

Self-medication with antibiotics during the COVID-19 pandemic: knowledge and practice among non-medical university students

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Abstract

Introduction: Self-medication with antibiotics (SMA) presents a major public health problem, particularly through the emergence of multidrug-resistant microorganisms. The coronavirus disease 2019 (COVID-19) pandemic may have intensified this practice. This study investigates the prevalence, knowledge, and key determinants of SMA among non-medical university students in M'sila Province, Algeria, during the pandemic.

Methodology: Descriptive statistics, including frequencies and cross-tabulations of selected variables, were calculated. The Chi-square test was used to assess associations between categorical variables. Logistic regression analysis was conducted to identify factors independently associated with SMA.

Results: A total of 415 students (78.1% female) consented to participate in the study between May 2021 and March 2022. The prevalence of SMA for treating COVID-19 symptoms among non-medical students was 40.5%. Higher rates were observed among biology, single, and graduate students, at 44.4%, 41.2%, and 41.9%, respectively. In case of mild illness, 34.7% of biology respondents self-medicated with antibiotics compared to higher proportion (42.4%) of non-biology students ($p = 0.048$). Logistic regression analysis showed that students who were supposed to have excellent knowledge of medications were more likely to self-medicate (OR = 6.613; $p < 0.05$). Furthermore, the COVID-19 pandemic context increased the likelihood of SMA by more than 3-fold (OR = 3.104; $p < 0.001$).

Conclusions: The COVID-19 pandemic significantly increased SMA among non-medical university students, highlighting the urgent need for targeted awareness campaigns and educational interventions to promote rational antibiotic use during health crises. Furthermore, relevant health authorities should strengthen their control measures during pandemics to prevent drug delivery misuse.

Key words: COVID-19; self-medication; antibiotics; university student; Algeria.

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Introduction

Self-medication is defined as the use of drugs by individuals or their family members to treat self-identified symptoms or disorders, or the intermittent or continued use of prescribed drugs for chronic or recurrent diseases or symptoms [1]. Despite its recognized role in healthcare settings, self-medication with antibiotics (SMA) remains a serious threat to global public health and imposes a considerable burden on healthcare systems worldwide. The use of antibiotics without medical guidance increases the risk of antibiotic resistance [2–4]. In 2021, it was estimated that 4.71 million deaths were associated with bacterial antimicrobial resistance (AMR), with 1.14 million deaths directly attributable to AMR. Alarming, by 2050, AMR is expected to directly cause 1.91 million

deaths, and to be associated with a total of 8.22 million deaths globally [5]. Coronavirus disease 2019 (COVID-19), an acute respiratory infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and initially detected in China, rapidly evolved into a global pandemic [6]. In this context, the COVID-19 pandemic has further intensified the challenges posed by AMR by significantly altering the community healthcare behaviors towards self-use of drugs, driven by the fear of illness, increased mortality rates, widespread misinformation, limited access to healthcare services, and the urgency to seek quick solutions.

The developing countries have seen an increased use of SMA at a population level in response to the uncertainty, fear, and psychological distress associated

with the rapid spread of the emerging SARS-CoV-2 infection and the high fatality rates [7,8]. Indeed, numerous studies have highlighted a significant variation in the prevalence of COVID-19-related self-medication, with rates ranging from 3.4% to 96%. On average, the overall prevalence of self-medication against COVID-19 disease was found to be 44.9%. Antibiotics were the most self-administered drugs used, accounting for 79% of the reported cases [9].

The practice of SMA among university students exacerbated during the COVID-19 pandemic; this population group is particularly known for higher engagement in self-care practices. One of the potential drivers of SMA during the COVID-19 pandemic was the widespread misconception that antibiotics are effective against viral infections [10]. In this context, misconceptions were further exacerbated by reports of bacterial co-infections in some patients, leading individuals to SMA in order to prevent such potential infections [11]. However, this misuse of antibiotics did not only fail to prevent or treat COVID-19 infections, but also significantly contributed to the growing issue of antibiotic resistance.

