JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

DOI: https://doi.org/10.61919/mg1x1t59

Original Article

Assessment of Self-Medication and Non-Compliance of Antibiotics Among Health Majored Students in Peshawar

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"Cite this Article" **Received**: 10 February 2026; **Accepted**: 06 June 2026; **Published**: 10 July 2026

Author Contributions: Concept: HTK and SM; Design: HTK, SM and SA; Data Collection: A, HTK, MS and LM; Analysis: HTK and SM; Drafting: A, HTK; Critical Review: SM, SA, MS and LM. **Ethical Approval**: Sarhad University of Science and Information Technology, Peshawar, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: NA

ABSTRACT

Background: Self-medication with antibiotics and non-compliance with prescribed antibiotic regimens are important contributors to antimicrobial resistance, particularly in settings where antibiotics remain easily accessible without prescription. Health sciences students are a key population because their antibiotic-related practices may influence future patient counseling and community behavior. Objective: To determine the frequency of antibiotic self-medication, assess antibiotic-related knowledge, and describe compliance patterns among allied health sciences students in Peshawar, Pakistan. Methods: This institution-based descriptive cross-sectional study was conducted among 450 allied health sciences students from Sarhad University of Science and Information Technology and Khyber Medical University, Peshawar, from 15 May to 30 July 2023. Data were collected using a structured self-administered questionnaire and analyzed in SPSS version 22 using frequencies and percentages. Results: Self-medication with antibiotics was reported by 365 students (81.1%). Although 429 participants (95.3%) were aware of antibiotics and 379 (84.2%) had heard of antibiotic resistance, only 180 (40.0%) correctly reported that self-medication increases resistance. Time-saving was the most common reported reason for self-medication (35.5%). Community pharmacies were the leading antibiotic source (37.6%), and 245 participants (54.4%) had recommended antibiotics to others without prescription. Dose skipping was reported often by 186 participants (41.3%). Conclusion: Antibiotic self-medication and non-compliance were common despite high general antibiotic awareness, indicating a substantial knowledge-practice gap. Targeted antimicrobial stewardship education and stronger enforcement of prescription-only antibiotic dispensing are needed. Keywords: Antibiotics; self-medication; antimicrobial resistance; non-compliance; allied health sciences students; Pakistan

INTRODUCTION

Antibiotics transformed the management of infectious diseases after the discovery of penicillin, but their clinical effectiveness is increasingly threatened by antimicrobial resistance, which has become one of the most serious public health challenges worldwide (1). Global estimates indicate that bacterial antimicrobial resistance was directly responsible for approximately 1.27 million deaths and associated with 4.95 million deaths in 2019, with the greatest projected burden expected in low- and middle-income countries where infectious disease burden, health-system constraints, and regulatory weaknesses intersect (2). If current trends continue, drug-resistant infections may contribute to millions of

preventable deaths annually and impose substantial clinical and economic pressure on already constrained health systems (3).

Self-medication with antibiotics refers to the use of antibiotics without consultation with a qualified medical practitioner, including use based on personal judgment, previous prescriptions, leftover medicines, advice from family or friends, or direct access through pharmacies. This practice contributes to inappropriate antibiotic selection, incorrect dosing, premature discontinuation, adverse drug reactions, masking of serious infections, treatment failure, and selection of resistant bacterial strains (4). Although self-medication may be perceived by individuals as convenient, time-saving, or cost-saving, it undermines rational antibiotic use and weakens antimicrobial stewardship at the community level (5,6). The problem is particularly important in countries where antibiotics remain easily accessible without prescription and where professional healthcare consultation may be delayed or avoided because of financial, geographic, cultural, or time-related barriers (7,8).

Pakistan represents a high-risk setting for antibiotic self-medication because community access to antibiotics remains widespread despite legal and regulatory frameworks requiring prescription-based dispensing. Previous work has shown that antibiotics are commonly obtained from community pharmacies without a valid prescription, reflecting gaps in enforcement, pharmacy staffing, public awareness, and health-system accessibility (7). In addition, self-treatment is socially normalized in many communities, where family advice, previous experience, and informal consultation often guide medicine use before formal medical care is sought (8). These factors create conditions in which antibiotic misuse may continue even among educated populations.

