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Investigation of Self-Medication Practice Among Medical Students During the COVID-19 Pandemic in Niš

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Self-medication is a widespread practice and serious concern of public health. The objective of the study was to evaluate the prevalence of self-medication among medical students during the third wave of COVID-19 pandemic in the city of Niš and the factors associated with it.

A cross-sectional study was performed using an anonymous questionnaire distributed among medical students *online* via the Google platform. The study was conducted from November 1, 2020 to December 1, 2020.

A total of 351 medical students took part in the study and the prevalence of self-medication was 81.5%. The most significant factors associated with self-medication were: female gender by 0.741 (95%CI: from 0.088 to 1.394; $p=0.026$), COVID-positive status by 0.531 (95%CI: from 0.325 to 0.738; $p<0.001$), medical knowledge, with a significantly smaller increase in self-medication during the study by 0.259 (95%CI: from -0.386 to -0.133; $p<0.001$), and availability of over-the-counter medications, by 3.081 (95%CI: from 1.829 to 4.332; $p<0.001$). The most commonly used medication were analgetics, antipiretics, antibiotics, antitussives, nasal drops, anti-diarrheal medications, herbal preparations, vitamin supplements, and vitamin D. There is no official data indicating the use of ivermectin, or chloroquine among the studied population.

The prevalence of self-medication was notably high among medical students during the COVID-19 pandemic. There is a need for additional education for medical students regarding the side effects, toxicity, and drug resistance associated with medications.

Key words: self-medication, COVID-19 pandemic, medical students

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Istraživanje samolečenja za vreme Kovid-19 pandemije kod studenta medicine u Nišu

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Samolečenje je rasprostranjeno među studentima medicine i zdravstvenim radnicima i širom sveta i predstavlja ozbiljan problem za javno zdravlje. Cilj ove studije bio je da se proceni učestalost samolečenja među studentima medicine tokom trećeg talasa pandemije COVID-19 u gradu Nišu i faktora koji su sa njom povezani.

Sprovedena je studija preseka korišćenjem anonimnog upitnika koji je distribuiran studentima medicine *on line* preko Google platforme. Studija je sprovedena u periodu od 1. novembra 2020 do 1. decembra 2020. godine.

U istraživanju je učestvovao 351 student medicine (23 studenata i 328 studentkinja). Prevalencija samomedikacije iznosila je 81.5% u prethodnih 12 meseci. Najznačajniji faktori povezani sa samolečenjem bili su: ženski pol 0.741 (95% CI: od 0.088 do 1.394; $p=0.026$), Kovid-pozitivan status 0.531 (95%CI: od 0.325 do 0.738; $p<0.001$), medicinsko znanje 0.259 (95%CI: od -0.386 do -0.133; $p<0.001$) i mogućnost nabavke lekova bez recepta 3.081 (95% CI: od 1.829 do 4.332; $p<0.001$). Najviše su se koristili antipiretici, analgetici i antibiotici, kapi za nos, sirupi protiv kašlja, probiotici, biljni preparati, čajevi, suplementi, vitamin D. Nema zvaničnih izveštaja o korišćenju ivermektrina i hlorokina.

Prevalencija samolečenja bila je visoka među studentima medicine tokom pandemije Kovid-19. Neophodno je dodatno obrazovanje studenata medicine o neželjenim reakcijama, toksičnosti i rezistenciji na lekove koja može da se dogodi tokom samolečenja.

Ključne reči: samolečenje, Kovid-19 pandemija, studenti medicine

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Introduction

Self-medication is a widespread practice and serious concern of public health [1]. When the novel corona virus called Severe Acute Respiratory Syndrome Coronavirus Type 2 (SARS-CoV-2) emerged from Wuhan in China in December 2019 [2], spreading rapidly among residents of China, it became clear that the inhabitants of the entire planet would inevitably come into contact with it sooner or later [3]. By January 13, 2020, the first case outside China was recorded, and on January 30, 2020 [4], and on January 30, 2020, the World Health Organization (WHO) declared a state of public health emergency due to the emergence of COVID-19 disease, outbreak a Public Health Emergency of International Concern, its highest level of alarm [5].

