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ORIGINAL RESEARCH

Antibiotic Self-Medication Patterns and Associated Factors in the Context of COVID-19, Medellín, Colombia: A Survey Based Cross Sectional Study

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Objective: To describe the frequency of self-medication with antibiotics and its associated factors in Medellín, Colombia.
Methods: A descriptive study was conducted on 778 individuals surveyed regarding sociodemographic characteristics, self-medication with antibiotics, reasons for using these drugs, and types of antibiotics used. The analysis was performed in SPSS using absolute and relative frequencies with their corresponding confidence intervals, chi-square test, and logistic regression.
Results: The frequency of self-medication with antibiotics was 46% (95% CI 42.5–49.5), with 47.4% (95% CI 42.2–52.5) of the population using antibiotics without medical prescription for flu-like symptoms related to COVID-19. Amoxicillin (33.7%), azithromycin (10.9%), and cephalexin (4.7%) were the most used antibiotics. The main factors associated with self-medication were age group, zone of residence, and lack of information on the appropriate use of these medications.
Conclusion: The city exhibits a high frequency of self-medication with antibiotics, predominantly in conditions where they are ineffective, such as flu-like symptoms related to COVID-19. These findings highlight the contribution of the COVID-19 pandemic to bacterial resistance through self-medication and underscore the need to implement targeted actions to control the use of these medications.
Keywords: self-medication, antibiotics, COVID-19, bacterial resistance

Background

Self-medication (SM) is a common practice that involves the use of medications without a medical prescription to treat self-diagnosed symptoms or disorders.[1] According to the World Health Organization (WHO), more than 50% of medications prescribed, dispensed, or sold worldwide are inappropriately administered. At the same time, it has been reported that up to 50% of patients take medications incorrectly.[2] The frequency of this behavior varies depending on each country and its level of development, ranging from 11.2% to 93.7%.[3]

Within the phenomenon of SM, the use of antibiotics constitutes a global public health problem because it has been associated with antimicrobial resistance and the development of adverse effects, which, in addition to the consequences in morbidity and mortality, represent an economic burden for health services.[4] There are multiple reasons that lead to SM with antibiotics, including difficult access to the healthcare system, proximity of pharmacies to the place of residence, education level, socioeconomic status, the need to reduce costs for patients, and emergencies.[5]

One of the recent emergency situations with the greatest impact on global public health was the COVID-19 pandemic, during which SM with antibiotics became a prevalent practice for the prevention and management of symptomatic cases associated with this disease.[1] Some studies indicate that during the first year of the pandemic,

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the use of antibiotics and cases of resistant infections increased, with 50% of patients with severe COVID-19 infection dying in hospitals due to bacterial resistance.[6]

Previous studies conducted across globe have measured the frequency of SM with various categories of medications, including antibiotics during the pandemic in Iran,[7] Pakistan,[8] Togo[9] and Australia.[10] In Latin America, SM is common. In Peru, a frequency of SM for COVID-19 treatment of 54.8% was reported, with 71.5% of them using azithromycin.[11] In Ecuador, a frequency of SM of 48.4% was found, with azithromycin being the most used antibiotic (22%), and this practice was associated with male sex and access to unreliable sources of information.[12]

In Colombia, there is only one study in which it was revealed that the COVID-19 pandemic has prompted people to increase SM behavior as a way to control their health.[4] This study was conducted in the city of Pereira and the surrounding areas. The results showed that 136 of the participants had SM practices from the beginning of the quarantine until the time of the survey, representing a frequency of 34.3%, and approximately 15% of people who SM used antibiotics.[4] This behavior is due to several reasons, including uncertainty and concern generated by the disease, lack of access or availability of medical care due to healthcare system overload, and the search for quick and accessible solutions to relieve symptoms or prevent the disease.[4]

In Medellín, the second largest city in Colombia, there is a lack of data regarding the prevalence of SM with antibiotics during the COVID-19 pandemic. Moreover, no previous studies have been conducted to identify the frequency of this practice and its associated factors in the general population of the city. The present study was undertaken to address this gap and provide a description of the frequency of SM with antibiotics and its related factors during the COVID-19 pandemic in Medellín, Colombia.

