SHORT COMMUNICATION OPEN ACCESS

Awareness, Knowledge, and Practices Regarding Antibiotic Resistance Among University Students: A Pilot Cross-Sectional Study

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Abstract

***Objective*:** This study aimed to assess the knowledge, awareness, and practices regarding antibiotic use and antibiotic resistance among university students of Pakistan (Khyber Pakhtunkhwa region) and Afghanistan (Jalalabad). Of the 53 participants, 28 were from Afghanistan and 25 were from Pakistan.

***Methods*:** This was a cross-sectional study with the use of questionnaire. The data was collected from 53 university students through a questionnaire distributed via social media and student networks in March 2026. Participants were recruited from Spinghar University and Rokhan University in Afghanistan and from various universities in Khyber Pakhtunkhwa, Pakistan through personal contacts. The data were analyzed descriptively which included frequencies and percentages. Data analysis was performed using SPSS version 25.

***Results*:** A majority of participants (81.1%) reported having heard of antibiotic resistance. In addition, (82.7%) recognized that inappropriate antibiotic use contributes to antibiotic resistance. However, (32.1%) of participants incorrectly believed that antibiotics are effective against viral infections. When it comes to their behavioral practices, only 49.1% always finish their full course of antibiotics. Regarding leftover antibiotics, 21.2% reported using them and 26.9% were uncertain (n = 52 valid responses). Among the 51 participants who responded, 3 (5.9%) reported taking antibiotics without a prescription; two participants did not respond to this question.

***Conclusion*:** Despite the relatively high level of awareness among students, important misconceptions and inappropriate antibiotic practices were still observed. Targeted educational interventions are needed to improve responsible antibiotic use and help reduce antimicrobial resistance.

Keywords: Drug Resistance, bacterial, health knowledge, attitudes, practice, health behavior, students, Afghanistan, Pakistan, pilot projects.

1. INTRODUCTION

Antibiotic resistance is a major global public health concern. It occurs when bacteria adapt and become resistant to antibiotics that were previously effective against them. Misuse of antibiotics, including self-medication and premature discontinuation of treatment, contributes significantly to antimicrobial resistance [1, 2]. This issue is particularly important among university and medical students, as future healthcare professionals play a key role in promoting rational antibiotic use [3, 4]. Therefore, assessing their knowledge, attitudes, and practices regarding antibiotic use is essential [5, 6]. In Pakistan and Afghanistan, antibiotics are frequently obtained without a prescription. These medications are commonly acquired directly from local pharmacies without consultation with qualified healthcare professionals [3, 5]. Pharmacy attendants often lack formal pharmaceutical training, and antibiotics are frequently dispensed based on customer requests or symptom-based descriptions without proper clinical evaluation [5]. As a result, self-medication is widespread and often inappropriate [3, 7]. This unrestricted access

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creates selective pressure that drives the emergence and spread of drug-resistant pathogens [1]. According to the World Health Organization [1], irrational antimicrobial use in humans, animals, and agriculture is a major driver of antimicrobial resistance. Furthermore, approximately 20–30% of outpatient antibiotic prescriptions are considered unnecessary, further accelerating the development of resistant organisms [8].

Undergraduate medical and health science students represent an important group, as they will serve as future healthcare providers and can influence antibiotic use practices within communities [2, 4]. However, few studies have examined knowledge, attitudes, and practices related to antibiotic resistance among university students from Pakistan and Afghanistan [5, 3, 6]. To our knowledge, no similar study has been published from Spinghar University. However, the specific gap addressed by this study is the lack of data on antibiotic resistance awareness and practices among university students recruited from both Afghanistan and the Khyber Pakhtunkhwa region of Pakistan, particularly in a student-led pilot setting. Therefore, this study aimed to assess the knowledge, awareness, and practices regarding antibiotic use and antibiotic resistance among university students from Pakistan and Afghanistan.

2. METHODOLOGY

2.1. Study Design and Setting

Data were collected during March 2026. A questionnaire-based cross-sectional study was conducted among university students.

2.2. Participants and Sampling

A total of 53 university students participated in the study. Convenience sampling was used to select participants. As this was a pilot study, no formal sample size calculation was performed. A sample of 53 participants was feasible for an exploratory student-led project. Participants were recruited from Spinghar University and Rokhan University in Afghanistan and from Khyber Medical University (KMU) and various other universities in the Khyber Pakhtunkhwa region, Pakistan, through personal contacts and student networks. Participation in the study was voluntary. No personally identifiable information was collected. Informed consent was obtained from all participants prior to data collection.