The WHO defines self-medication as the treatment of self-identified health issues or symptoms using medications without prior consultation with a qualified healthcare professionals or the intermittent or ongoing use of medications previously prescribed by a doctor for chronic or recurring conditions [6]. The highest self-medication prevalence before the pandemic was observed in Oceania at 91.7%, while the lowest was found in Europe at 55.8%. The prevalence of self-medication among students was 70.1% from 1995 to 2017, and the prevalence of self-medication among medical science students was 97.2%, which was more than twice as high as the prevalence among non-medical students, which stood at 47.7% [7]. A study conducted in 2014 reported that the prevalence of self-medication among medical students at the University of Belgrade in Serbia was 79.9% [8]. The prevalence of self-medication during the COVID-19 pandemic ranged from 40.0% up to 72.7% [9-11] with the highest prevalence was recorded in Asia 53.0% and the lowest was in Europe 40.8%. The highest prevalence was among students 54.5% and the lowest among healthcare professionals [12]. Various reasons impact on the decisions for self-medication during in the early stages of the pandemic such as people's fear of contracting the new corona virus, the lack of an effective treatment for COVID-19, and the absence of vaccines, limited access to healthcare facilities and because of lockdowns and other restriction measures [10,13,14]. Anxiety and depression are associated with self-medication and according to the data of the WHO in the first year of the COVID-19 pandemic, prevalence worldwide of anxiety and depression increased by 25% [15]. At the same time, widespread misinformation on social media platforms created significant panic surrounding the prevention and treatment of COVID-19 [16].

The prevalence of self-medication among medical students during the COVID pandemic vary a lot between countries, from 14.9% in Brazil [17] to 83% in Pakistan [18]. The most commonly self-prescribed medications were antipyretics, analgesics, and antibiotics [10]. Over-the-counter medications (OTC) were mostly bought for mild symptoms, and they were mostly nasal drops, cough syrups, multivitamins, herbal teas, and supplements [19,20]. At the beginning of the pandemic, many medications were recommended and purchased despite insufficient evidence of their effectiveness against COVID-19, including antimalarials such as chloroquine and hydroxychloroquine, [21] as well as antibiotics penicillin, cephalosporin, fluoroquinolones, metronidazole, despite antibiotics do not treat or prevent viral infections, including COVID-19, and antiparasitic medications such as ivermectin. The ivermectin inhibited viral replication *in vitro*, but the results in human populations were controversial [22]. Similar laboratory findings existed for hydroxychloroquine, but they were not confirmed in clinical trials [23]

The first confirmed case of COVID-19 was registered on 6 March 2020 in Serbia, a state of emergency was declared on March 15, 2020 [24] and a pandemic of great epidemiological significance was declared on 19 March 2020 [25]. According to the Center for Disease Control (CDC) [26], the dominant strain of the virus in 2020 and 2021 was the Delta variant. The Delta variant was initially identified in India and quickly spread to other countries and it was a significant factor in the increase in COVID-19 cases in many regions. Physicians have observed that individuals, especially the younger population, are falling ill more rapidly [27]. During the first wave of the pandemic in Serbia, when the Delta variant was circulating, medical students predominantly exhibited symptoms of respiratory infection, with some even having confirmed infections [23]. The COVID-19 lockdown in Serbia lasted from March to May 2020, during which all university activities were halted, and student dormitories were closed. Due to the strict control measures, a small number of medical students were affected by COVID-19 in the initial phase of the pandemic. However, after the reopening in May 2020 [28], there was a noticeable increase in the number of students seeking medical care across various health institutions.

Considering that knowledge about the many risks and side effects connected to self-medication remains limited among medical students, this study evaluates the prevalence of self-medication among

medical students during the third wave of COVID-19 pandemic in the city of Niš and the factors associated with it.

Material and Method

Study Design

A cross-sectional study was performed using an anonymous questionnaire distributed among medical students *online* via the Google platform. The survey was conducted from November 1, 2020 to December 1, 2020 during the third wave of the pandemic. The first two and a half pandemic waves of COVID-19 in Serbia were caused by the original strain from Wuhan, while by the end of 2020 and the beginning of 2021, the *Alpha* variant became dominant [27]. Medical students from all study years were included in the study. Participation in this study was voluntary and was conducted only after obtaining each student's consent. The inclusion criteria were being older than 18 years, being an undergraduate medical student, and voluntary participation. The exclusion criteria were a refusal to participate in the study and graduation from the Faculty of Medicine.

