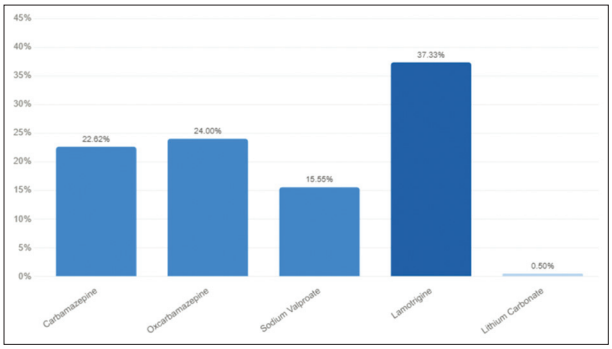

FIGURE 5. Consumption of individual generics in the Mood Stabilizers group.

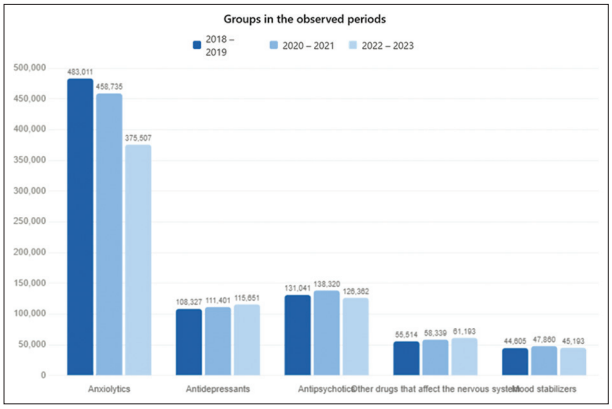

FIGURE 6. The quantity of drugs used for the periods (before the COVID-19 pandemic 2018-2019, the COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023).

6.80%, whereas in the post-COVID-19 pandemic period it decreased compared to the COVID-19 pandemic period by 5.57%. The consumption of other drugs that affect the nervous system increased in the COVID-19 pandemic period compared to the before-COVID-19 pandemic period by 4.84%, and also in the post-COVID-19 pandemic period compared to the COVID-19 pandemic period by 4.89%. It can be concluded that the consumption of antidepressants as well as mood stabilizers gradually increased throughout the observed period. The trend of growth in the consumption of antidepressants and mood stabilizers in the COVID-19 pandemic period continued in the post-COVID-19 pandemic period, which may indicate the impact of the pandemic on the psychological state of people. Of the antidepressants, escitalopram was used the most, the consumption of which increased throughout the monitored period, followed by sertaline, paroxetine and fluoxetine. The use of anxiolytics gradually decreased throughout the monitored period, both during the COVID-19 pandemic and after the pandemic. The most used anxiolytics during the monitored period were bromazepam and diazepam. The use of antipsychotics increased during the COVID-19 pandemic period, but decreased in the post-COVID-19 pandemic period. The most commonly used antipsychotics were sulpiride, haloperidol and promazine. The consumption

TABLE 2. The ratio of the quantity of drugs used for the periods (before the COVID-19 pandemic 2018-2019, the COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023) by groups of drugs in percentage

Group	Before COVID	COVID	Post-COVID	COVID versus Before COVID		Post-COVID versus COVID	
	2018-2019	2020-2021	2022-2023	Quantity	Percentage	Quantity	Percentage
Anxiolytics	483.011	458.735	375.507	−24.276	−5.29	−83.228	−18.14
Antidepressants	108.327	111.401	115.651	3.074	2.76	4.250	3.82
Antipsychotics	131.041	138.320	126.362	7.279	5.26	−11.958	−8.65
Other drugs that affect the nervous system	55.514	58.339	61.193	2.825	4.84	2.854	4.89
Mood stabilizers	44.605	47,860	45.193	3.255	6.80	−2.667	−5.57
Total	822.498	814.655	723.906	−7.843	−0.96	−90.749	−11.14