Inclusion criteria were:
(1) current enrollment as a university student and
(2) willingness to participate.
Exclusion criteria were:
(1) non-students and
(2) participants who did not complete the questionnaire.

2.3. Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki. Participation was voluntary, and all responses were anonymous. No personally identifiable information was collected. Informed consent was obtained from all participants prior to completing the questionnaire. This study was an anonymous, minimal-risk survey with no patient involvement. The ethical approval was obtained from the Department of Medicine, Spinghar University, Afghanistan.

2.4. Instrument for Data Gathering

We used Google Forms to create a survey. The questionnaire was divided into four sections: demographic information (age, gender, field of study), awareness of antibiotic resistance, knowledge about antibiotic use, and behavioral practices regarding antibiotics. In the second section, we asked about their knowledge of antibiotic resistance. The third section asked about their knowledge of antibiotic use. The fourth section asked about how they actually use antibiotics. We distributed the questionnaire online and collected the responses. The questionnaire was developed by the authors based on the study objectives. It was pre-tested on five students to assess clarity and comprehensibility. Formal reliability testing, such as Cronbach's alpha, was not performed due to the pilot nature and small sample size of the study.

2.5. Data Analysis

We collected the data and exported it from Google Forms into SPSS 25 to analyze it. Descriptive statistical analysis was performed using frequencies and percentages. Comparative analyses were conducted between medical and non-medical students. Country of recruitment was recorded for participants, with 28 participants recruited from Afghanistan and 25 from Pakistan. However, country-specific comparative analyses were not performed because of the small sample size and limited subgroup sizes. Where appropriate, a chi-square and Fisher’s exact test were conducted to explore the association between field of study (medical vs. non-medical) and categorical variables. Because the sample size was small and expected cell counts were low, Fisher's exact test was used for the final p-values reported in this study. Due to the limited sample size, other inferential analyses were restricted, and results should be interpreted with caution.

3. RESULTS

3.1. Demographics

Participants were aged between 18 and 24 years, with the majority aged 21 years (n=22). The remaining age distribution was as follows: 1 student was 18 years, 6

Table 1: Demographic characteristics and source of information of participants (n = 53).

Variable	Category	Frequency (n)	Percentage (%)
Age Range	18-24 years	53	100%
Gender	Male	44	83.0%
	Female	9	17.0%
Source of Information	University	33	62.3%
	Internet	11	20.8%
	Others	9	17.0%

were 19 years, 8 were 20 years, 5 were 22 years, 5 were 23 years, and 6 were 24 years. Of the participants, 44 (83.0%) were male and 9 (17.0%) were female. In terms of field of study, 46 (86.8%) were medical students and 7 (13.2%) were non-medical students.

3.2. Awareness and Knowledge

A total of 53 university students participated in the study. Regarding awareness, 43 participants (81.1%) had heard of antibiotic resistance, while 10 (18.9%) had not. The most common source of information was university (33, 62.3%), followed by the internet (11, 20.8%) and others (9, 17.0%). When asked whether misuse of antibiotics leads to resistance, 43 participants (82.7%) responded "yes," while 6 (11.5%) responded "no" and 3 (5.8%) were unsure. One participant did not respond to this question.

Regarding knowledge, 31 participants (58.5%) correctly stated that antibiotics are not effective against viral infections. However, 17 participants (32.1%) reported that antibiotics are effective against viral infections, and 5 (9.4%) were unsure.

A Fisher's exact test was performed to examine the association between field of study (medical vs. non-medical) and the belief that antibiotics are effective against viral infections. No statistically significant association was found ($p = 0.229$).

3.3. Behavioral Practices

Regarding behavioral practices, 26 participants (49.1%) reported always completing their antibiotic course, while 22 (41.5%) reported doing so only sometimes and 5

Table 2: Awareness and knowledge of antibiotic resistance (n = 53).

Variable	Responses	Frequency (n)	Percentage (%)	p-value
Heard of antibiotic resistance	Yes	43	81.1%	0.144
	No	10	18.9%	
Source of information	University	33	62.3%	0.011
	Internet	11	20.8%	
	Others	9	17.0%	
Aware that misuse leads to resistance	Yes	43	82.7%	0.048
	No	6	11.5%	
	Not Sure	3	5.8%	
Antibiotics are effective against viral infections	True	17	32.1%	0.229
	False	31	58.5%	
	Not Sure	5	9.4%	

Note: Percentages for individual questions with missing responses are based on valid responses. One response was missing for the question regarding whether antibiotic misuse leads to resistance.
p-values represent comparisons between medical and non-medical students using Fisher's exact test.