Approval for this study was obtained from the Ethics Committee of the Faculty of Medicine Nis (Number of Decision: No. 12-8590, 16 September 2020).

The Questionnaire

A general semi-structured questionnaire consisting of three parts was created for this study. The first part of the questionnaire addressed the socio-demographic characteristics of the students. The second part contained questions about the reasons for self-medication and the most common used medications. The third part included questions about the most common method of obtaining medications for self-medication and about sources of information on treatment and prevention of COVID-19.

Statistical Analysis

A statistical analysis of the data was performed using the IBM SPSS software (SPSS 20.0 statistical package for Windows, SPSS Inc, Chicago, IL, USA). All continuous variables are noted as

means $\pm$ standard deviations (SDs). Average values of continuous variables in the two tested groups were compared using Student's t-test, and the Chi-squared test was used to examine differences in categorical variables. Comparison of mean values of numerical variables between more than two groups of respondents, as well as within the same group across more than two measurements, was performed using analysis of variance (ANOVA) followed by Dunnett's post hoc test. To identify factors that predict the practice of self-medication (SM), multivariate logistic regression was applied. The dependent variable was the practice of self-medication in the last 12 months and the independent variables were: gender, study year, housing condition, COVID-19 positive status, medical education, and ability to obtain medications without a medical prescription. Effects of independent variables (for continuous variables) on the dependent variable were assessed by univariate and multivariate linear regression analysis. Regression coefficients (B) and 95% confidence intervals (95%CI for B) were calculated. Final regression models were developed using stepwise regression analysis, analyzing all possible combinations. Statistical significance was accepted when the corresponding p-values were less than 0.05 ($p < 0.05$).

Results

A total of 351 medical students (23 males and 328 females), took part in the study. Of these, 81.5% had practiced some form self-medication within the past 12 months. The average age of students who practiced self-medication was 22.12 ± 2.13 .

Socio demographic characteristics of medical students are shown in Table 1.

Table 1. Socio-demographic characteristics of medical students, (N=351).

Variables		Number	Percentage %
Gender	Females	328	93.4
	Males	23	6.6
Average age	22.12 ± 2.13		
Finished secondary school	Secondary medical School	239	67.7
	General High School	90	25.6
	Pofessional studiess	22	6.7

Housing	Living with parents	133	37.6
	In a student dormitory	91	26.2
	In a leased apartment	127	36.2
Study year	First-year	15	4.3
	Second-year	20	5.7
	Third-year	71	20.2
	Fourth-year	199	56.7
	Fifth-year	30	8.5
	Sixth-year	16	4.6
Commorbities	Yes	69	19.7
	No	282	80.3
Do You practice self-medication?	Yes	286	81.5
	No	65	18.5
Do You have family member who self-medicated?	Yes	115	32.8
	No	236	67.2
Do You have home pharmacies?	Yes	241	68.7
	No	15	31.3
Do You used earlier prescribed medical prescriptions?	Yes	101	28.8
	No	250	71.2
Bying in pharamcies without medical prescription	Yes	240	68.4
	No	111	31.6

Positively tested as COVID-19	Yes	215	61.3
	No	136	38.7
COVID-19 positive family member	Yes	52	14.8
	No	299	85.2
To avoid visit to health care facility	Yes	11	3.1
	No	340	96.9
Positive previous experiences with the same medications	Yes	306	87.2
	No	45	12.8
Symptoms were mild	Yes	308	87.7
	No	43	12.3

A significantly higher number of female students participated in the study compared to male students ($p < 0.001$). The majority of students completed secondary medical school (67.7%), one-quarter finished general high school (25.6%), and the smallest group had finished professional studies (6.7%). More than one-third of the students live with their parents (37.6%), a similar percentage (36.2%) live in rented apartments, and the least live in student dormitories (26.2%). The study was most widely responded to by fourth-year students (56.7%). Comorbidities such as diabetes mellitus, anxiety, thyroid disease, and anemia are present etc. in 19.7% of the students. Nearly one-third of the students 32.6% have at least one family member who self-medicated, and 67.7% have home pharmacies. More than one-quarter of the students (28.8%) have previously written medical prescriptions, and 68.4% buy medication without prescriptions at pharmacies (Table 1).