Methods

Design and Population

This study is a cross-sectional descriptive study that included 778 individuals over 18 years old from the general population of Medellín city, distributed across seven geographical zones. In the sample, we maintained the proportion of individuals contributed by each zone to the total population as follows: North-western (% of the population 19.8 - % of the sample 20.3 (95% CI 17.6–23.2)), North-eastern (% of the population 22.7 - % of the sample 19.3 (95% CI 16.6–22.2)), Central-western (% of the population 13.9 - % of the sample 14.4 (95% CI 12.1–17.0)), Central-eastern (% of the population 16.0 - % of the sample 17.1 (95% CI 14.6–19.9)), South-western (% of the population 10.8 - % of the sample 10.9 (95% CI 8.9–13.3)), South-eastern (% of the population 4.3 - % of the sample 5.0 (95% CI 3.6–6.7)), Rural districts (% of the population 12.5 - % of the sample 13.0 (95% CI 10.8–15.5)). The sample size was calculated following the approach used by Sampedro et al.[13] Participants who demanded financial compensation for their participation, those who did not sign the informed consent form, and those who could not respond to the entire survey were excluded. Additionally, a control variable was considered to exclude participants who reported taking antibiotics but used other types of drugs such as analgesics, antihypertensives, anti-inflammatories, among others. Therefore, 136 individuals were excluded from the initial 914 required in the sample size calculation.

Survey

For this study, a primary source of information was used, which consisted of a survey with 11 items that inquired about sociodemographic characteristics and SM with antibiotics during 2021–2022 (Supplementary Survey). The socioeconomic level was defined according to the socioeconomic stratification conducted by the National Administrative Department of Statistics (DANE, acronym in Spanish). The inclusion of this timeframe is justified by the declaration of a state of health emergency due to COVID-19 in Colombia on March 12, 2020,[14] followed by Decree 457 of March 22, 2020, which ordered mandatory preventive isolation nationwide starting on March 25, 2020. This included measures such as restricted movement and curfews that limited the free circulation of both individuals and vehicles.[15] The mandatory isolation period was extended several times, with different measures applied for the reactivation of municipalities according to their level of virus impact.[16–21] From September 1, 2020, a selective isolation measure was implemented, which included continued individual responsibility for distancing, selective isolation in highly affected municipalities, compliance with biosecurity protocols for activities, teleworking or working from home, and border closures.[22] The following stage was referred to as the "new normality", which involved the continuation of some regulations on free circulation but allowed for the gradual resumption of activities subject to compliance with biosecurity protocols established by the Ministry of Health and Social Protection. Finally, the Health Emergency due to COVID-19 was lifted on July 1, 2022, leading to relaxed isolation measures that enabled the execution of this study.[23]

The survey instrument design was based on similar studies conducted in other countries such as Peru,[24] Nigeria,[25] Iran,[7] and Togo.[9] Additionally, a validation process was carried out by microbiologists with experience in bacterial resistance research for its appearance, and a pilot test was conducted on 30 people to ensure its applicability and acceptability among the study subjects. The survey was self-administered and took approximately 5 to 10 min.

Data Collection

Three researchers distributed across each city's zone administered the survey. They stationed themselves in high-traffic areas, such as those near mass transit systems, shopping centers, parks, and sports venues. This procedure occurred between August and December 2022.

Data Analysis

In the data analysis, surveys with more than 20% of unanswered questions were excluded. The data were analyzed by calculating absolute and relative frequencies of sociodemographic variables with their 95% confidence intervals. A comparison was made between the frequency of SM and sociodemographic variables such as age group, sex, economic level, zone, education level, healthcare profession, familiarity with the term "resistance", receiving information about resistance, and receiving information about the use of antibiotics using Pearson's Chi-square test. The strength of the association was quantified using odds ratios with 95% confidence intervals. A binary logistic regression model was used to identify confounders and explanatory variables. In constructing the model, variables with a p-value < 0.25 in bivariate analysis were considered.[26] This procedure allowed the estimation of the adjusted odds ratios (ORa). For polytomous variables, indicator variables were created using the lowest frequency group as the reference group. Analyses were considered significant with p-values < 0.05 and were executed using SPSS 29 software.

