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Prevalence and socio-demographic factors associated with self-medication with antibiotics in the municipality of Nikšić, Montenegro

Преваленција и социо-демографски фактори повезани са самолечењем антибиотицима у општини Никшић, Црна Гора

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SUMMARY

Introduction/Objective Self-medication (SM) and self-initiated treatment of others (STO) with antibiotics contribute to antimicrobial resistance and represent a significant public health concern. This study aimed to assess their prevalence and association with socio-demographic factors within primary healthcare setting of Niksic, Montenegro.

Methods A cross-sectional study was conducted among 356 adults who visited a general practitioner or family medicine specialist at the Primary Healthcare Center Niksic between 1 March and 31 May 2024. Data were collected through interviews using a structured questionnaire and analyzed using SPSS 25. Associations were assessed using chi-square and Fisher's exact tests, with Spearman's correlation for strength of relationships. Logistic regression analyses were performed to explore factors associated with SM and STO.

Results The prevalence of SM was 43%, while 16.6% of respondents reported STO. A significant positive association was found between these practices ($p < 0.001$). SM was more common among individuals aged 35–49, employed, and with higher education, while STO was more frequent among those living in family or community settings. In univariate analysis, age 50–64, higher education, and employment were associated with SM, while being retired was associated with STO, however, no variables remained significant in multivariate analysis.

Conclusion SM and STO are common and significantly associated behaviors in the studied population in Nikšić, and may represent important public health challenges, including development and spread of antimicrobial resistance, adverse health outcomes, and unnecessary costs. The absence of independent socio-demographic factors associated with these behaviors indicates a complex, multifactorial underlying structure, warranting further investigation.

Keywords: antibiotics; self-medication; socio-demographic factors; Montenegro

САЖЕТАК

Увод/Циљ Самолечење (СЛ) и самоиницијативно лечење других (СЛД) антибиотицима доприносе антимикробној резистенцији и представљају значајан јавноздравствени проблем. Циљ овог истраживања био је да се процене њихова учесталост и повезаност са социо-демографским факторима на нивоу примарне здравствене заштите у Никшићу, Црна Гора.

Методе Спроведена је студија пресека на узорку од 356 одраслих испитаника који су посетили доктора медицине или специјалисту породичне медицине у Дому здравља Никшић у периоду од 1. марта до 31. маја 2024. године. Подаци су прикупљени путем интервјуа коришћењем структурираног упитника и анализирани у *SPSS25*. Повезаности су испитиване хи-квадрат и Фишеровим тестом, док је Спирманова корелација коришћена за процену јачине односа. Логистичка регресија је примењена за испитивање фактора повезаних са СЛ и СЛД.

Резултати Учесталост СЛ износила је 43%, док је 16,6% испитаника пријавило СЛД. Утврђена је значајна позитивна повезаност између ова два обрасца понашања ($p < 0,001$). СЛ је била чешћа међу особама старости 35–49 година, запосленима и онима са вишим образовањем, док је СЛД била чешћа код особа које живе у породичном домаћинству или заједници. У униваријантној анализи, узраст 50–64 године, више образовање и запосленост били су повезани са СЛ, а пензионерски статус са СЛД, међутим, ниједан фактор није остао значајан у мултиваријантној анализи.

Закључак СЛ и СЛД су чести и значајно повезани обрасци понашања у испитиваној популацији у Никшићу и могу представљати важне јавноздравствене изазове, укључујући настанак и ширење антимикробне резистенције, неповољне здравствене исходе и непотребне трошкове. Одсуство независних социо-демографских фактора повезаних са овим понашањима указује на сложену, мултифакторску основну структуру, што захтева даља истраживања.

Кључне речи: антибиотици; самолечење; социо-демографски фактори; Црна Гора

INTRODUCTION

Modern medicine—including surgical, invasive diagnostic, and transplant procedures—relies heavily on antibiotics. According to some authors, their widespread use has increased average human lifespan by approximately 23 years [1]. However, this success has been accompanied by the growing threat of antimicrobial resistance (AMR), now recognized as a major global public health challenge. The increase in antibiotic consumption worldwide, particularly in low- and middle-income countries, along with their irrational use in human medicine, agriculture, and trade [2, 3], is a key driver of AMR [4]. Multidrug-resistant microorganisms are estimated to cause around 1.2 million deaths annually, with projections rising to 10 million by 2050 [5].