The most used sources of information about the prevention and treatment of COVID-19 symptoms are shown in Table 2.

The primary source of information for students was data from the WHO and CDC, followed by experiences shared by others on social networks (58.1%).

Table 2. Sources of information about treatment of COVID-19 symptoms.

Internet, social networks, WHO*, CDC**	204	58.1%
Pharmacy	94	26.8%
Personal Medical knowledge	15	4.3%
Health care professionals	38	10.8%

*World Health Organization

**Center for Diseases Control and Prevention

26.8% sought advice from a pharmacist, less than 5% relied on medical books and personal medical knowledge, and only 10.8% visited physicians (Table 3).

Table 3 presents students responses to used drugs for self-medication.

Table 3. The most frequently used drugs and the most common conditions among medical students during COVID-19 pandemic.

Characteristics	Number	Percentage %
Which of the following medications You used for self-medication? (multiple answers question)		
Antypiretics	139	39.4
Analgesic	84	23.8
Antibiotics	203	57.5
Antiviral drugs	0	0
Antitussives	287	81.3
Antidiarrheals	178	50.4
Sedatives	43	12.8

Anxylitics	69	19.5
Vitamin supplements	310	87.2
Nasal drops	298	84.4
Herbal preparations (tea)	276	78.2
Homeopathic remedies	5	1.4
Ivermectrin	0	0
Chloroquine	0	0
Vitamin D	116	32.9
Common symptoms during COVID-19 pandemic (multiple answers question)		
Fever	186	52.6
Headache	102	29.0
Pains	42	12.0
Breathing difficulties	94	26.5
Chronic diseases	69	19.5
Without symptoms	86	24.2
Loss of smell and taste	61	17.2

It can be observed that the students used a large number of medications. The most commonly used were antipiretics, analgetics, antibiotics, antitussives, nasal drops, probiotics, herbal preparations, vitamin supplements, and vitamin D. There is no data indicating the use of ivermectin, and chloroquine in the studied population. The most common symptom among COVID-positive students was fever (body temperature >38 degrees Celsius) (Table 3).

Table 4. Significant factors associated with self-medication among medical students. Results of multivariate regression analysis.

Characteristics	B	95% CI for B		P
		Lower	Upper	

Constant	4.772	-5.886	15.431	0.378
COVID-positive tested	0.531	0.325	0.738	<0.001
Medical knowledge	-0.259	-0.386	-0.133	<0.001
Availability of over-the-counter medications	3.081	1.829	4.332	<0.001

The most significant factors associated with self-medication among medical students that were confirmed in the study include: female gender, COVID-positive status, medical knowledge, and availability of over-the-counter medications. An increase in the value of the following factors by one unit was associated with a significant increase in self-medication during the study: female gender by 0.741 (95%CI: from 0.088 to 1.394; $p=0.026$) and availability of over-the-counter medications by 3.081 (95%CI: from 1.829 to 4.332; $p<0.001$). An increase in medical knowledge by 1 was associated with a significantly smaller increase in self-medication during the study by 0.259 (95%CI: from -0.386 to -0.133; $p<0.001$). Among COVID-positive students, an increase of one unit was associated with a significant increase in self-medication during the study by 0.531 (95% CI: from 0.325 to 0.738; $p<0.001$).

Discussion

Based on our results the prevalence of self-medication among medical students during third wave of COVID-19 pandemic was 81.5%. The most significant factors associated with self-medication were: female gender, COVID-positive status, medical knowledge, and availability of over-the-counter medications. Fever was the most frequent condition that led to self-medication. The most commonly used medication were antipiretics, analgetics, antibiotics, antitussives, nasal drops, probiotics, herbal preparations, vitamin supplements, and vitamin D. There is no official data indicating the use of ivermectin, or chloroquine among student population. The most common symptom among COVID-positive students was a fever. 68.4% out of all medical students obtained medications from a pharmacy, bought them, or reused previous prescriptions. Nearly one quarter of students used medications in order to prevent COVID-19 because they did not have symptoms of infection. Less than one-quarter already

had medications stored in home pharmacies, and the majority of students obtained information about the treatment and prevention of COVID-19 from the Internet, social networks, web portals of the WHO, CDC and Ministry of health of the Republic Serbia. More than one quarter consulted a pharmacist, about 10% visited health care professionals and less than 5% relied on medical books and personal medical knowledge.