Various studies have demonstrated that patterns of SMA vary across different populations. A recent study that surveyed 1,000 students across three universities in Bangladesh revealed that 61.0% of them had used SMA [12]; while another study in Ghana reported a higher rate (76%) of SMA use [13]. Similarly, SMA was reported as a common practice in different eastern Mediterranean region countries prior to the COVID-19 pandemic, with SMA varying between 19% and 82% [14]. Another multinational cross-sectional study, across different developing countries, has reported a varying prevalence of self-medication practice that ranged from 40.1% to 72.1% among the general population [15]. The use of SMA remains a common practice among university students worldwide, with a notably higher rate observed among undergraduate students [16–18]. During the COVID-19 pandemic, the most reported drivers for SMA included the limited access to healthcare services particularly in remote areas where a strict lockdown was imposed; high consultation fees applied; and an unrestricted availability of antibiotics despite strict local regulations. Furthermore, there is a significant association between the prevalence of SMA and various factors, including demographic and wider determinants of health (age, gender, monthly income, educational levels) and other risk factors such as overloaded health workers, patients' attitude, and a lack of medical knowledge. However, the involvement and the negative

impact of the above factors differ across various populations [19–22].

In Algeria, the practice of SMA presents an emerging challenge for both patients and healthcare providers. However, the prevalence of SMA and its determining factors among the university students remained unclear during the COVID-19 pandemic. Estimating the prevalence of SMA within this population group is crucial, as university students represent a highly educated segment of the population with greater access to available information. Hence, this study aimed to estimate the prevalence of SMA among university students at M'sila University from both biological and non-biological specialties and to evaluate their knowledge, attitudes, practices, and behaviors related to this matter. Furthermore, the study assessed the impact of these factors around self-medication practices with antibiotic use during the COVID-19 pandemic.

Methodology

Study design

This face-to-face, survey-based, cross-sectional study was used to evaluate the prevalence, knowledge, and practices of SMA for treating COVID-19 caused by SARS-CoV-2 infection among non-medical university students in M'sila province, Algeria, from May 2021 to March 2022. Eligible university students from biology and non-biological specialties who agreed to answer all the questions in the SMA-focused questionnaire were included in the study. More specifically, individuals aged 18 years or older, who were enrolled in undergraduate and postgraduate programs at the University of M'sila were included. Students enrolled in medical, paramedical, and pharmacology specialties were excluded from this study.

The study specifically assessed SMA practices related and limited to the COVID-19 pandemic, excluding the pre-pandemic period. The participants were asked to report practices within a less than 12-month timeframe (May 2021 to March 2022) to minimize recall bias.

Sample size estimation

A convenience sampling method was used to enroll participants. The required sample size was calculated using the following formula as previously described by Kitching *et al.* [23], assuming expected prevalence of SMA use against COVID-19 symptoms at 50%, given that no existing studies about SMA prevalence were conducted in the study area, a confidence interval of 95%, and an absolute precision of 0.05%.

$$N = \frac{1.96^2(1-p_{\text{exp}}) p_{\text{exp}}}{d^2}$$

where N = total number of students, and thus the sample size; p_{exp} indicates expected prevalence on self-medication using antibiotics; d is the desired precision. $Z = 1.96$ is the z value that corresponds to the 5% risk read in the standard normal distribution table: $N(0, 1)$, considering the total number of registered students at M'sila University (30,000). According to this formula, the calculated sample size was 384. A total of 415 students were randomly interviewed in this study.

Study instrument

The questionnaire was developed based on a bibliographical review of previously published studies [18,24,25] to better evaluate the prevalence, knowledge, and practices of SMA among non-medical university students. The finalized questionnaire comprised 20 pre-tested questions, incorporating both dichotomous (yes/no) and multiple-choice closed-ended formats. The questionnaire evaluated self-reported knowledge and practices regarding antibiotics and the use of SMA.

The questionnaire consisted of four sections: i) socio-demographic characteristics of the respondents, ii) reasons for practicing SMA among respondents and sources of antibiotics, iii) students' overall knowledge

and practices about antibiotics, and iv) COVID-19 pandemic-related SMA practices.