Health sciences students are a particularly important population for studying antibiotic self-medication and non-compliance because they are future healthcare providers and are expected to promote rational medicine use in clinical and community settings. However, their partial medical knowledge, peer networks, exposure to clinical environments, and perceived confidence in recognizing common illnesses may increase the likelihood of self-directed antibiotic use. Prior studies in Pakistan have reported high levels of antibiotic self-medication among allied health and medical students, suggesting that knowledge alone may not reliably translate into safe antibiotic-related behavior (9,10). This knowledge-practice gap is concerning because students may not only self-medicate but may also recommend antibiotics to relatives, peers, or community members, thereby extending inappropriate antibiotic practices beyond their own use.

Peshawar and the wider Khyber Pakhtunkhwa context require focused attention because the region faces a high infectious disease burden, variable access to healthcare services, and ongoing challenges related to medicine regulation and community-level antibiotic availability (11). Despite the public health importance of antimicrobial resistance, limited local evidence is available on how allied health sciences students in Peshawar obtain antibiotics, why they self-medicate, how they comply with antibiotic regimens, and whether their antibiotic knowledge is reflected in safer practices. Generating such evidence is necessary for designing targeted antimicrobial stewardship education, improving student counseling behavior, and informing institutional and regulatory interventions.

Therefore, this study was conducted to determine the frequency of self-medication with antibiotics among allied health sciences students in Peshawar, assess their knowledge regarding antibiotic use and antimicrobial resistance, identify sources and reasons for antibiotic self-medication, describe commonly used antibiotic classes and treated conditions, and evaluate patterns of antibiotic compliance and healthcare-provider coordination. The study also aimed to describe the knowledge-practice gap by comparing reported antibiotic awareness with self-medication and non-compliance behaviors among this student population.

MATERIAL AND METHODS

This institution-based descriptive cross-sectional study was conducted among allied health sciences students enrolled at Sarhad University of Science and Information Technology and Khyber Medical University, Peshawar, Pakistan. Data were collected from 15 May to 30 July 2023, while overall study-related activities were completed over six months. A cross-sectional design was selected because the study aimed to estimate the frequency of antibiotic self-medication, describe antibiotic-related knowledge, and assess compliance practices at a single point in time among students from health-related academic programs.

The study population consisted of allied health sciences students enrolled in relevant departments at the selected institutions, including Radiography Technology, Pharmacy, Dental Technology, and Medical Laboratory Technology. Students were eligible for inclusion if they were enrolled in a health sciences program at either institution during the data-collection period and provided consent to participate. Students from non-health departments and those who did not provide consent were excluded. Participants were recruited from faculty premises using purposive sampling, and students were approached in small groups of three to six to complete the survey.

The sample size was calculated as 450 using the RaoSoft sample-size calculator with a 95% confidence level, 5% margin of error, and allowance for non-response. Data were collected using a structured, self-administered questionnaire adapted from previously published questionnaire-based studies on antibiotic self-medication and antibiotic-use practices (12,13). The questionnaire contained four sections covering demographic characteristics, antibiotic-related knowledge, self-medication behavior, and compliance patterns. Demographic variables included age group, gender, level of education, academic year, academic program, and health insurance status. Knowledge-related items assessed awareness of antibiotics, understanding of bacterial versus viral indications, recognition that different infections require different antibiotics, awareness of antibiotic side effects, and awareness of antimicrobial resistance.

Self-medication with antibiotics was operationally defined as the use of any antibiotic without consultation with a qualified medical practitioner or without a current valid prescription. Practice-related variables included frequency of self-medication, reasons for self-medication, conditions for which antibiotics were used, sources of antibiotics, sources of advice or recommendation, and antibiotic classes used. Compliance-related variables included following doctors' instructions, skipping doses, stopping antibiotics before completing the course, reasons for discontinuation, response to side effects, whether healthcare providers asked about previous antibiotic use, and students' views regarding the role of healthcare-provider coordination in reducing antimicrobial resistance.

Ethical clearance was obtained before data collection, and institutional permission was granted by the relevant university authorities. Participants were informed about the purpose of the study, voluntary participation, and confidentiality of responses before completing the questionnaire. Verbal informed consent was obtained from all participants prior to data collection. The survey was self-administered to reduce interviewer influence and to encourage honest reporting of antibiotic-use behaviors.