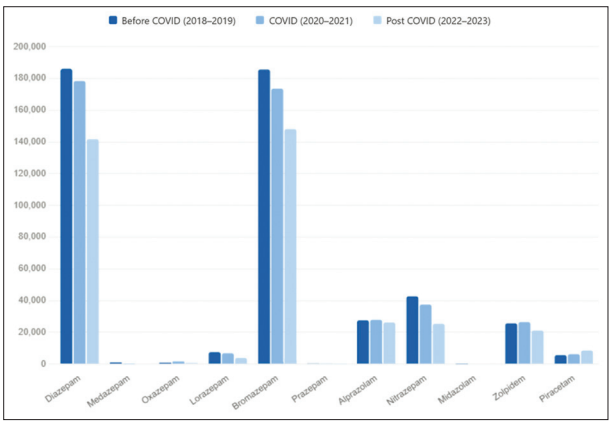

FIGURE 7. Quantity of drugs used in the Anxiolytics group (before the COVID-19 pandemic 2018-2019, the COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023)

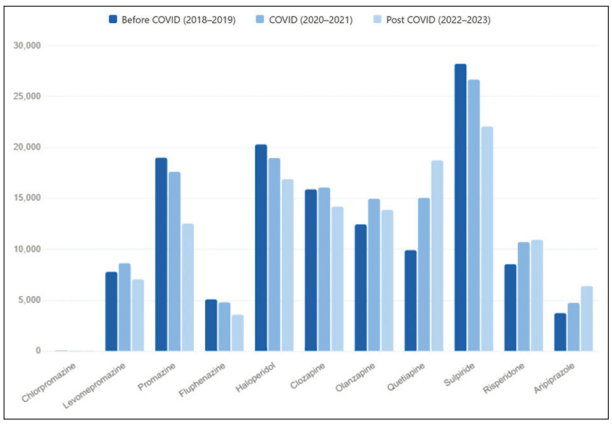

FIGURE 9. Quantity of drugs used from the Antipsychotics group (before COVID-19 pandemic 2018-2019, COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023).

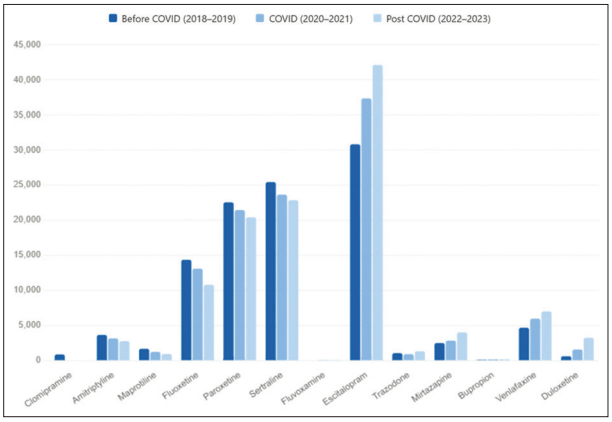

FIGURE 8. Quantity of drugs used in the antidepressants group (before the COVID-19 pandemic 2018-2019, the COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023).

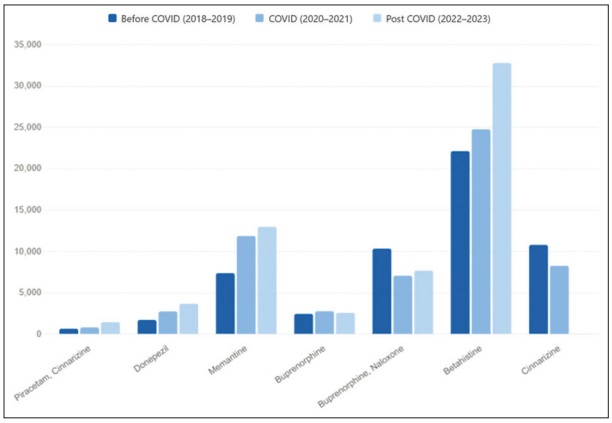

FIGURE 10. Quantity of drugs used from the group of other drugs that affect the nervous system (before the COVID-19 pandemic 2018-2019, the COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023).

of other drugs that affect the nervous system gradually increased throughout the monitored period. The most commonly used drugs from this group are betahistine, followed by cinnarizine and naloxone. The most commonly used mood stabilizer in the monitored period was lamotrigine, followed by carbamazepine and oxcarbamazepine.