In Montenegro, outpatient antibiotic use increased by 71% between 2000 and 2022, with self-medication (SM) identified as a contributing factor [6]. Compared to EU/EEA countries, the use of most Anatomical Therapeutic Chemical (ATC) subgroups was higher, with a statistically significant difference observed for cephalosporins [6, 7].

The World Health Organization defines SM as the selection and use of medicines (including herbal and traditional products) by individuals to treat self-recognized illnesses or symptoms [8]. In practice, this also includes the use of medicines without a prescription, as well as sharing medicines with family members or friends [9]. While acceptable for approved over-the-counter drugs used appropriately [10], antibiotic SM is problematic. It contributes to AMR, delays proper diagnosis and treatment, and increases the risk of adverse effects and drug interactions.

A2025 systematic review of 71 studies (63,251 participants) reported a global SM prevalence ranging from 0.65% to 92.2%, with a pooled estimate of 43% [11]. Prevalence was highest in sub-Saharan Africa (55.2%), followed by the Middle East and North Africa (48.3%), and Europe (34.7%). In Europe, lower rates were reported in northern countries such as Denmark (4.5%) and Sweden (0.43%) [12, 13], while higher rates were observed in Southern and Eastern Europe, ranging from 18.9% in Portugal [14] to over 40% in Bulgaria and Greece [15, 16]. Common reasons for SM include perceived knowledge, previous experience, mild symptoms, and easy access to antibiotics [11].

Antibiotics are often used for conditions where they are not indicated, such as cough, common cold, fever, headache or dizziness [17, 18]. Inappropriate practices—such as early discontinuation, incorrect dosing, and sharing antibiotics—further worsen outcomes [16].

Determinants of SM operate at patient, healthcare professional, and system levels [19]. According to Lescure et al. (2018), patient-level factors include socio-demographic characteristics (e.g., age, gender, education), treatment-related factors (e.g., lack of knowledge, storing antibiotics at home), and health- and disease-related factors (e.g., presence of chronic illness) [19]. Understanding these determinants is essential for designing effective public health interventions.

This study aimed to assess the prevalence and socio-demographic factors associated with SM and self-initiated treatment of others (STO) with antibiotics in a primary healthcare setting in Niksic, Montenegro.

METHODS

Study setting and design

This cross-sectional, questionnaire-based descriptive study was conducted in the municipality of Niksic, the second largest municipality in Montenegro. According to the recent 2023 census, the municipality had a population of 65,705, which is about 10% of the total population in the country [20]. Data were collected between 1 March and 31 May 2024 in the Public Health Institution Primary Healthcare centre Niksic.

Sample

A convenience sample of 356 participants who visited a general practitioner or family medicine specialist was recruited. Inclusion criteria were age ≥ 18 years, ability to understand the questions and provide clear responses, and signed Informed consent.

Although the sample was not strictly random with respect to the general population, it reflects individuals seeking healthcare services. Based on the total population of Niksic (65,705) and the proportion of adults (78.45%), the estimated adult population is approximately 51,500 [20]. Using national data indicating that around 3% of citizens use antibiotics daily [21], and adjusting for a three-month period, it is estimated that between 1,500 and 2,500 adults received antibiotic therapy in this setting. With a sample size of 356, the margin of error at the 95% confidence level is approximately ± 4.5% to ± 4.8%, supporting the statistical reliability of the findings for the defined population of healthcare users, although the findings primarily apply to healthcare-seeking individuals.

Data collection procedures

The questionnaire was created based on the high-quality studies with similar topic published so far [22, 23, 24], including questions that we considered relevant to our conditions.

The questionnaire had two parts. Part one included socio-demographic characteristics such as sex, age, place of housing, educational level, employment status, way of living and marital status. Part two included questions to assess SM and STO with antibiotics (‘’Do you use antibiotics at your judgment, without doctor’s prescription?’’ and ‘’Do you administer antibiotics to other people at your judgment, without doctor’s prescription?’’). The answers offered to both questions were: ‘’No, never’’, ’’Yes, occasionally’’, ‘’Yes, often’’ and ‘’Yes, whenever I think it's necessary.’’