Data were entered and analyzed using SPSS version 22. Descriptive statistics were used to summarize all study variables. Categorical variables were reported as frequencies and percentages. The primary outcome was the frequency of self-medication with antibiotics among allied health sciences students. Secondary outcomes included antibiotic-related knowledge, reasons and sources of self-medication, commonly used antibiotic classes, conditions treated with antibiotics, and compliance patterns. Percentages were calculated using clearly defined denominators according to the relevant variable, including the total sample or the subgroup reporting antibiotic self-medication where applicable.

RESULTS

A total of 450 allied health sciences students participated in the study. The demographic profile of participants is presented in Table 1. The study population was predominantly composed of young adult students aged 18–29 years, who accounted for 254 participants (56.4%). Male students represented 295 participants (65.6%), and most participants were enrolled in bachelor's degree programs, comprising 404 students (89.8%). Second-year students formed the largest academic-year group, with 194 participants (43.1%), while 235 students (52.2%) reported having health insurance.

Table 1. Demographic Characteristics of Study Participants

Variable	Category	n (%)
Age group	18–29 years	254 (56.4)
Gender	Male	295 (65.6)
Degree level	Bachelor's degree	404 (89.8)
Academic year	Second year	194 (43.1)
Health insurance status	Yes	235 (52.2)

Table 2. Knowledge Regarding Antibiotics and Antimicrobial Resistance

Knowledge Item	Response	n (%)
Awareness of antibiotics	Yes	429 (95.3)
Correctly identified bacterial indications for antibiotics	Yes	373 (82.9)
Knew that different infections require different antibiotics	Yes	410 (91.1)
Correctly identified cold/flu as viral illness	Yes	208 (46.2)
Awareness of antibiotic side effects	Yes	228 (50.7)
Sought prompt medical attention after side effects	Yes	113 (25.1)
Heard of antibiotic resistance	Yes	379 (84.2)

Antibiotic awareness was high, with 429 participants (95.3%) reporting awareness of antibiotics, and 410 participants (91.1%) recognizing that different infections require different antibiotics. However, only 208 participants (46.2%) correctly identified cold or flu as viral illness, and 228 participants (50.7%) reported awareness of antibiotic side effects. Although 379 participants (84.2%) had heard of antibiotic resistance, the findings indicate important gaps in applied knowledge, particularly regarding viral illness, side effects, and appropriate response to adverse effects.

Table 3. Self-Medication Practices and Antibiotic-Related Attitudes

Variable	Category	n (%)
Self-medication with antibiotics	Yes	365 (81.1)
Believed antibiotics speed up recovery	Yes	239 (53.1)
Recommended antibiotics to family/friends without prescription	Yes	245 (54.4)
Acknowledged importance of antibiotic compliance	Yes	362 (80.4)

Self-medication with antibiotics was reported by 365 students (81.1%), indicating a high burden of non-prescription antibiotic use in this student population. More than half of participants believed antibiotics speed up recovery, reported by 239 students (53.1%), and 245 students (54.4%) had recommended antibiotics to family or friends without prescription. Although 362 participants (80.4%) acknowledged the importance of compliance, this did not correspond with safe antibiotic-use behavior at the population level.

Table 4. Reported Reasons for Self-Medication with Antibiotics

Reason	Reported %
Time-saving	35.5
Previous experience	14.7
Cost-saving	14.7
Inconvenient healthcare access	11.5
Other reasons	23.6

The most commonly reported reason for antibiotic self-medication was time-saving, reported as 35.5%, followed by previous experience and cost-saving, each reported as 14.7%. Inconvenient healthcare access

accounted for 11.5%, while other reasons accounted for 23.6%. These findings suggest that self-medication was driven not only by knowledge gaps but also by convenience, prior personal experience, cost concerns, and access-related barriers. Reviewer-style note: The manuscript does not clearly state whether the percentages in Table 4 were calculated from the total sample or only from students who reported self-medication. The authors should verify and report the exact denominator in the final manuscript.