Ethics

This study was conducted following the ethical principles outlined in the Declaration of Helsinki and was approved by the Institutional Ethics Committee of the Universidad Cooperativa de Colombia with the code BIO233. Additionally, according to Resolution 8430 of the Ministry of Health of Colombia, this study is classified as a research with no risk.[27]

Results

This study included 778 participants, of whom 52.1% (95% CI 48.5–55.6) were female. Most of the participants were located in the urban part of the city 87.9% (95% CI 84.5–89.2). Regarding educational level, 31.7% (95% CI 28.5–35.1) had a basic level of education, while 12.1% (95% CI 10.0–14.6) had an education in the healthcare field or related areas. Regarding the population's awareness of the study topic, 55.1% (95% CI 51.6–58.6) had not heard of the term "bacterial resistance", 58.8% (95% CI 55.3–62.3) had not received information on this topic, and 51.2% (95% CI 47.6–54.7) had not received information on the use of antibiotics (Table 1).

The frequency of SM with antibiotics was 46% (95% CI 42.5–49.5). The most used antibiotic was amoxicillin 33.7% (95% CI 29.0–38.7), followed by azithromycin with 10.9% (95% CI 8.0–14.4), and cephalexin with 4.7% (95% CI 2.9–7.3) (Figure 1). The main reasons for use were flu-like symptoms associated with COVID-19 47.4% (95% CI 42.2–52.5), urinary tract infection 8.1% (95% CI 5.6–11.2), and tonsillitis 8.1% (95% CI 5.6–11.2) (Figure 2).

Table 1 Description of the Sociodemographic Characteristics of the General Population of Medellín, 2022

		n	%	95% Confidence Interval (CI)
Age group*	Young	141	18.1	15.5–20.9
	Adult	451	58.0	54.5–61.4
	Elderly	186	23.9	21.0–27.0
Sex**	Female	404	52.1	48.5–55.6
	Male	372	47.9	44.4–51.5
Economic level	Low	382	49.1	45.6–52.6
	Middle	374	48.1	44.6–51.6
	High	22	2.8	1.8–4.2
Education level	Basic	181	23.3	20.4–26.3
	Intermediate	247	31.7	28.5–35.1
	Technical education	231	29.7	26.6–33.0
	Higher	119	15.3	12.9–18.0
Healthcare-related**	No	673	87.9	85.4–90.0
	Yes	93	12.1	10.0–14.6
Heard of bacterial resistance	No	429	55.1	51.6–58.6
	Yes	349	44.9	41.4–48.4
Received information on resistance**	No	449	58.8	55.3–62.3
	Yes	314	41.2	37.7–44.7
Received information on antibiotic use	No	398	51.2	47.6–54.7
	Yes	380	48.8	45.3–52.4

Notes: *The age group was classified according to the categories of the Ministry of Health and Social Protection: Young (18–26 years), Adult (27–59 years), and Elderly (60 years or older).[27] **In these variables, n is less than 778 because some participants did not respond to that question.

When comparing the sociodemographic characteristics of the population with the frequency of SM with antibiotics, it was found to be more common in adults 50.6% (95% CI 45.9–55.2), in women with 48.5% (95% CI 43.7–53.4), individuals from higher socioeconomic level with 63.6% (95% CI 42.9–81.1), and those residing in the southwest region with 62.4% (95% CI 51.8–72.1) (Figure 3). Additionally, it was more prevalent in individuals with higher education levels 57.1% (95% CI 48.2–65.8), and those with a background in the healthcare field with 49.5% (95% CI 39.4–59.5). A statistically significant association was observed for age group, region, and education level ($p < 0.05$) (Table 2).

In the multivariate analysis, age group, geographical zone, and lack of information about antibiotic use showed a statistically significant association with SM with antibiotics. The frequency of SM with antibiotics was 2.037 (95% CI 1.416–2.930) times higher in adults than in older adults. Those residing in Zone 6 (Southwest) practiced SM with antibiotics 2.524 (95% CI 1.386–4.598) times more than those residing in other areas of the city. Additionally, individuals who did not receive information about antibiotic use engaged in SM 1.405 (95% CI 1.048–1.883) times more than those who received information about antibiotic use. Furthermore, it was identified that educational level was a confounding variable (Table 3).