The data were collected through face-to-face interviews conducted by two previously educated medical doctors, during their mandatory internship at the Primary Healthcare Center Niksic.

Statistical analysis

Data were analyzed using SPSS version 25. Both descriptive and inferential statistical methods were applied. Descriptive statistics were used to present the prevalence of SM and STO, as well as participants' socio-demographic characteristics.

Associations between SM and STO were assessed using the chi-square (χ^2) test, while the the chi-square test for linear trend (linear-by-linear association) was used to examine trend relationships. The strength and direction of associations were additionally evaluated using Spearman's rank correlation coefficient. Fisher's exact test was applied when expected cell counts were less than 5.

Associations between SM, STO, and socio-demographic variables were examined using the chi-square (χ^2) test, while Fisher's exact test was used when assumptions for the χ^2 test were not met.

SM and STO were treated as dependent variables in separate analyses, while socio-demographic characteristics (sex, age, education, employment status, place of residence, living arrangement, and marital status) were included as independent variables.

Univariate logistic regression analysis was performed to assess the association between each independent variable and the outcomes (SM and STO), with odds ratios (OR) and 95% confidence intervals (CI) reported.

Variables that were statistically significant ($p < 0.05$) or showed borderline significance ($p < 0.1$) in univariate analysis were included in the multivariate logistic regression model to identify independent predictors while controlling for potential confounders. Model fit was assessed using the Nagelkerke R^2 coefficient. Statistical significance was set at $p < 0.05$.

Ethics: The study was approved by the PHI Primary Healthcare centre Niksic Ethics Committee (Protocol No. 883, February 27, 2024).

RESULTS

SM with antibiotics was reported by 43% of participants and 16.6% reported STO. (Table 1)

A statistically significant association between SM and STO was observed ($\chi^2 = 95.369$, df = 9, $p < 0.001$). A chi-square test for linear-by-linear association indicated a significant positive trend between increasing frequency of SM and STO ($p < 0.001$). Fisher's exact test confirmed the statistical significance of the association ($p < 0.001$). Additionally, Spearman's rank correlation confirmed a moderate positive association between these variables ($\rho = 0.343$, $p < 0.001$) (Table 2).

SM was significantly associated with age ($p = 0.008$), employment status ($p = 0.003$), and education level ($p = 0.026$, Fisher's exact test). The highest prevalence of SM was observed among participants aged 35–49 years (56.5%), employed individuals (53%), and those with higher education (53.8%).

Although SM was more frequent among women (44.1%) and urban residents (44.4%) compared to men (40.7%) and rural residents (34.6%), these differences were not statistically significant.

STO with antibiotics was significantly associated with living arrangement (p = 0.049), with higher prevalence observed among individuals living in family or community settings (18.1%) compared to those living alone (6.5%). No statistically significant differences were found according to sex, age, education, employment, or place of residence (Table 3).

In univariate logistic regression analysis, age, education, and employment status were significantly associated with SM with antibiotics. Participants aged 50–64 years were more likely to report SM compared to those aged 18–34 years (OR = 3.9, 95% CI 1.14–13.31, p = 0.030). Higher education was associated with lower odds of SM (OR = 0.4, 95% CI 0.19–0.81, p = 0.011), while employed individuals had higher odds compared to unemployed participants (OR = 2.55, 95% CI 1.46–4.44, p = 0.001). No significant associations were observed for sex, place of residence, living arrangement, or marital status (Table 4).

In multivariate logistic regression analysis, none of the examined variables remained independently associated with SM. Although the overall model was statistically significant (χ^2 = 17.749, p = 0.023), individual socio-demographic factors including age, education, and employment were not significant after adjustment. This suggests that the associations observed in univariate analysis may be confounded by other variables. The model explained a small proportion of variance (Nagelkerke R^2 = 0.065) (Table 5.).