Statistical analysis

A descriptive and comparative statistical data analysis was performed using R software (v 4.0.0). Frequencies and cross tables of predefined variables were calculated, and Pearson's Chi-square test was used to evaluate the differences in frequencies and assess the associations between variables.

Relevant variables were then entered into logistic regression analysis to calculate the adjusted odds ratio (OR), standard error (std. error), z value, and p value; which were used to assess the strength of the association between independent variables and SMA. A p value < 0.05 was considered statistically significant.

Ethical statement

This study was conducted in accordance with the Declaration of Helsinki and the ethical standards set by the institutional research committee of the university, and approved by the concerned institutional ethics committee (Ethical Approval Number: 931/2021). The participants' anonymity was maintained throughout the research process and informed consent was obtained from all the participants.

Results

General characteristics of the surveyed students

Among 415 students randomly interviewed, a total of 410 non-medical university students consented to participate in the study by responding to the questionnaire. Thus, the response rate was 98.8%. More than half of the respondents (225 individuals or 55%) were from the biological specialty, and the remaining 185 (45%) were from non-biological specialties. The general characteristics of the respondents are summarized in Table 1.

The mean age of the respondents was 21.9 ± 3.4 (SD) (median 21; range 18–40) years. 78.1% of all respondents were female. Most of respondents were postgraduate (61.7%) living in urban areas (70.0%). 40.5% of all participants reported self-medicating with antibiotics for COVID-19 symptoms during the 11-month period between May 2021 and March 2022. Most of the surveyed population (391 individuals, or 95.4%) reported that they were single, with a low monthly income (344 students, or 83.9%).

Reasons for practicing SMA

Approximately one-third (34.7%) of biology respondents had self-medicated with antibiotics when

Table 1. Socio-demographic characteristics of the respondents.

Characteristics	n (%)
Gender	
Female	320 (78.1%)
Male	90 (21.0%)
Age (years)	
< 20	70 (17.1%)
20-24	290 (70.7%)
> 24	50 (12.2%)
Marital status	
Single ¹	391 (95.4%)
Married	19 (4.6%)
Education level	
Undergraduate	157 (38.3%)
Postgraduate	253 (61.7%)
Specialty	
Biological	225 (54.9%)
Non-biological	185 (45.1%)
Monthly income	
< 5000 DZD*	344 (83.9%)
5000–20000 DZD*	33 (8.1%)
20000–40000 DZD*	16 (3.9%)
> 40000 DZD*	17 (4.2%)
Healthcare insurance	
Yes	249 (60.7%)
No	161 (39.3%)
Place of residence	
Urban	287 (70.0%)
Rural	123 (30.0%)
Self-medication with antibiotics during the last 12 months	
Yes	166 (40.5%)
No	244 (59.5%)

¹: Single included divorced; *: DZD: Algerian currency.

they had mild illness, such as influenza-like symptoms, compared to a higher proportion (42.4%) of non-biology students ($p = 0.048$).

Figure 1 summarizes several other reasons for practicing SMA. The most common reasons reported by biology versus non-biology students were their experience with the use of antibiotics (47.5% vs 43.9%), advice from friends or relatives (11.8% vs 28.8%), ease of obtaining drugs (22.8% vs 16.7%), and sufficient medical knowledge (15.8% vs 15.2%), respectively.

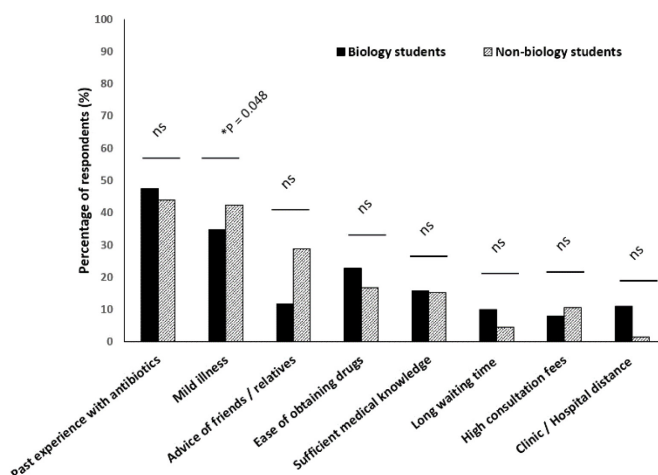
Respondents' self-use of antibiotics and their main sources