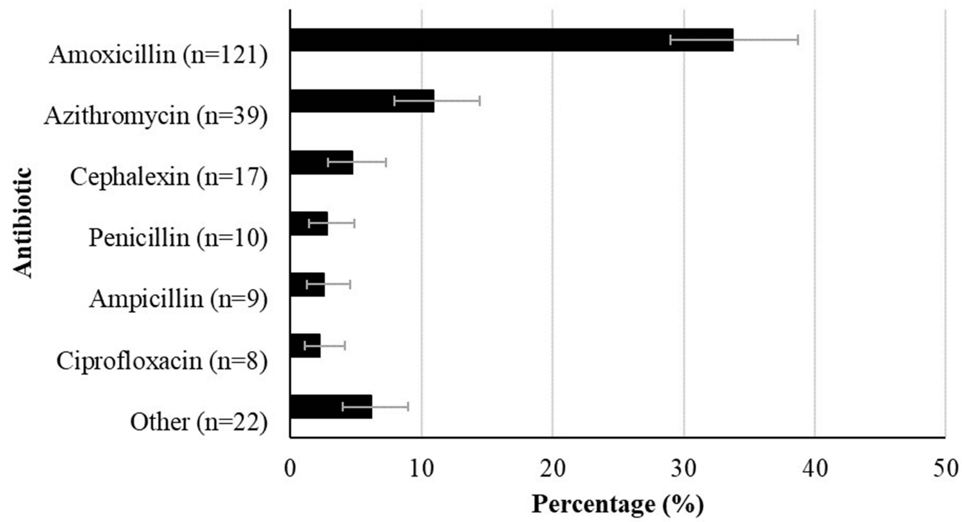

Figure 1 Most commonly used antibiotics in self-medication among the general population of Medellín, 2022.
Note: 36.9% do not recall the antibiotic they consumed.

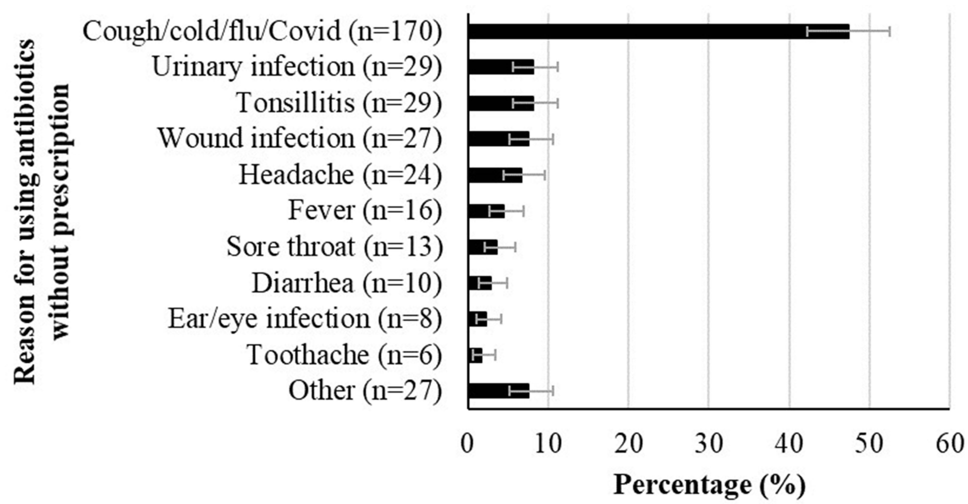

Figure 2 Reasons for self-medication with antibiotics in the population of Medellín, 2022.

Discussion

In this study, the frequency of SM with antibiotics in Medellin was 46%. In addition, the main reason for using antibiotics without a medical prescription was to treat symptoms associated with COVID-19, accounting for 47.4%. This finding was significantly higher than that of a similar study conducted in Australia, where the frequency was 19.5% (n=2217),[10] and another in Kenya, where the frequency was 23.6% (n=280).[28] It was also higher than a research conducted in Pereira's city, Colombia (n=397), where the frequency was 15%.[4] The differences among the studies could be attributed to factors such as stricter regulations regarding the over-The-counter sales of these drugs in each country or city.[10] One study in Medellín found that pharmacists exhibit inadequate knowledge, attitudes, and practices regarding the use and sale of antibiotics without a medical prescription, with 41.3% admitting to selling antibiotics without a prescription for upper respiratory tract infections.[29] Initiatives to regulate the sale of antibiotics without a medical prescription have been implemented in Latin American countries suggest that implementing regulatory measures to control the over-The-counter sale of antibiotics has an immediate impact on reducing their consumption.[30] Another reason for these differences is the knowledge and beliefs of the SM population. A study in Medellín in this regard show that up to one in four people believe that antibiotics have analgesic or