According to our findings the prevalence of self-medication during COVID-19 pandemic was high among medical students. A similarly high prevalence was reported by studies carried out by Tomas Petrovic et al, in Novi Sad of the Republic of Serbia [20], Sánchez-Chamba et al. in Northern Peru [29], by Yasmin et al. in Pakistan [18], by Shams et al. in Bangladesh [30], by Patel et al. in India [31] and by Younis et al. in Egypt [32], by Al-Kubaiss et al. in the United Arab Emirates [33], by Mallik et al. in Saudi Arabia [35]. However, a lower prevalence was reported by de Souza et al. in Southern Brasil [17], Acharya et al. in Nepal [32], in Ethiopia [36] and by et al. in Iran [37]. These could be attributed to a variety of factors, including the different study years, demographic characteristics, pandemic waves, varying sample sizes, students' medical education, better internet access, and other variables [9]. Zheng et al. (2023) assumed that the prevalence of self-medication among medical students increased during the COVID-19 pandemic and it can be attributed to their higher education level compared to the general population. According to the same systematic review gender, age, education, marital status, and concern about COVID-19 were the most usual associated factors [38].

Female students participated to the study significantly more than male students. Similar findings can be found in the literature [7,10,11,20,29-32]. Behzadifar et al. found that the prevalence of self-medication was higher in women compared with men because women use more medications because of menstruation pains, contraception pills, and gynecological problems, and they usually look for information about their illnesses [7]. However, some studies have shown different results [33,35]. Generally, medical studies on self-medication show inconsistencies regarding gender and age in relation to self-medication. Students who attend clinical courses used self-medication significantly more often than students from the preclinical study years in our study. Our results agree with the results from the literature [31,35,37]. Healthcare-related education in students and young adults has been shown to lead to more responsible self-medication, although there are differing results in the literature [31].

Our results showed that the most frequent condition for self-medication was fever, and our results are in agreement with findings of similar studies from Nepal, [33], and Bangladesh [30], where fever was also the most common symptom of COVID-19 among students [18,19,24]. In a study conducted in Saudi Arabia, more than half (64.56%) of medical students stated that their most common condition was headache [35]. According to the results of a systematic analysis by Shrestha et al. [10], fever and headache were equally prevalent, as well as in Pakistan [18], while body pains and fever were more common in south India [33]. In Northern Peru the most common symptoms were pain (40.6%), cold/flu (27.5%), and fever (19.9%) [29]. In Nepal, 15.1% of individuals had comorbidities such as hypertension and diabetes mellitus, while 17.2% used medications and supplements for prevention, despite not experiencing any COVID-19 symptoms [33]. A study in Iran found that the majority of students (69.4%) used continuous medications during the COVID-19 pandemic, even though they did not have a chronic disease [37].

Our findings showed that significant factors associated with self-medication reported by medical students included a positive COVID-19 status and they are consistent with data from the literature [31-34,36,38]. According to our results, 32.8% of respondents had family members who self-medicate and more than 68% out of all students had home pharmacies and more than one quarter had prescriptions for previously prescribed medications. They were mostly students who were suffering from diabetes mellitus, thyroid diseases, anxiety, respiratory infections, etc. In the similar study in the Arab Emirates self-medication was 2.9 times higher among students belonging to families self-medication [34]. Findings of some studies have confirmed that self-medication is more common among students living with their parents, for example, in Saudi Arabia [35], in Egypt [32] and Iran [37] because they usually have home pharmacies. That was the same in our study. Based on our results, students who lived in dormitories or on their own found it harder to obtain medications and were less likely to engage in self-medication. There are also contrary findings, suggesting that living in dormitories and campuses actually made it easier for students to access medications [18,37,38].