International evidence supports these findings, particularly regarding antidepressant use. In the study by Pazzagli et al., antidepressant consumption increased during the COVID-19 pandemic in Italy compared with pre-pandemic years, with sustained elevation throughout 2020 (16). This is in line with our findings, where antidepressant use increased during the COVID-19 pandemic period and further rose in the post-COVID-19 pandemic period, suggesting a persistent upward trend beyond the acute phase. The authors attributed these changes to increased psychological distress, although changes in prescribing behavior were also considered.

Similarly, Di Valerio et al. reported the strongest increase in antidepressant use among adolescents and young adults, particularly females, with sustained growth throughout the pandemic period (17). Although our study did not analyze age-specific subgroups, the observed overall increase in antidepressant consumption is consistent with these findings, suggesting a broader population-level mental health impact.

A systematic review by Tiger et al. confirmed an early surge

TABLE 3. The ratio of the quantities of drugs used for the periods (before the COVID-19 pandemic 2018-2019, the COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023) classified by ATC/generics

Group	ATC	INN	Before COVID-19 pandemic	COVID-19 pandemic	Post-COVID- 19 pandemic	COVID-19 pandemic versus Before COVID-19 pandemic		Post-COVID-19 pandemic versus COVID-19 pandemic	
			2018-2019	2020-2021	2022-2023	Quantity	Percentage	Quantity	Percentage
Anxiolytics	N05BA01	diazepam	186.123	178.355	141.702	−7.768	−4.36	−36.653	−20.55
Anxiolytics	N05BA03	medazepam	985	49	0	−936	−1910.20	−49	−100.00
Anxiolytics	N05BA04	oxazepam	796	1.621	590	825	50.89	−1.031	−63.60
Anxiolytics	N05BA06	lorazepam	7.492	6.775	3.817	−717	−10.58	−2,958	−43.66
Anxiolytics	N05BA08	bromazepam	185.611	173.579	148.061	−12,032	−6.93	−25,518	−14.70
Anxiolytics	N05BA11	prazepam	408	426	228	18	4.23	−198	−46.48
Anxiolytics	N05BA12	alprazolam	27.542	27,842	26,184	300	1.08	−1.658	−5.96
Anxiolytics	N05CD02	nitrazepam	42.662	37,456	25,339	−5.206	−13.90	−12,117	−32.35
Anxiolytics	N05CD08	midazolam	174	0	0	−174	0	0	0
Anxiolytics	N05CF02	zolpidem	25.617	26,423	21,090	806	3.05	−5.333	−20.18
Anxiolytics	N06BX03	piracetam	5.601	6.209	8,496	608	9.79	2,287	36.83
Anxiolytics in total			**483.011**	**458.735**	**375.507**	**−24.276**	**−5.29**	**−83.228**	**−18.14**
Antidepressants	N06AA04	clomipramine	875	0	0	−875	0	0	0
Antidepressants	N06AA09	amitriptyline	3.655	3.159	2,762	−496	−15.70	−397	−12.57
Antidepressants	N06AA21	maprotiline	1.684	1.239	933	−445	−35.92	−306	−24.70
Antidepressants	N06AB03	fluoxetine	14.358	13,095	10,799	−1.263	−9.64	−2,296	−17.53