The main findings regarding the antibiotics used for self-medication by both biology and non-biology students are summarized in Figure 2. Amoxicillin was the most used antibiotic by both groups for treating COVID-19 symptoms, with a significantly higher prevalence seen among non-biology students (72.7%) compared to biology students (65.0%) ($p < 0.001$). Amoxicillin/clavulanic acid was the second most frequently reported, used by 41% of biology students and 31.8% of non-biology students, and this difference was statistically significant ($p = 0.028$).

Respondents' knowledge, beliefs, and practices regarding antibiotics

The participants' level of knowledge, beliefs, and practices about the effectiveness, resistance, and safety of antibiotics are described in Table 2.

Figure 1. Main reasons for practicing self-medication with antibiotics according to the specialty.



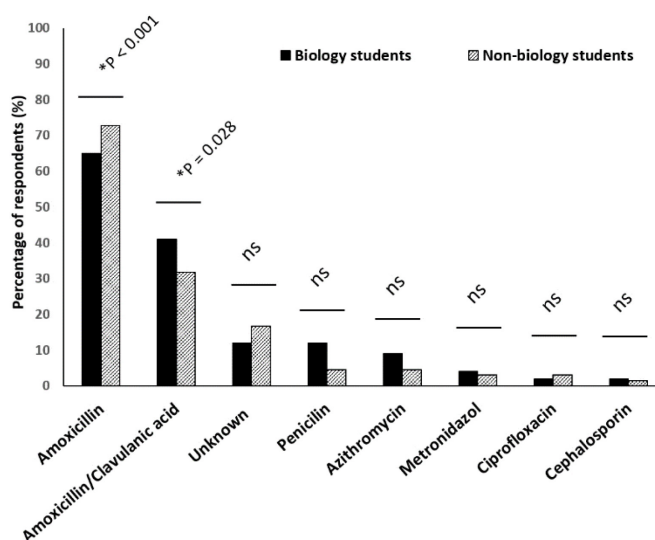
Percentage of respondents agreeing on statements; respondents could agree on more than one statement; $p < 0.05$ was considered to be statistically significant; "ns" indicates not statistically significant.

There was a significant difference between users and non-users regarding their beliefs about using SMA for SARS-CoV-2 infection ($p < 0.001$). Approximately, two-thirds (67.7%) of self-medication users (who had not necessarily tested positive for COVID-19) compared to one-third (32.3%) of non-users believed that SMA could be used for treating COVID-19 due to SARS-CoV-2 infection ($p < 0.001$). Furthermore, the majority (80.3%) of surveyed SMA non-users believed that antibiotics without medical prescription were not as effective as when prescribed by the doctor; there was a significant difference ($p < 0.001$) between the non-users and the students using SMA (56%). Similarly, SMA non-users were also more likely to consider self-prescribing antibiotics unsafe and inappropriate, with (77.9%) agreeing with this view ($p = 0.019$). On the other hand, a large proportion (80.7%) of SMA users reported keeping leftover antibiotics for future use ($p < 0.001$).

Predicting factors of SMA

Logistic regression analysis was performed to identify the different factors associated with SMA use (Table 3). Among the variables examined, the highest odds ratios of engaging in SMA were observed in individuals who rated their knowledge of antibiotics as "excellent." Those who rated their knowledge as excellent had an odds ratio (OR) of 6.61 ($p = 0.016$), suggesting a strong association with self-medication. In contrast, the levels of knowledge in the other categories

Figure 2. Most common antibiotics used in self-medication according to the specialty.



Percentage of respondents agreeing on statements; respondents could agree on more than one statement; $p < 0.05$ was considered to be statistically significant; "ns" indicates not statistically significant.

Table 2. Respondents' knowledge, beliefs, and practices regarding antibiotics.