When it comes to STO with antibiotics (Table 6), female gender (OR = 0.58, p = 0.095) and living in a family/community setting (OR = 0.32, p = 0.061) showed near-significant associations, although neither reached statistical significance. Additionally, being retired was significantly associated with higher odds of STO compared to unemployed individuals (OR = 2.34, p = 0.043).

Multivariate logistic regression analysis showed that none of the examined variables were independently associated with STO. However, female gender (OR = 0.57, p = 0.088), living in a family/community setting (OR = 0.36, p = 0.102), and being retired (OR = 2.13, p = 0.078) showed borderline associations with STO with antibiotics (Table 7).

DISCUSSION

This study showed a high prevalence of SM (43%) and STO (16.6%) with antibiotics. To our knowledge, this is the first study demonstrating a significant positive association between these behaviors, suggesting they tend to co-occur. These findings should be considered in future public health interventions aimed at addressing both simultaneously. Although age, education, employment, and living arrangements were associated with SM and STO in univariate analyses, none remained significant in multivariate models, indicating a complex, multifactorial background.

The high prevalence of SM among primary healthcare users in Niksic may be explained by limited awareness of risks (e.g., adverse effects, interactions, AMR), time constraints, perceived knowledge of symptoms and antibiotics, prior positive experience, mild symptom perception, as well as insufficient control of over-the-counter antibiotic sales in Montenegro.

Interestingly, the 43% SM rate in our study is comparable to the global pooled prevalence reported in a recent meta-analysis [11] and earlier findings from EU countries such as Bulgaria (43%) and Greece (44.6%) [15, 16]. In Montenegro, a study from Podgorica reported that 61% of respondents used antibiotics in the previous year, but only 44.1% had a prescription [17]. Similar patterns are reported in Serbia (47.2% lifetime SM) [25] and Albania (53%) [26], highlighting a regional public health concern requiring urgent action.

This study is also the first to show a statistically significant positive association between SM and STO, suggesting a behavioral continuum where individuals who self-medicate are more likely to administer antibiotics to others. In our study, STO refers to self-initiated administration of antibiotics to both adults and children. However, due to the lack of comparable studies, direct comparison was limited, but a systematic review reported that about 24% of parents in Italy self-medicated their children with antibiotics [27]. It may be assumed that children are often exposed to antibiotic SM in our setting, but it should be examined in future studies.

Socio-demographic trends suggest higher SM among middle-aged, employed, and more educated individuals. Similar findings were reported in China [28]. Our results can be explained by time constraints, perceived knowledge about symptoms and antibiotics and easier access to information. The availability of antibiotics without prescription in our country may further reinforce these behaviors [17]. However, these associations were not confirmed in multivariate analysis, supporting the view that SM is multifactorial [19, 29].

STO may be influenced by close social relationships and caregiving roles. Previous research in Montenegro showed that 24.6% of parents self-medicate their children. Specific maternal factors that independently raise the probability of SM were higher education, health profession and smoking [25]. Retired individuals were associated with STO in univariate analysis, possibly reflecting caregiving roles and prior experience. In the USA, 65% of older adults reported keeping leftover antibiotics [30], increasing the risk of their inappropriate use and misuse. This is also a topic that should be further investigated in our setting.

Although not significant in multivariate analysis, these patterns suggest underlying behavioral mechanisms shaped by contextual factors, which require further investigation in larger samples.

This study has several limitations. Causality cannot be established due to its cross-sectional design, and the sample—limited to primary healthcare patients—reduces generalizability. Some subgroups were small, potentially affecting statistical power. The questionnaire did not capture detailed information on antibiotic types, sources, or reasons for SM and STO. Finally, self-reported data may be subject to bias.

CONCLUSION

Self-medication and STO with antibiotics are highly prevalent in investigated population. A significant positive association was found between these two behaviors for the first time, indicating that individuals who practice SM are also more likely to treat others with antibiotics on their own initiative. These findings should be considered in the development of future public health interventions, aiming to simultaneously address and reduce these negative behavioral patterns.

Socio-demographic factors such as age, education, employment, and living arrangement were associated with these behaviors in univariate analyses, but none remained significant in multivariate analysis, suggesting a complex and multifactorial pattern that should be further investigated in a larger sample, exploring behavioral, cultural, and systemic drivers.