(9.4%) reported never completing the course. With respect to the use of leftover antibiotics, 27 participants (51.9%) reported never using them, whereas 11 (21.2%) reported using leftover antibiotics and 14 (26.9%) were unsure. Self-medication with antibiotics was reported by 3 participants (5.9%), while 39 (76.5%) reported not practicing self-medication and 9 (17.6%) were uncertain. In terms of antibiotic use frequency, 26 participants (49.1%) reported using antibiotics 2–3 times per year, followed by 12 (22.6%) who used them 0–1 time, 7 (13.2%) who used them 4–5 times, and 8 (15.1%) who reported using antibiotics more than 5 times annually. Regarding safety practices, 42 participants (79.2%) reported always checking the expiry date before use, while 7 (13.2%) reported checking sometimes and 4 (7.5%) reported never checking.

4. DISCUSSION

This study assessed the knowledge, awareness, and behavioral practices regarding antibiotic use and antibiotic resistance among university students in Pakistan and Afghanistan. Most participants (81.1%) were aware of antibiotic resistance. Additionally, 82.7% recognized that inappropriate antibiotic use contributes to antibiotic resistance. However, a considerable proportion of students (32.1%) incorrectly believed that antibiotics are effective against viral infections. Regarding behavioral practices, only 49.1% finished the full course of antibiotics. These findings suggest that although students possess general awareness regarding antibiotic resistance, important misconceptions still remain. Additional educational interventions are therefore necessary. The World Health Organization (2023) emphasizes that inadequate awareness and knowledge are key contributing factors to the spread of antimicrobial resistance, particularly in low- and middle-income countries [1]. Most students demonstrated a basic understanding of antibiotic resistance. A large majority (81.1%) had heard of the concept, and 82.7% correctly recognized that misuse of antibiotics contributes to resistance. This is consistent with the National Library of Medicine's report that public awareness is a key component of antimicrobial stewardship programs [9]. Similarly, a study of health-related students in Saudi Arabia found that students had above-average knowledge of antibiotics and antibiotic resistance, which is consistent with our finding that 81.1% of students had heard of antibiotic resistance [2]. Our finding is nearly identical to a study of Polish medical students, where

Table 3: Behavioral practices regarding antibiotic Use (n = 53).

Variable	Responses	Frequency (n)	Percentage (%)	P-value
Completion of antibiotic course	Yes	26	49.1%	0.007
	No	5	9.4%	
	Sometimes	22	41.5%	
Use of leftover antibiotics	Yes	11	21.2%	0.410
	No	27	51.9%	
	Not sure	14	26.9%	
Self-medication with antibiotics	Yes	3	5.9%	0.199
	No	39	76.5%	
	Not sure	9	17.6%	
Antibiotic usage frequency per year	0-1 times	12	22.6%	1.000
	2-3 times	26	49.1%	
	4-5 times	7	13.2%	
	>5 times	8	15.1%	
Checking expiry date before use	Always	42	79.2%	0.056
	Sometimes	7	13.2%	
	Never	4	7.5%	

Note: Percentages for questions with missing responses are based on valid responses. For leftover antibiotics, n=52 valid responses (one missing). For self-medication, n=51 valid responses (two missing).
p-values represent comparisons between medical and non-medical students using Fisher's exact test.

81.1% of students also positively assessed their antibiotic knowledge [4]. A study from a medical school in Peshawar, Pakistan, found that 78.2% of medical students knew about antibiotic resistance, which is similar to our finding [3]. Similarly, a study from Lahore, Pakistan, found that medical students had significantly better knowledge of antibiotic resistance compared to non-medical students (49% vs. 27.9%, $p < 0.05$) [6]. In our sample, medical students appeared to have slightly better knowledge, but the difference was not statistically significant ($p = 0.229$). University education was reported as the primary source of information regarding antibiotic resistance among participants (62.3%). This highlights the important role of formal education in awareness. Despite this awareness, an important misconception remained, as nearly one-third of participants (32.1%) believed that antibiotics are effective against viral infections. Misconceptions were reported as prominent among medical students in Saudi Arabia, and regarding the concept of antibiotics and their uses which is opposite of knowledge gap observed in our study [2]. Similarly, a study conducted among medical students in Nigeria found in their study that 39.1% wrongly believed that bacteria can cause common cold and influenza, this confirms that these misconceptions about antibiotics and viral infections are a widespread misunderstanding across different countries [10]. Also, a study from Poland observed that only 3% of senior medical students believed that antibiotics can be effective against viral infections, it shows a large educational difference in our study [4]. This misconception may lead to inappropriate antibiotic use for viral illness like common cold and influenza, further increase in the spread of antibiotic resistance. Overall, these findings suggest that although basic awareness exists, important knowledge gaps remain. These results highlight the need for more comprehensive educational interventions to promote responsible antibiotic use among university students. A study from Kabul University found that basic sources of information about antibiotics were friends and family (65.6%) and the internet (31.2%), highlighting that the informal sources play a major role in antibiotic use among students in Afghanistan [5].