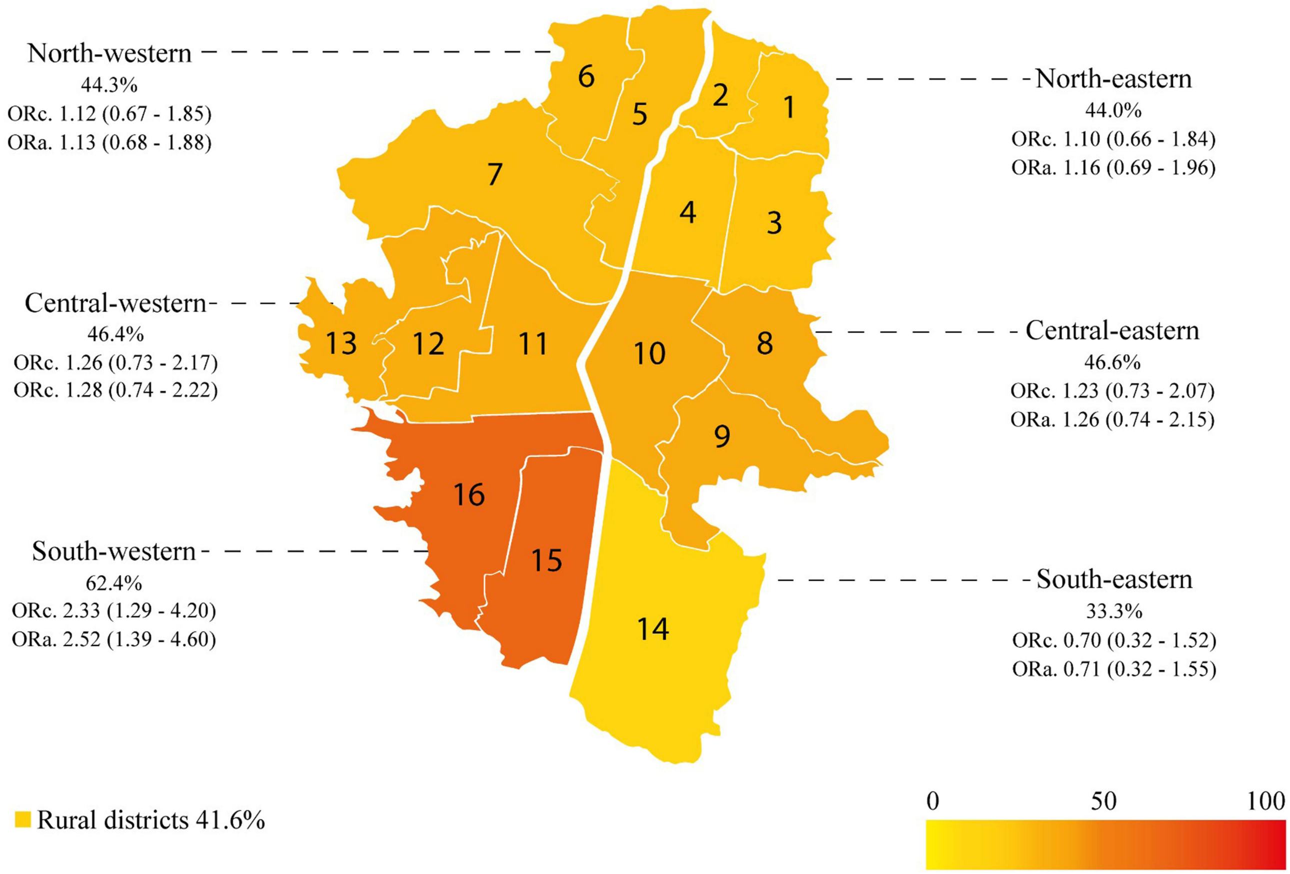

Figure 3 Frequency of self-medication with antibiotics distributed in the geographical zones of the city of Medellín. The crude Odds Ratio (ORc) and the adjusted Odds Ratio (ORa) are also presented. The "corregimiento" category was used as the reference for calculating the odds ratios.