Statements	User of self-medication n (%)	Non-user of self-medication n (%)	p value
A. Is self-medication with antibiotics suitable for COVID-19 (SARS-CoV-2 infection)?			
No	124 (35.6%)	224 (64.4%)	p < 0.001
Yes	42 (67.7%)	20 (32.3%)	
B. Are antibiotics suitable for bacterial infections?			
Correct statements	78 (47%)	112 (45.9%)	0.829
Incorrect statements	88 (53%)	132 (54.1%)	
C. The symptoms and diseases for which antibiotics are prescribed			
Correct statements	23 (13.9%)	22 (09%)	0.124
Incorrect statements	143 (86.1%)	222 (91%)	
D. The reasons of discontinuation of antibiotics use			
Correct statements	40 (24.1%)	72 (29.5%)	0.227
Incorrect statements	126 (75.9%)	172 (70.5%)	
E. Do you think antibiotic self-prescription is as effective as when prescribed by the doctor?			
Correct statements	93 (56%)	196 (80.3%)	p < 0.001
1. No			
Incorrect statements	73 (44%)	48 (19.7%)	
2. Yes			
3. Do not know			
F. Do you think self-prescription of antibiotics is safe and a good practice?			
Correct statements	112 (67.5%)	190 (77.9%)	0.019
1. No			
Incorrect statements	54 (32.5%)	54 (22.1%)	
2. Yes			
G. Do you keep leftover antibiotics for future use?			
Correct statements	32 (19.3%)	116 (47.5%)	p < 0.001
1. No			
Incorrect statements	134 (80.7%)	128 (52.5%)	
2. Yes			
3. Do not know			
H. How do you evaluate your knowledge on antibiotics use and practice?			
Poor	28 (16.9%)	67 (27.5%)	0.004
Average	93 (56%)	134 (54.9%)	
Good	35 (21.1%)	40 (16.4%)	
Excellent	10 (06.0%)	3 (01.2%)	

p < 0.05 was considered to be statistically significant.

Table 3. Logistic regression analysis of factors associated with self-medication with antibiotics.

Level	Coefficient	Std. Error	z value	p value	Odds ratio (OR)
Specialty					
Biological sciences	-	-	-	-	-
Non-biological sciences	0.203084	0.235123	0.864	0.388	0.816
Marital Status					
Single	-	-	-	-	-
Married	- 0.787714	0.633552	- 1.243	0.214	0.455
How do you evaluate your knowledge on antibiotics use and practice					
Poor	-	-	-	-	-
Average	0.304341	0.299810	1.015	0.309	1.356
Good	0.499391	0.370081	1.349	0.177	1.648
Excellent	1.888982	0.780179	2.421	0.016 *	6.613
Do you think self-prescription of antibiotics is safe and a good practice?					
Correct answer	-	-	-	-	-
Incorrect answer	0.291142	0.255083	1.141	0.254	1.338
Do you keep leftover antibiotics for future use?					
Correct answer	-	-	-	-	-
Incorrect answer	1.232804	0.259909	4.743	p < 0.001 ***	3.431
Is self-medication with antibiotics suitable for COVID-19 (SARS-CoV-2 infection)?					
No	-	-	-	-	-
Yes	1.1327	0.3204	3.535	p < 0.001 ***	3.104
Are antibiotics suitable for viral and/or bacterial infections?					
Correct answer	-	-	-	-	-
Incorrect answer	- 0.005822	0.227086	- 0.026	0.980	0.994

p < 0.05 was considered to be statistically significant.

(poor, average, good) did not show significant associations with SMA. Regarding beliefs about antibiotic use, respondents who believed that self-medication with antibiotics was suitable for treating COVID-19 were more likely to use antibiotics without medical supervision, with an OR of 3.10 ($p < 0.001$). The practice of keeping leftover antibiotics for future use was another significant predictor. Respondents who reported storing leftover antibiotics had an OR of 3.43 ($p < 0.001$), indicating a strong association with SMA use. Conversely, beliefs about the safety and appropriateness of self-prescribing antibiotics did not significantly affect the likelihood of SMA (OR = 1.34, $p = 0.254$). Marital status and the field of study (biological vs. non-biological sciences) were not significant predictors of SMA. Similarly, the perception of antibiotics as suitable for treating viral and/or bacterial infections did not show a meaningful association with SMA (OR = 0.99, $p = 0.980$). These findings highlight that certain beliefs and practices, particularly regarding COVID-19 treatment, effectiveness of self-prescribed antibiotics, and the storage of leftover antibiotics, play a significant role in the likelihood of engaging in SMA practices.