Conflict of interest: None declared.

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Table 1. The frequency of self-medication (SM) and self-initiated treatment of others (STO) with antibiotics

Frequency	SM		STO	
	N	%	N	%
"No, never"	203	57	297	83.4
"Yes, occasionally"	119	33.4	46	12.9
"Yes, often"	33	9.3	9	2.5
"Yes, whenever I think it's necessary"	1	0.3	4	1.1
Total	356	100	356	100

Table 2. Association between self-medication (SM) and self-initiated treatment of others (STO) with antibiotics

SM\STO	No, never	Occasionally	Often	Whenever	Total
No, never	190 (93.6)	11 (5.4)	2 (1)	0 (0)	203 (100)
Occasionally	88 (73.9)	27 (22.7)	1 (0.8)	3 (2.5)	119 (100)
Often	19 (57.6)	8 (24.2)	5 (15.2)	1 (3)	33 (100)
Whenever	0 (0)	0 (0)	1 (100)	0 (0)	1 (100)
Total	297 (83.4)	46 (12.9)	9 (2.5)	4 (1.1)	356 (100)

Table 3. Distribution of self-medication (SM) and self-initiated treatment of others (STO) with antibiotics across socio-demographic characteristics

Socio-demographic categories	Total N (%)	SM			STO		
		Yes (%)	No (%)	p-value	Yes (%)	No (%)	p-value
Sex							
Male	118 (33.1)	48 (40.7)	70 (59.3)	0.537	14 (11.9)	104 (88.1)	0.093
Female	238 (66.9)	105 (44.1)	133 (55.9)		45 (18.9)	193 (81.1)	
Age in years							
18–34	105 (29.5)	49 (46.7)	56 (53.3)	0.008*	19 (18.1)	86 (81.9)	0.430
35–49	69 (19.4)	39 (56.5)	30 (43.5)		14 (20.3)	55 (79.7)	
50–64	93 (26.1)	40 (43)	53 (57)		17 (18.3)	76 (81.7)	
65–79	73 (20.5)	21 (28.8)	52 (71.2)		7 (9.6)	66 (90.4)	
≥ 80	16 (4.5)	4 (25)	12 (75)		2 (12.5)	14 (87.5)	
Place of residence							
Urban	304 (85.4)	135 (44.4)	169 (55.6)	0.187	52 (17.1)	252 (82.9)	0.514
Rural	52 (14.6)	18 (34.6)	34 (65.4)		7 (13.5)	45 (86.5)	
Education							
No formal education	5 (1.4)	0 (0)	5 (100)	0.026*	0 (0)	5 (100)	0.338
Primary school	52 (14.6)	18 (34.6)	34 (65.4)		8 (15.4)	44 (84.6)	
Secondary school	221 (62.1)	93 (42.1)	128 (57.9)		33 (14.9)	188 (85.1)	
Faculty/College	78 (21.9)	42 (53.8)	36 (46.2)		18 (23.1)	60 (76.9)	
Employment							
Employed	160 (44.9)	84 (53)	76 (47.5)	0.003*	31 (19.4)	129 (80.6)	0.086
Unemployed	93 (26.1)	39 (41.9)	54 (58.1)		19 (20.4)	74 (79.6)	
Retired	86 (24.2)	26 (30.2)	60 (69.8)		8 (9.3)	78 (90.7)	
Other	17 (4.8)	4 (23.5)	13 (76.5)		1 (5.9)	16 (94.1)	
Way of living							
In family/Community	310 (86.5)	135 (43.5)	175 (56.5)	0.572	56 (18.1)	254 (81.9)	0.049*
Alone	46 (13.5)	18 (39.1)	28 (60.9)		3 (6.5)	43 (93.5)	
Marital status							
Single	115 (32.3)	51 (44.3)	64 (55.7)	0.106	19 (16.5)	96 (83.5)	0.884
Married / In partnership	194 (54.5)	84 (43.3)	110 (56.7)		34 (17.5)	160 (82.5)	
Divorced	6 (1.7)	5 (83.3)	1 (16.7)		0 (0)	6 (100)	
Widowed	41 (11.5)	13 (31.7)	28 (68.3)		6 (14.6)	35 (85.4)	