antipyretic properties.[13] In response to this issue, the World Health Organization (WHO) has proposed initiatives such as World Antibiotic Awareness Week.[31] However, these initiatives alone are insufficient, and it is necessary to design interventions that involve the participation of different sectors that go beyond the unidisciplinary approach of the health sector and extend to the socio-structural determinants of SM.[32]

Table 2 Comparison Between Sociodemographic Characteristics and the Frequency of Self-Medication with Antibiotics

		Frequency of Self-Medication with Antibiotics			p-value	Crude Odds Ratio 95% Confidence Interval (CI)
		n	%	IC 95%		
Age group	Young	64	45.4	37.3–53.6	0.002*	1.56 (0.99–2.43)
	Adult	228	50.6	45.9–55.2		1.86 (1.31–2.64)
	Elderly	66	35.5	28.9–42.5		1.0
Sex	Female	196	48.5	43.7–53.4	0.124	1.24 (0.93–1.64)
	Male	160	43.0	38.0–48.1		1.0
Economic level	Low	163	42.7	37.8–47.7	0.070	1.0
	Middle	181	48.4	43.4–53.5		1.27 (0.96–1.70)
	High	14	63.6	42.9–81.1		2.35 (0.96–5.74)

(*Continued*)

Table 2 (Continued).

		Frequency of Self-Medication with Antibiotics			p-value	Crude Odds Ratio 95% Confidence Interval (CI)
		n	%	IC 95%		
Education level	Basic	66	36.5	29.7–43.6	0.005*	1.0
	Intermediate	116	47.0	40.8–53.2		1.54 (1.04–2.28)
	Technical education	108	46.8	40.4–53.2		1.56 (1.05–2.32)
	Higher	68	57.1	48.2–65.8		2.32 (1.45–373)
Healthcare-related	No	308	45.8	42.0–49.5	0.503	1.0
	Yes	46	49.5	39.4–59.5		1.21 (0.78–1.87)
Heard of bacterial resistance	No	187	43.6	39.0–48.3	0.132	1.0
	Yes	171	49.0	43.8–54.2		1.26 (0.95–1.67)
Received information on resistance	No	204	45.4	40.9–50.1	0.524	1.0
	Yes	150	47.8	42.3–53.3		1.11 (0.83–1.48)
Received information on antibiotic use	No	196	49.2	44.4–54.1	0.064	1.29 (0.97–1.71)
	Yes	162	42.6	37.7–47.6		1.0

Note: *This is a statistically significant result.

Table 3 Multivariate Analysis of Factors Associated with Self-Medication with Antibiotics

	Wald	p-value	Adjusted Odds Ratio	95% Confidence Interval (CI)	
Age group	14.743	<0.001*			
Young/Elderly	4.392	0.036	1.628	1.032	2.569
Adult/Elderly	14.728	<0.001*	2.037	1.416	2.930
Zone	14.015	0.029*			
North-eastern/Rural districts	0.337	0.562	1.166	0.694	1.961
North-western/ Rural districts	0.209	0.647	1.127	0.676	1.878
Central-eastern / Rural districts	0.753	0.385	1.264	0.745	2.146
Central-western/ Rural districts	0.793	0.373	1.283	0.741	2.223
South-eastern / Rural districts	0.732	0.392	0.711	0.325	1.554
South-western/ Rural districts	9.159	0.002*	2.524	1.386	4.598
Did not receive information about the use of antibiotics.	5.178	0.023*	1.405	1.048	1.883

Note: *This is a statistically significant result.