Discussion

Little is known about prevalence, knowledge and practices of self-medication among the Algerian population [15,26]. The current study aimed to assess the prevalence, knowledge and associated factors of SMA among university students during the COVID-19 pandemic in M'sila, Algeria. The main findings were: (i) the prevalence of SMA was relatively high among all respondents, regardless of their specialty; (ii) the most commonly used antibiotics were amoxicillin and amoxicillin/clavulanic acid (Augmentin®); (iii) the main sources of antibiotics were community pharmacies, relatives or friends, and leftover antibiotics from previous consultations; (iv) the context of the COVID-19 pandemic emerged as one of the most important factors predicting SMA use among university students in the province of M'sila, Algeria.

From May 2021 to March 2022, 40.5% of respondents reported engaging in SMA use for treating COVID-19 due to SARS-CoV-2 infection, within the past 11 months, coinciding with the COVID-19 pandemic period. This prevalence is slightly lower than that observed in a multinational cross-sectional study conducted across the Arab region during the same period, which found an average SMA prevalence of 43.3% [15]. Similarly, a meta-analysis revealed a high rate of antimicrobial drug consumption among COVID-

19 patients, with 68% of all cases involving the use of antibiotics [7].

This variation can be explained by the fact that these earlier studies targeted the general population, whereas the current study focused specifically on SMA use among university students. Given their higher level of education, university students may be more conscious of the risks associated with SMA than the public.

The main reasons cited by participants who used antibiotics without a medical prescription included prior experience with the use of antibiotics, perception of 'mild illness', advice from friends or relatives, and ease of obtaining these drugs without prescription. These findings align with those reported in previous studies [18,27]. Interestingly, non-biology students demonstrated a higher tendency to practice SMA (42.4%) compared to biology students, particularly when addressing mild illnesses.

In this study, amoxicillin has emerged as the most used antibiotic among respondents, consistent with findings from a previous study conducted during the COVID-19 pandemic [27]. While amoxicillin was frequently used for self-medication, its usage was significantly higher among non-biology students (72.7%); whereas amoxicillin/clavulanic acid was more frequently used among biology students (41%). Surprisingly, more than 16% of non-biology students were unaware of the specific antibiotic they had used without a prescription, compared to a lower proportion among biology students (12%). Overall, these findings suggest a preference for the use of a broad-spectrum of antibiotics, particularly amoxicillin/clavulanic acid, among students that used to self-medicate across different specialties. Despite their ineffectiveness against COVID-19 infections and the risk of developing multidrug resistance, students most likely think that broad-spectrum antibiotics produce the desired effect. Understanding these determinants can help policymakers prioritize targeted interventions to effectively control certain SMA practices.

The main source of SMA for both biology and non-biology students was community pharmacists (64% and 53%, respectively). This is in line with findings from a study conducted during the same period in western Algeria, which reported that 61.1% of pharmacy staff were dispensing antibiotics over the counter [26]. These alarming practices highlight that, despite the global adoption of regulations on antibiotics dispensing, including in Algeria, the effective enforcement of stricter measures by the Algerian health authorities remains an emergency with immediate interventions required to prevent the sale of antibiotics over the

counter, without a medical prescription.