Some students were avoiding visits to healthcare institutions because of a fear of being exposed to infection. This was a reason have been mentioned by students in other studies [9,7,18]. In our study, 3.1% of medical students did not want to go to the health care professionals for fear of long waiting

hours [22]. According to our results, nearly 60% out of all medical students obtained information about self-medication from the Internet, mainly from the official website of the WHO, CDC and official website of Ministry of health of the Republic of Serbia, and more than one-third consulted a pharmacist. In other studies, students stated that they wanted to take active care of their health [16,18]. Medical students generally have awareness and knowledge about medications.

According to our results, the availability of medications in pharmacies and the possibility of buying them without a doctor's prescription or based on a previous prescription were significant factors contributing to self-medication. There are similar results in the literature [27,34,36,37]. According to Shams et al. (2024) among 190 students in Bangladesh who practiced self-medication during COVID-19 pandemic, over 76% out of all practiced it because it seems convenient to them, 21.1% students did it to save time and only 2.1% students did it due to cost saving [36].

Most of the medications used in self-medication for COVID-19 have poor evidence, and the available studies have important limitations [7]. In our study students mostly used antipyretics, analgesics, antibiotics, nasal drops, cough syrups, and herbal teas for treatment of COVID-19. Our results agree with the literature [8,9,18,12,33,38]. In our study the practice of taking supplements and zinc to strengthen immunity and prevent COVID-19 was widespread but not significant. They obtained the medications through prescriptions from previous doctor visits or purchased them at the pharmacy. They did not visit a doctor because they mostly had mild symptoms that responded to the treatment they had prescribed for themselves, which is why they treated themselves at home. There is no official data on the use of ivermectin and antimalarials in Serbia.

The family was significantly linked to self-medication among medical students during the first wave of COVID-19 in 2020, as confirmed by a multi-sectional study conducted in 10 countries in the Arab region [11]. In our study all students had variably sized home pharmacies, mainly consisting of multivitamins, zinc, antibiotics, probiotics, nasal drops, and herbal preparations-teas. According to Food, Drug, Association (FDA) an ivermectin anti-parasitic agent, was found to inhibit severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) replication in vitro [22] so it was widely used during pandemic in many low- and middle-income countries with a high burden of parasitic diseases such as South America, Asia and Africa. In countries with high numbers of SARS-CoV-2 infections, including the United

States of America (USA) and countries of South America and Asia ivermectin was widely used both for the prevention and treatment of COVID-19 [22]. For example, in May 2020, Bolivian and Peruvian health officials recommended ivermectin for the treatment of COVID-19 without supplying evidence. In Brazil, it was promoted as a preventive measure by municipalities [17]. In Brazil, the most commonly used drug among students was ivermectin [17], as in northern Peru, where students also used ivermectin, as well as antibiotics and corticosteroids, for self-medication [29]. In Nepal students used chlorocin and ivermectin followed by vitamins C and D, teas, azithromycin, zinc, and propolis extract [33].

The use of traditional herbal medicines for prophylaxis among medical students was widespread in India, with Ayurvedic preparations being the most commonly used. Throughout the entire pandemic, 84% of the total number of students used them [31]. According to the results of a multicenter study in 10 Arab countries during the pandemic, more than a quarter of participants, 38.2% of the self-medicated individuals, used medications as prophylaxis against COVID-19 [11]. The importance of home pharmacies in self-medication was mentioned by many authors [12,38]. In the Republic of Serbia, many analgesics for mild and moderately severe pain are available over the counter without a prescription, and control over these medications is insufficient. The ability to purchase medications at pharmacies and their availability was one of the significant factor for self-medication in our study.

The strengths of our study: this is the first study to investigate the behavior of medical student regarding self-medication during the pandemic COVID-19.

The limitations of the study are: significantly small number of male students participated. The study did not investigate the allergic reactions, or side reactions of used medications, nor did it address the use of alcohol, recreational drugs, or similar substances.

Conclusion

The data presented indicate that the prevalence of self-medication was notably high among medical students during the COVID-19 pandemic. Main factors contributing to self-medication included a positive COVID-19 diagnosis, medical knowledge, and the availability of medications without a

prescription. There is a need for additional education for medical students regarding the side effects, toxicity, and drug resistance associated with medications, as well as stricter legal regulations governing the purchase and sale of over-the-counter medications.

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