When it comes to behavioral practices, some positive trends were seen. Most students (79.2%) said they always check the expiry date before using antibiotics, and self-medication was fairly low (5.9%). This finding is much lower than a study conducted at Kabul University, which reported that 59.1% of nonmedical students practiced self-medication with antibiotics [5]. The difference may be because our sample consisted mostly of medical students (86.8%), who may have better knowledge about the risks of self-medication. Still, there were clear gaps in behavior. Less than half of the students (49.1%) reported always finishing their full course of antibiotics, 41.5% did so only sometimes, and 9.4% never completed it. Strikingly, a study of medical students in Nigeria found that only 49.3% completed their antibiotic course, which is almost identical to our finding of 49.1% [7]. This similarity across two different continents (Asia and Africa) suggests that poor antibiotic completion behavior is a widespread problem among medical students in developing countries. Regarding leftover antibiotics, 21.2% of participants reported using them, while 26.9% were uncertain about this practice. Incomplete antibiotic courses and the use of leftover antibiotics may allow bacteria to survive and contribute to antimicrobial resistance. This may result in infections becoming increasingly difficult to treat. Although most students reported checking expiry dates, inappropriate antibiotic practices were still observed. These findings highlight the need for improved antibiotic stewardship education. In many South Asian countries, self-medication with antibiotics remains common due to easy access to non-prescription medications. In Afghanistan, many individuals reported using antibiotics based on previous illness experiences (39%) and many patients do not see doctors due to financial barriers limiting access to healthcare services (35.5%) [5].

In Pakistan and Afghanistan, antibiotics are often available without a prescription, contributing to inappropriate antibiotic use and self-medication practices. Many pharmacy attendants lack formal pharmaceutical training and frequently dispense antibiotics without appropriate medical evaluation. As a result, antibiotics are frequently used without appropriate medical supervision, and this contributes significantly to inappropriate antibiotic use and may accelerate the spread of antimicrobial resistance within the region. Similarly, a study from a medical school in Peshawar, Pakistan, reported that 80.7% of medical students practiced self-medication with antibiotics, which is much higher than the 5.9% found in our study [3]. In comparison, a community-based study in low-income urban Delhi, India, found that 24.6% of the general population practiced self-medication with antibiotics, and only 19.4% were aware of antimicrobial resistance [11]. In contrast, a study among medical undergraduates in Northern Nigeria found that 38.8% practiced self-medication with antibiotics, which is still substantially higher than our finding of 5.9% [7]. The large difference may be due to differences in how self-medication was defined or measured, or because our study relied on self-reporting which may have led to underreporting. These factors may also contribute to self-medication practices among university students in our study. Previous studies also found that medical students were more likely than non-medical students to let minor ailments recover naturally, suggesting that medical education promotes more judicious antibiotic use [6].

This study has several limitations. First, the relatively small sample size ($n = 53$) limits the extent to which the findings can be generalized to a broader population. Second, convenience sampling was used, meaning that only students who were available and willing to

participate were included. This may have introduced selection bias and affected the representativeness of the sample. Third, most participants were medical students (86.8%), which may limit the applicability of the findings to students from non-medical disciplines. Fourth, the study relied on self-reported responses, which may be affected by social desirability bias, where participants may provide answers that they believe are expected or acceptable rather than accurately reflecting their actual behaviors and practices. Fifth, because the study was conducted exclusively among university students, the findings may not be representative of the general population.

Furthermore, previous research reported significantly higher rates of self-medication among male students (86.2%) compared with female students (68.4%), as well as among rural students (90.2%) compared with urban students (75.9%) in Pakistan [3]. Since the majority of participants in the present study were male (83%), this demographic imbalance may have influenced the observed self-medication practices.

Additionally, nationality or country of residence was not collected through the questionnaire. Although country of recruitment was recorded (28 from Afghanistan, 25 from Pakistan), separate comparisons between Pakistani and Afghan participants could not be performed because of the limited subgroup sizes. Future studies should include these variables to allow more meaningful subgroup analyses and country-level comparisons.

Based on these findings, several recommendations can be made. First, universities should strengthen programs on antibiotic awareness and stewardship, with a special focus on correcting the common misconception that antibiotics can treat viral infections.