Antidepressants	N06AB05	paroxetine	22.546	21.442	20.415	−1.104	−5.15	−1.027	−4.79
Antidepressants	N06AB06	sertraline	25.431	23.634	22.843	−1.797	−7.60	−791	−3.35
Antidepressants	N06AB08	fluvoxamine	0	20	15	20	100.00	−5	−25.00
Antidepressants	N06AB10	escitalopram	30.810	37.345	42.118	6.535	17.50	4.773	12.78
Antidepressants	N06AX05	trazodone	1.059	912	1.328	−147	−16.12	416	45.61
Antidepressants	N06AX11	mirtazapine	2.501	2.845	4.022	344	12.09	1.177	41.37
Antidepressants	N06AX12	bupropion	119	157	172	38	24.20	15	9.55
Antidepressants	N06AX16	venlafaxine	4.680	5.977	6.996	1.297	21.70	1.019	17.05
Antidepressants	N06AX21	duloxetine	609	1.576	3.248	967	61.36	1.672	106.09
Antidepressants in total			**108.327**	**111.401**	**115.651**	**3.074**	**2.76**	**4.250**	**3.82**
Antipsychotics	N05AA01	chlorpromazine	46	12	8	−34	−283.33	−4	−33.33
Antipsychotics	N05AA02	levomepromazine	7.795	8.643	7.065	848	9.81	−1.578	−18.26
Antipsychotics	N05AA03	promazine	19.004	17.620	12.537	−1.384	−7.85	−5.083	−28.85
Antipsychotics	N05AB02	fluphenazine	5.097	4.808	3.593	−289	−6.01	−1.215	−25.27
Antipsychotics	N05AD01	haloperidol	20.309	18.974	16.894	−1.335	−7.04	−2.080	−10.96
Antipsychotics	N05AH02	clozapine	15.894	16.079	14.207	185	1.15	−1.872	−11.64
Antipsychotics	N05AH03	olanzapine	12.457	14.968	13.884	2.511	16.78	−1.084	−7.24
Antipsychotics	N05AH04	quetiapine	9.923	15.061	18.750	5.138	34.11	3.689	24.49
Antipsychotics	N05AL01	sulpiride	28.223	26.677	22.072	−1.546	−5.80	−4.605	−17.26
Antipsychotics	N05AX08	risperidone	8.545	10.724	10.946	2.179	20.32	222	2.07
Antipsychotics	N05AX12	aripiprazole	3.748	4.754	6.406	1.006	21.16	1.652	34.75
Antipsychotics in total			**131.041**	**138.320**	**126.362**	**7.279**	**5.26**	**−11.958**	**−8.65**
Other drugs that affect the nervous system	N06BX	piracetam, cinnarizine	667	822	1.460	155	18.86	638	77.62
Other drugs that affect the nervous system	N06DA02	donepezil	1.726	2.756	3.684	1.030	37.37	928	33.67
Other drugs that affect the nervous system	N06DX01	memantine	7.383	11.873	12.983	4.490	37.82	1.110	9.35
Other drugs that affect the nervous system	N07BC01	buprenorphine	2.460	2.778	2.586	318	11.45	−192	−6.91
Other drugs that affect the nervous system	N07BC51	Buprenorphine, naloxone	10.346	7.067	7.684	−3.279	−46.40	617	8.73
Other drugs that affect the nervous system	N07CA01	betahistine	22.133	24.774	32.794	2.641	10.66	8.020	32.37
Other drugs that affect the nervous system	N07CA02	cinnarizine	10.799	8.269	2	−2.530	−30.60	−8.267	−99.98
Other drugs acting on the nervous system in total			**55.514**	**58.339**	**61.193**	**2.825**	**4.84**	**2.854**	**4.89**
Mood stabilizers	N03AF01	carbamazepine	11.628	11.018	8.495	−610	−5.54	−2.523	−22.90