*Statistically significant ($p < 0.05$);

Fisher's exact test was used when expected cell counts were < 5

Table 4. Univariate logistic regression with self-medication (SM) with antibiotics as a dependent variable and socio-demographic characteristics as independent variable

Variable	OR (95% CI)	p-value
Sex		
Female *vs.* male	0.87 (0.56–1.36)	0.537
Age (years)		
35–49 *vs.* 18–34	2.63 (0.8–8.67)	0.113
50–64 *vs.* 18–34	3.9 (1.14–13.31)	0.030*
65–79 *vs.* 18–34	2.26 (0.68–7.55)	0.183
≥ 80 *vs.* 18–34	1.21 (0.35–4.19)	0.762
Education		
Secondary *vs.* low	0.62 (0.37–1.05)	0.074
Higher *vs.* low	0.4 (0.19–0.81)	0.011*
Employment		
Employed *vs.* unemployed	2.55 (1.46–4.44)	0.001*
Retired *vs.* unemployed	1.48 (0.81–2.7)	0.199
Residence		
Urban *vs.* rural	0.66 (0.36–1.23)	0.189
Living arrangement		
Family *vs.* alone	0.83 (0.44–1.57)	0.573
Marital status		
Single *vs.* married	1.23 (0.64–2.36)	0.534
Other *vs.* married	1.28 (0.64–2.57)	0.480

*$p < 0.05$ was considered statistically significant

Table 5. Multivariate logistic regression with self-medication (SM) with antibiotics as a dependent variable and relevant socio-demographic characteristics as independent variable

Variable	Adjusted OR (95% CI)	p-value
Age (years)		
35–49 *vs.* 18–34	2.41 (0.58–10.01)	0.228
50–64 *vs.* 18–34	3.06 (0.7–13.36)	0.137
65–79 *vs.* 18–34	2 (0.5–7.95)	0.327
≥ 80 *vs.* 18–34	1.19 (0.34–4.13)	0.781
Education		
Secondary *vs.* low	0.83 (0.47–1.46)	0.511
Higher *vs.* low	0.68 (0.3–1.52)	0.342
Employment		
Employed *vs.* unemployed	1.17 (0.44–3.12)	0.751
Retired *vs.* unemployed	0.84 (0.33–2.18)	0.725

Table 6. Univariate logistic regression with self-initiated treatment of others (STO) with antibiotics as a dependent variable and socio-demographic characteristics as independent variable

Variable	OR (95% CI)	p-value
Sex		
Female *vs.* male	0.58 (0.3–1.1)	0.095
Age (years)		
35–49 *vs.* 18–34	1.78 (0.36–8.77)	0.477
50–64 *vs.* 18–34	1.57 (0.33–7.54)	0.576
65–79 *vs.* 18–34	1.57 (0.33–7.54)	0.576
≥ 80 *vs.* 18–34	0.74 (0.14–3.96)	0.727
Education		
Secondary *vs.* low	0.59 (0.31–1.11)	0.103
Higher *vs.* low	0.54 (0.22–1.36)	0.192
Employment		
Employed *vs.* unemployed	2.17 (0.9–5.19)	0.083
Retired *vs.* unemployed	2.34 (1.03–5.36)	0.043*
Residence		
Urban *vs.* rural	0.75 (0.32–1.77)	0.515
Living arrangement		
Family *vs.* alone	0.32 (0.1–1.06)	0.061
Marital status		
Single *vs.* married	1.45 (0.57–3.69)	0.433
Other *vs.* married	1.35 (0.5–3.63)	0.549

*$p < 0.05$ considered statistically significant

Table 7. Multivariate logistic regression analysis of factors associated with self-initiated treatment of others (STO) with antibiotics

Variable	OR (95% CI)	p-value
Sex		
Female *vs.* male	0.57 (0.29–1.09)	0.088
Living arrangement		
Family *vs.* alone	0.36 (0.11–1.22)	0.102
Employment status		
Employed *vs.* unemployed	1.82 (0.75–4.43)	0.185
Retired *vs.* unemployed	2.13 (0.92–4.93)	0.078