On the other hand, amoxicillin (33.7%) was the most used antibiotic, followed by azithromycin (10.9%). These results are consistent with those of a study conducted in Nigeria, which found that amoxicillin was the most used antibiotic, accounting for 24.9% of all antibiotics.[25] Similarly, studies in Pakistan and Nepal reported that azithromycin was the most commonly used antibiotic, with percentages of 14.9% and 8%, respectively.[8,33] One reason for this finding is that these antibiotics are frequently prescribed for the outpatient treatment of respiratory infections. Therefore, the common use of these drugs may be related to previous prescriptions.[34] The high frequency of using these two medications is alarming. On one hand, it contributes, as mentioned earlier, to antibiotic resistance, and on the other hand, it can be associated with adverse effects. Amoxicillin, for example, can cause gastrointestinal problems such as diarrhea, abdominal pain, and even severe allergic reactions, including anaphylaxis, angioedema, or bronchospasm.[35] In addition, azithromycin can lead to adverse effects such as diarrhea, abdominal pain, nausea, vomiting, headache, dizziness, taste disturbances, and ototoxicity with the administration of high doses over a prolonged period.[36]

Furthermore, the most common reasons for SM with antibiotics were flu-like symptoms associated with COVID-19, urinary tract infection symptoms, and tonsillitis. Similarly, in Kenya, Bangladesh, and Peru, it has been reported that treating COVID-19-related symptoms was one of the main reasons for SM with antibiotics.[24,28,37] This trend in the results can be attributed to the widespread belief that antibiotics can treat symptoms related to viral infections.[10,38] However, antibiotics such as amoxicillin work by inhibiting the synthesis of peptidoglycans in the bacterial cell wall, whereas azithromycin inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit.[36] Therefore, as emphasized by the World Health Organization (WHO), antibiotics are not effective against viral infections. It is crucial to debunk the misconception that antibiotics can treat symptoms related to viral infections because these medications are designed exclusively for the treatment of bacterial infections.[39]

Additionally, this study found that the main factors associated with SM were being an adult (27–59 years old), residing in the southwestern zone, and lacking information about the proper use of antibiotics. These findings are consistent with those of the existing literature, which also indicates that the frequency of SM is more common in this age group.[8,40] One possible explanation for this finding is that the adult population is economically active and often faces higher work demands, which may hinder their access or availability of time to seek proper medical attention. Regarding the zone of residence, our results indicate that those residing in urban areas showed a higher frequency of SM than those living in rural areas, similar to findings in other countries such as Iran[7] and Nepal.[41] While not explored in depth, there may be several reasons that could explain this finding and could be the subject of future research. For example, urban areas tend to have greater availability and accessibility of pharmacies and establishments where medications can be obtained. In addition, people living in urban areas may have a faster-paced lifestyle, which could lead to reduced willingness to seek medical attention. In this study, it was also found that a lack of information about the proper use of antibiotics is associated with a higher frequency of SM. Other studies have also supported this finding.[10,25] However, a research in Medellín found that having good knowledge does not always translate into appropriate practices.[13] This highlights the need to redesign intervention strategies with a greater emphasis on actual practices, as knowledge alone does not guarantee appropriate behavior regarding SM.

The findings of this study should be interpreted with caution because it was conducted in the city of Medellín, and they may not be generalizable to the entire population of Colombia. Additionally, it is essential to consider that the information collected only pertains to the period of economic reactivation between 2021 and 2022, excluding the more critical period of the pandemic, which was marked by mandatory preventive isolation in 2020 with stricter quarantine periods. This omission was due to operational limitations that prevented the study from being conducted during the study period. This study did not include a question about the source of information for self-medication. Subsequent studies should consider this aspect. In addition, the results may be subject to memory bias because the participants were asked about their past antibiotic use. Despite these limitations, being the first study of its kind in Colombia, this research could serve as a basis for replication in other cities in the country, allowing for data that reflects the situation at a national level and contributing to informed decision-making in the healthcare sector. In this regard, reducing SM could have a positive impact by lowering expenses related to medical care and treatments associated with antibiotic resistance and adverse effects.

Conclusion

In the city of Medellín, there is a high frequency of SM with antibiotics, and their use is prevalent in illnesses where they are ineffective, such as flu-like symptoms related to COVID-19. These findings highlight the contribution of the COVID-19 pandemic to antibiotic resistance through SM and underscore the need for implementing targeted actions to control the use of these drugs. This study can serve as a reference point for future research in other cities and even in other countries, enabling more specific design of educational strategies and the implementation of actions to regulate the use of antibiotics.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

This study was conducted following the ethical principles outlined in the Declaration of Helsinki and was approved by the Institutional Ethics Committee of Universidad Cooperativa de Colombia with the code BIO233.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests in this work.

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