(*Contd...*)

TABLE 3. (*Continued*)

Group	ATC	INN	Before COVID-19 pandemic	COVID-19 pandemic	Post-COVID- 19 pandemic	COVID-19 pandemic versus Before COVID-19 pandemic		Post-COVID-19 pandemic versus COVID-19 pandemic	
			2018-2019	2020-2021	2022-2023	Quantity	Percentage	Quantity	Percentage
Mood stabilizers	N03AF02	oxcarbamazepine	10.178	11.469	11.385	1.291	11.26	−84	−0.73
Mood stabilizers	N03AG01	sodium valproate	6.069	7.571	7.765	1.502	19.84	194	2.56
Mood stabilizers	N03AX09	lamotrigine	16.515	17.524	17.352	1.009	5.76	−172	−0.98
Mood stabilizers	N05AN01	lithium carbonate	215	278	196	63	22.66	−82	−29.50
Mood stabilizers total			**44.605**	**47.860**	**45.193**	**3.255**	**6.80**	**−2.667**	**−5.57**
Total			**822.498**	**814.655**	**723.906**	**−7.843**	**−0.96**	**−90.749**	**−11.14**

Bold values indicate the total drug consumption for the respective therapeutic group.

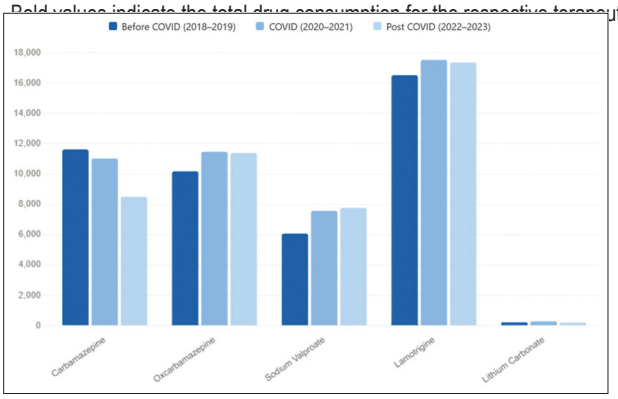

FIGURE 11. Quantity of drugs used from the mood stabilizers group (before the COVID-19 pandemic 2018-2019, the COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023).

in antidepressant, anxiolytic, and hypnotic prescribing during the first phase of the pandemic, followed by a sustained but more stable increase in antidepressant use (18). This aligns partially with our results, particularly regarding antidepressants; however, unlike their mixed findings for anxiolytics, our study demonstrated a consistent decrease in anxiolytic consumption throughout and after the COVID-19 pandemic period.

Tomsone et al. demonstrated that pandemic-related restrictions influenced consumption patterns of pharmaceuticals and other substances, with both short-term and longer-term changes observed (19). This supports our findings, where antidepressants and mood stabilizers showed sustained increases even after the COVID-19 pandemic period, suggesting prolonged effects on mental health-related pharmacological use.

Armando et al. similarly reported increased antidepressant use among young adults following an initial short-term decline, with sustained elevation over time (20). This is consistent with our findings of a progressive and continued rise in antidepressant consumption, indicating that mental health consequences may persist beyond the acute pandemic phase.

Satriani et al. observed increased use of antidepressants, anxiolytics, and antipsychotics during the pandemic, particularly benzodiazepines and selective serotonin reuptake inhibitors (21). While our results confirm increased antidepressant use, they differ regarding anxiolytics, as we observed a continuous decline in anxiolytic consumption during and after the COVID-19 pandemic period, suggesting possible regional or healthcare-system-related differences.

Alsultan reported increased psychotropic medication use in Saudi Arabia during the COVID-19 pandemic, particularly antidepressants and antipsychotics, with higher use among women and younger adults (22). This partially corresponds with our findings, where antidepressants and antipsychotics increased during the pandemic period; however, anxiolytics showed a decreasing trend in our study, indicating differing prescribing patterns across settings.

García et al. demonstrated a sustained increase in psychotropic medication use in Spain, especially antidepressants, with higher consumption among women and younger populations (23). This supports our findings of increased antidepressant use, reinforcing the global consistency of this trend.

Benistand et al. reported increased antidepressant, anxiolytic, and hypnotic use in France during the pandemic (24). In contrast, our study showed divergent trends for anxiolytics, which decreased, highlighting variability across drug classes and populations.

Ibsen et al. found that psychotropic and analgesic use increased mainly after lockdown among healthier older individuals (25), whereas Sanchez et al. confirmed increased psychotropic drug use among French military personnel during the pandemic (26). Both studies support the general increase in psychotropic consumption observed in our research.

Vukićević et al. reported long-term increases in psychotropic drug use in Croatia without significant pandemic-specific changes (27), suggesting that some increases observed elsewhere may reflect pre-existing trends rather than solely pandemic effects.

Lamer et al. identified sustained increases in antidepressant use among adolescents and young adults, particularly females (28), while Del Fiol et al. reported increased antidepressant consumption in Brazil peaking in 2021 (29), both consistent with our findings of continued antidepressant growth in the post-pandemic period.

Estrela et al. demonstrated heterogeneous prescribing patterns, including both increases and decreases depending on age and drug class (30), whereas Escalante Saavedra et al. confirmed increased antidepressant and hypnotic use in Brazil (31). These findings support the complexity of psychotropic prescribing trends observed internationally.

Villalobos-Madriz et al. reported an initial decline followed by recovery in psychotropic use in Costa Rica (32), whereas Zhang et al. found overall increased use in China but lower levels compared to other countries (33), indicating global variation in prescribing intensity.

Visser et al. observed mostly stable prescribing patterns in the Netherlands (34), whereas De Bandt et al. identified

a sustained increase in antidepressant use in France (35), further supporting the heterogeneity of pandemic-related effects.