Antibiotics are not effective against COVID-19 as it is a viral disease, and antibiotics only work on bacterial infections. Medical guidelines from key organizations like the World Health Organization (WHO) generally recommend against the routine use of antibiotics for COVID-19 patients unless there is strong clinical suspicion or confirmed evidence of a secondary bacterial infection. In this study, a proportion of students demonstrated poor knowledge about antibiotic efficiency, safety, and appropriate use. Many students (67.7% in users of self-medication versus 32.3% in non-users of self-medication; Table 2) believed that antibiotics are suitable for treating viral infections, such as SARS-CoV-2. The practice of keeping leftover antibiotics for future use was significantly higher among SMA users compared to non-users (80.7% and 52.5% respectively; $p < 0.001$). In addition, as shown in Table 2, there was no significant difference in the practice of SMA use between undergraduate and postgraduate students. This could explain the high rate of incorrect answers and beliefs observed in both groups. These observations differ from the survey findings of previous studies conducted among Saudi and Chinese students [18,28]. In these studies, the students' awareness improved as they progressed through their education level. Therefore, both biology and non-biology students should acquire more comprehensive knowledge to achieve the necessary level to better understand the use of antibiotics.

Logistic regression analysis of the factors associated with SMA provided an interesting insight that may explain the beliefs and behaviors of the surveyed students, highlighting that SMA practices appear widespread across various subgroups. In the present research, no significant associations were found between SMA and the socio-demographic characteristics of the respondents, such as gender, age, or marital status. Surprisingly, the level of SMA use was not significantly influenced by their specialty. This suggests that biology programs may require improvement to better educate students about the effective use and risks of antibiotics misuse. Previous studies have indicated that SMA patterns can vary by specialty, particularly when comparing health sciences students with those in other fields [18,29]. An important factor influencing SMA use patterns was the student's misconception about antibiotics use. Interestingly, participants who reported adequate knowledge related to the use and effectiveness of antibiotics, were more likely to self-medicate. Furthermore, the students who incorrectly believed that self-prescription of antibiotics

is as effective as prescribed by the doctor, as well as those who kept leftover antibiotics for future use, were more prone to engage in self-medication. This highlights their false sense of security associated with such practices [30–32].

Therefore, future educational actions should prioritize enhancing students' understanding of antibiotics while simultaneously fostering positive changes in attitudes towards the appropriate use of antibiotics. The context of the COVID-19 pandemic appears to have significantly increased the risk of using antibiotics without medical consultation, regardless of the respondent's level of knowledge about the effectiveness of antibiotics against bacterial infections. This is consistent with data from previous studies, which identified the fear of contracting the disease as a key predictor of negative attitude towards antibiotic use [7,33,34]. The COVID-19 pandemic has thus led to a major paradigm shift, which had a profound impact on students' beliefs and practices, including a notable increase in their use of SMA. Addressing these shifts through targeted interventions could mitigate the long-term consequences of such behaviors, not only at the local or regional level but also on a global scale.

Conclusions

This study sheds light on the knowledge and attitudes associated with self-medication with antibiotics within the specific context of the COVID-19 pandemic among non-medical university students. The associated panic and uncertainty undoubtedly contributed to an increased use of SMAs. During pandemics or other high-stress health-related situations, it is essential to improve the quality of school curricula with a view to addressing issues of antibiotic use, as well as enhancing awareness and education at any level, and students more specifically. This will help to mitigate the potential risks associated with SMA use, such as multidrug resistance. Students should also be informed to take advantage of the health insurance program's benefits and services; and as part of that, they must complete in a timely manner the required processes to be covered by government-offered health insurance. Health services could be enhanced via a social contract between the university and private healthcare facilities.

Algerian legislation stipulates that antibiotics can only be obtained with a strict medical prescription. However, in the context of the pandemic and the population's panic, some community pharmacies did not respect the above restriction. Therefore, it is recommended that the relevant health authorities

consider how they might improve their control measures during pandemics as well as any viral epidemics, to prevent any abuse of the drug supply chain. Further research is necessary to expand our understanding of SMA practices, particularly among nursing and medical students in Algerian universities, to develop more effective interventions.

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Authors' contributions

MLF: conceptualization, methodology, software, data curation, visualization, investigation, supervision, validation, writing—original draft preparation, reviewing, and editing; TB: conceptualization, methodology, software, data curation, writing—original draft preparation, visualization, investigation, supervision, validation, writing—reviewing and editing; KS: methodology, software, validation, writing—original draft preparation; M-ET: validation, writing—reviewing and editing; LB-M: validation, writing—reviewing and editing.

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Conflict of interest

No conflict of interest is declared.

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