Second, educational programs should not only focus on knowledge but also on students' behavior of antibiotic use. Students need to be taught the importance of completing the full course of antibiotics and not taking leftover or shared antibiotics, which can lead to antibiotic resistance. Our recommendation is also supported by previous research suggesting that the curriculum should be improved to better meet students' learning needs about antibiotics and resistance [2]. Sobierajski *et al*. also found that medical students who had received more education on antibiotics had better knowledge and healthier attitudes toward antibiotic use [4].

Third, future studies should include larger and more diverse groups of students, especially those outside the medical field, to gain a better understanding of students' and the general public's knowledge, attitudes, and practices related to antibiotics. Moreover, based on the findings of this study and everyday observations, awareness programs should be conducted in schools and colleges to educate students about the deleterious effects of misuse of antibiotics. There needs to be more emphasis on common behaviors such as taking antibiotics without prescription, stopping the medicine early when feeling better, and using leftover antibiotics. Also, students should be given simple educational booklets or pamphlets with pictures for better awareness. The female and non-medical students should be given special attention where they are usually involved in caring family members and they could use antibiotics without proper guidance.

5. CONCLUSION

In conclusion, this pilot study found that while awareness of antibiotic resistance among university students was relatively high based on a single awareness question, important gaps in knowledge and inappropriate antibiotic practices remain. These findings should be interpreted as exploratory and may not be generalizable to all university students in Pakistan and Afghanistan. Larger, multi-center studies are needed to confirm these findings and inform targeted educational interventions.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Spinghar University of Afghanistan.

CONFLICT OF INTEREST

The author declares that there is no conflict of interests.

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REFERENCES

[1] World Health Organization. Antimicrobial resistance. Geneva: World Health Organization; 2023 (cited 2026 Oct 10). Available from: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance

[2] Akbar Z, Alquwez N, Alsolais A, Thazha SK, Ahmad MD, Cruz JP. Knowledge about antibiotics and antibiotic resistance among health-related students in a Saudi university. J Infect Dev Ctries. 2021; 15(7): 925-33. https://doi.org/10.3855/jidc.12329

[3] Faisal R, Khan FA, Khan MA, Ahmad H. Prevalence of self-medication with antibiotics

and knowledge about antibiotic resistance: a cross-sectional study at a medical school of Pakistan. J Rehman Med Inst. 2025; 11(3): 107-12. https://doi.org/10.52442/jrmi.v11i3.808

[4] Sobierajski T, Mazińska B, Wanke-Rytt M, Hryniewicz W. Knowledge-based attitudes of medical students in antibiotic therapy and antibiotic resistance: a cross-sectional study. Int J Environ Res Public Health. 2021; 18(8): 3930. https://doi.org/10.3390/ijerph18083930

[5] Qudrati BA, Sakhi R, Nikzad H, Qudrati SA. Prevalence of self-medication with antibiotics among nonmedical students at Kabul University, Afghanistan: a cross-sectional study. Medicine. 2025; 104(34):e44124. https://doi.org/10.1097/MD.0000000000044124

[6] Ayub F, Khan TM, Amin MU, Baig MR, Bukhsh A, Zaman K, *et al*. Comparison of general use of antibiotics between medical and nonmedical university students of Lahore. Biomed Res Int. 2023; 2023: 8534944. https://doi.org/10.1155/2023/8534944

[7] Fadare JO, Tamuno I. Antibiotic self-medication among university medical undergraduates in Northern Nigeria. J Public Health Epidemiol. 2011; 3(5): 217-20. Available from: http://www.academicjournals.org/journal/JPHE/article-full-text-pdf/05F004B1416

[8] Centers for Disease Control and Prevention. Antibiotic use and stewardship. Atlanta (GA): Centers for Disease Control and Prevention; 2023 (cited 2026 Oct 10). Available from: https://www.cdc.gov/antibiotic-use/index.html

[9] Nimmana B, Nguyen A. Antibiotic resistance. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2026 (cited 2026 Oct 10). Available from: https://www.ncbi.nlm.nih.gov/books/NBK513277/

[10] Okedo-Alex I, Madubueze UC, Umeokonkwo CD, Oka OU, Adeke AS, Okeke KC. Knowledge of antibiotic use and resistance among students of a medical school in Nigeria. Malawi Med J. 2019; 31(2): 133-7. https://doi.org/10.4314/mmj.v31i2.5

[11] Rao S, Basu S, Rajaura S, Zode M, Singh MM, Sharma N. Knowledge, attitudes, and practices of antibiotic use and antimicrobial resistance in low-income urban Delhi, India: a community-based cross-sectional study. Antibiotics. 2025; 14(12): 1184. https://doi.org/10.3390/antibiotics14121184

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