González-López et al. reported increased psychotropic use, particularly among women, the elderly, and rural populations (36), whereas Bliddal et al. demonstrated significant increases in psychotropic use among adolescents (37), highlighting vulnerable groups.

Campitelli et al. and Leong et al. reported modest but consistent increases and two-phase patterns in psychotropic prescribing in Canada (38,39), whereas Marazzi et al. emphasized discrepancies between perceived mental health burden and medication use (40).

Couturas et al. and Farina et al. both reported increased psychotropic use in younger populations and general community settings (41,42), whereas Gallinella et al. confirmed rising pediatric psychotropic prescriptions in Italy (43), reinforcing the global trend.

CONCLUSION

The findings of this study indicate that the COVID-19 pandemic significantly influenced patterns of psychotropic drug consumption in the Sarajevo Canton. A marked increase was observed in the use of antidepressants and mood stabilizers during and after the pandemic, reflecting the growing demand for treatment of mood and affective disorders. In contrast, the use of anxiolytics declined, while antipsychotic prescriptions rose during the pandemic but fell in the post-pandemic period. Escitalopram was the most prescribed antidepressant, lamotrigine the leading mood stabilizer, bromazepam and diazepam the most frequently used anxiolytics, and sulpiride, haloperidol, and promazine the predominant antipsychotics. These outcomes suggest that the pandemic amplified the need for therapies targeting depression and mood instability, most likely as a consequence of prolonged psychological stress, isolation, and social disruption. The increased utilization of such medications, including among individuals without prior psychiatric diagnoses, highlights the long-term impact of the pandemic on community mental health. The results underscore the necessity of strengthening preventive and therapeutic strategies in mental health care to adequately address the challenges posed by large-scale crises such as pandemics.

DECLARATION OF INTERESTS

Authors declare no conflict of interest.

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SUPPLEMENTARY DATA

TABLE S1. Drug consumption for the entire period of six years according to ATC-INN

Group	ATC	INN	Quantity	Share (%)
Anxiolytics	N05BA01	diazepam	506.180	38.43
Anxiolytics	N05BA03	medazepam	1.034	0.08
Anxiolytics	N05BA04	oxazepam	3.007	0.23
Anxiolytics	N05BA06	lorazepam	18,084	1.37
Anxiolytics	N05BA08	bromazepam	507.251	38.51
Anxiolytics	N05BA11	prazepam	1.062	0.08
Anxiolytics	N05BA12	alprazolam	81,568	6.19
Anxiolytics	N05CD02	nitrazepam	105,457	8.01
Anxiolytics	N05CD08	midazolam	174	0.01
Anxiolytics	N05CF02	zolpidem	73,130	5.55
Anxiolytics	N06BX03	piracetam	20.306	1.54
Anxiolytics in total:			**1,317,253**	**100.00**
Antidepressants	N06AA04	clomipramine	875	0.26
Antidepressants	N06AA09	amitriptyline	9,576	2.86
Antidepressants	N06AA21	maprotiline	3,856	1.15
Antidepressants	N06AB03	fluoxetine	38,252	11.41
Antidepressants	N06AB05	paroxetine	64.403	19.20
Antidepressants	N06AB06	sertraline	71,908	21.44
Antidepressants	N06AB08	fluvoxamine	35	0.01
Antidepressants	N06AB10	escitalopram	110.273	32.88
Antidepressants	N06AX05	trazodone	3,299	0.98
Antidepressants	N06AX11	mirtazapine	9,368	2.79
Antidepressants	N06AX12	bupropion	448	0.13
Antidepressants	N06AX16	venlafaxine	17,653	5.26
Antidepressants	N06AX21	duloxetine	5,433	1.62
Antidepressants in total:			**335,379**	**100.00**
Antipsychotics	N05AA01	chlorpromazine	66	0.02
Antipsychotics	N05AA02	levomepromazine	23,503	5.94
Antipsychotics	N05AA03	promazine	49.161	12.42
Antipsychotics	N05AB02	fluphenazine	13,498	3.41
Antipsychotics	N05AD01	haloperidol	56,177	14.20
Antipsychotics	N05AH02	clozapine	46,180	11.67
Antipsychotics	N05AH03	olanzapine	41.309	10.44
Antipsychotics	N05AH04	quetiapine	43,734	11.05
Antipsychotics	N05AL01	sulpiride	76,972	19.45
Antipsychotics	N05AX08	risperidone	30,215	7.64
Antipsychotics	N05AX12	aripiprazole	14,908	3.77
Antipsychotics in total:			**395,723**	**100.00**
Other drugs that affect the nervous system	N06BX	piracetam, cinnarizine	2,949	1.68
Other drugs that affect the nervous system	N06DA02	donepezil	8.166	4.67
Other drugs that affect the nervous system	N06DX01	memantine	32,239	18.42
Other drugs that affect the nervous system	N07BC01	buprenorphine	7,824	4.47
Other drugs that affect the nervous system	N07BC51	buprenorphine, naloxone	25,097	14.34
Other drugs that affect the nervous system	N07CA01	betahistine	79,701	45.53
Other drugs that affect the nervous system	N07CA02	cinnarizine	19,070	10.89
Other drugs acting on the nervous system in general:			**175,046**	**100.00**
Mood stabilizers	N03AF01	carbamazepine	31.141	22.62
Mood stabilizers	N03AF02	oxcarbamazepine	33.032	24.00
Mood stabilizers	N03AG01	sodium valproate	21.405	15.55
Mood stabilizers	N03AX09	lamotrigine	51,391	37.33
Mood stabilizers	N05AN01	lithium carbonate	689	0.50
Mood stabilizers total			**137,658**	**100.00**
Total			**2,361,059**	**100.00**

TABLE S2. The quantity of drugs used for the periods (before the COVID-19 pandemic 2018-2019, the COVID-19 pandemic 2020-2021, and post-COVID-19 pandemic 2022-2023) by groups of drugs

Group	2018-2019	2020-2021	2022-2023	Total
Anxiolytics	483.011	458,735	375.507	1,317,253
Antidepressants	108.327	111.401	115,651	335,379
Antipsychotics	131.041	138,320	126,362	395,723
Other drugs that affect the nervous system	55,514	58,339	61.193	175,046
Mood stabilizers	44,605	47,860	45.193	137,658
Total	822.498	814.655	723.906	2,361,059

TABLE S3. Quantity of drugs consumed by year, classified by ATC/generics

Group	ATC	INN	2018	2019	2020	in 2021	in 2022	in 2023	In total
Anxiolytics	N05BA01	diazepam	93,902	92.221	94.001	84,354	71,818	69,884	506.180
Anxiolytics	N05BA03	medazepam	504	481	49	0	0	0	1.034
Anxiolytics	N05BA04	oxazepam	405	391	792	829	301	289	3.007
Anxiolytics	N05BA06	lorazepam	3,793	3,699	3,564	3.211	2,902	915	18,084
Anxiolytics	N05BA08	bromazepam	95,346	90,265	89,738	83,841	76,436	71,625	507.251
Anxiolytics	N05BA11	prazepam	223	185	225	201	111	117	1.062
Anxiolytics	N05BA12	alprazolam	13,980	13,562	14.272	13,570	12,981	13.203	81,568
Anxiolytics	N05CD02	nitrazepam	21,816	20,846	20,866	16,590	12,815	12,524	105,457
Anxiolytics	N05CD08	midazolam	174	0	0	0	0	0	174
Anxiolytics	N05CF02	zolpidem	12.109	13,508	14,451	11,972	10,856	10,234	73,130
Anxiolytics	N06BX03	piracetam	2,675	2,926	3,057	3.152	4.012	4,484	20.306
Anxiolytics in total:			**244,927**	**238,084**	**241.015**	**217,720**	**192.232**	**183.275**	**1,317,253**
Antidepressants	N06AA04	clomipramine	430	445	0	0	0	0	875
Antidepressants	N06AA09	amitriptyline	2.210	1,445	1,530	1,629	1.557	1.205	9,576
Antidepressants	N06AA21	maprotiline	871	813	711	528	451	482	3,856
Antidepressants	N06AB03	fluoxetine	7,283	7,075	6,816	6,279	5,596	5.203	38,252
Antidepressants	N06AB05	paroxetine	11,092	11,454	10,988	10,454	10.237	10.178	64.403
Antidepressants	N06AB06	sertraline	13,098	12,333	12,074	11,560	12.171	10,672	71,908
Antidepressants	N06AB08	fluvoxamine	0	0	8	12	15	0	35
Antidepressants	N06AB10	escitalopram	14.405	16.405	18.022	19,323	20,437	21,681	110.273
Antidepressants	N06AX05	trazodone	592	467	375	537	685	643	3,299
Antidepressants	N06AX11	mirtazapine	1.185	1.316	1,390	1,455	1,799	2.223	9,368
Antidepressants	N06AX12	bupropion	53	66	75	82	77	95	448
Antidepressants	N06AX16	venlafaxine	2.173	2,507	2,887	3,090	3.163	3,833	17,653
Antidepressants	N06AX21	duloxetine	153	456	613	963	1.351	1.897	5,433
Antidepressants in total:			**53,545**	**54,782**	**55,489**	**55,912**	**57,539**	**58.112**	**335,379**
Antipsychotics	N05AA01	chlorpromazine	23	23	10	2	4	4	66
Antipsychotics	N05AA02	levomepromazine	3,934	3,861	4,249	4,394	3.701	3,364	23,503
Antipsychotics	N05AA03	promazine	9,942	9,062	9.206	8,414	6,950	5,587	49.161
Antipsychotics	N05AB02	fluphenazine	2.162	2,935	2,990	1.818	1.922	1.671	13,498
Antipsychotics	N05AD01	haloperidol	11,693	8,616	8,273	10.701	9,725	7.169	56,177
Antipsychotics	N05AH02	clozapine	7,963	7,931	8,250	7,829	7,244	6,963	46,180
Antipsychotics	N05AH03	olanzapine	5,936	6,521	7.206	7,762	7,448	6,436	41.309
Antipsychotics	N05AH04	quetiapine	4,459	5,464	6,828	8.233	9.102	9,648	43,734
Antipsychotics	N05AL01	sulpiride	14.124	14,099	13,596	13.081	12,072	10,000	76,972
Antipsychotics	N05AX08	risperidone	4.139	4.406	5,509	5.215	5,055	5,891	30,215
Antipsychotics	N05AX12	aripiprazole	1.737	2.011	2.202	2,552	3.111	3,295	14,908
Antipsychotics in total:			**66.112**	**64,929**	**68,319**	**70,001**	**66,334**	**60,028**	**395,723**
Other drugs that affect the nervous system	N06BX	piracetam, cinnarizine	293	374	332	490	663	797	2,949
Other drugs that affect the nervous system	N06DA02	donepezil	579	1.147	1.334	1.422	1.818	1.866	8.166
Other drugs that affect the nervous system	N06DX01	memantine	2,778	4,605	6.005	5,868	7.171	5,812	32,239
Other drugs that affect the nervous system	N07BC01	buprenorphine	1.342	1.118	1,328	1,450	1.532	1,054	7,824
Other drugs that affect the nervous system	N07BC51	buprenorphine, naloxone	5,559	4,787	3.342	3,725	4.158	3,526	25,097
Other drugs that affect the nervous system	N07CA01	betahistine	10.361	11,772	11,792	12,982	15,862	16,932	79,701
Other drugs that affect the nervous system	N07CA02	cinnarizine	5,938	4,861	4,954	3.315	2	0	19,070
Other drugs acting on the nervous system in total:			**26,850**	**28,664**	**29,087**	**29,252**	**31.206**	**29,987**	**175,046**
Mood stabilizers	N03AF01	carbamazepine	5,687	5,941	5,640	5,378	4,809	3,686	31.141
Mood stabilizers	N03AF02	oxcarbamazepine	5,042	5.136	5,597	5,872	6.407	4,978	33.032
Mood stabilizers	N03AG01	sodium valproate	2,974	3,095	3,749	3,822	4,370	3,395	21.405
Mood stabilizers	N03AX09	lamotrigine	8,180	8,335	8,419	9.105	9,666	7,686	51,391
Mood stabilizers	N05AN01	lithium carbonate	90	125	126	152	102	94	689
Mood stabilizers total			**21,973**	**22,632**	**23,531**	**24,329**	**25,354**	**19,839**	**137,658**
Total			**413.407**	**409.091**	**417.441**	**397.214**	**372,665**	**351.241**	**2,361,059**