Table 5. Conditions for Which Antibiotics Were Used

Condition	Reported %
Cough/cold	19.6
Urinary tract infection	16.0
Acne	13.3
Sore throat/runny nose	11.3
Toothache	10.7
Ear infection	10.4
Diarrhea	8.2
Chest infection	7.8
Skin infection	2.7

Cough and cold were the most frequently reported conditions for which antibiotics were used, accounting for 19.6%, followed by urinary tract infection at 16.0% and acne at 13.3%. Use of antibiotics for cough/cold and sore throat/runny nose is clinically important because these symptoms are frequently viral or self-limiting, and antibiotic use in such situations may represent inappropriate use unless bacterial infection is clinically confirmed.

Reviewer-style note: The denominator for conditions treated with antibiotics is not explicitly stated. The authors should clarify whether these percentages are among all participants, among antibiotic users, or among self-medication episodes.

Table 6. Sources of Antibiotics and Sources of Recommendation

Domain	Category	Reported %
Antibiotic source	Community pharmacy	37.6
Antibiotic source	Hospital pharmacy	33.1
Antibiotic source	Relatives/friends	15.1
Antibiotic source	Leftover medicines at home	14.2
Recommendation source	Friends/relatives	36.9
Recommendation source	Community pharmacists	36.0
Recommendation source	Personal experience	13.1
Recommendation source	Other sources	14.0

Community pharmacies were the most common reported source of antibiotics at 37.6%, followed by hospital pharmacies at 33.1%. Relatives/friends and leftover medicines at home accounted for 15.1% and 14.2%, respectively. Recommendations most commonly came from friends or relatives at 36.9% and community pharmacists at 36.0%, indicating that antibiotic use was strongly influenced by informal advice networks and pharmacy-based access.

Table 7. Antibiotic Classes Reportedly Used

Antibiotic Class	Reported %
Penicillins	21.1
Fluoroquinolones	17.8
Tetracyclines	16.7
Macrolides	14.7
Aminoglycosides	9.1
Third-generation cephalosporins	5.3
Second-generation cephalosporins	4.8
First-generation cephalosporins	4.0
Sulfonamides	2.9
Fourth-generation cephalosporins	1.8

Penicillins were the most frequently reported antibiotic class at 21.1%, followed by fluoroquinolones at 17.8%, tetracyclines at 16.7%, and macrolides at 14.7%. The reported use of fluoroquinolones and macrolides is important from an antimicrobial stewardship perspective because these agents require cautious use and should generally be guided by appropriate clinical indication and prescription oversight. Reviewer-style note: Antibiotic-class percentages do not clearly specify the denominator and should be verified against the original dataset. The authors should also clarify whether students selected individual drugs, drug classes, or both.

Table 8. Understanding of the Effect of Self-Medication on Antibiotic Resistance

Response	n (%)
Increases resistance	180 (40.0)
Decreases resistance	176 (39.1)
No change	64 (14.2)
Do not know	30 (6.7)

Only 180 participants (40.0%) correctly reported that self-medication with antibiotics increases antibiotic resistance. A nearly equivalent proportion, 176 participants (39.1%), incorrectly believed that self-medication decreases resistance, while 64 participants (14.2%) believed it has no effect and 30 participants (6.7%) did not know. This pattern shows a major conceptual gap in understanding antimicrobial resistance despite high general awareness of antibiotics.

Table 9. Antibiotic Compliance Patterns

Variable	Category	n (%)
Followed doctor instructions	Always	197 (43.8)
Followed doctor instructions	Sometimes	58 (12.9)
Followed doctor instructions	Never	195 (43.3)
Skipped antibiotic doses	Often	186 (41.3)
Skipped antibiotic doses	Sometimes	82 (18.2)
Skipped antibiotic doses	Never	182 (40.4)

Doctor-instruction adherence showed a concerning pattern, with 197 participants (43.8%) reporting that they always followed doctors' instructions and 195 participants (43.3%) reporting that they never followed them. Dose skipping was also common, with 186 participants (41.3%) reporting that they often skipped antibiotic doses and 82 participants (18.2%) reporting that they sometimes skipped doses. These findings indicate substantial non-compliance despite the high proportion of participants who acknowledged the importance of completing antibiotic therapy.

Reviewer-style note: The "never followed doctor instructions" value is unusually high and should be checked against the questionnaire coding before final submission. If the item was reverse-coded or mislabelled, the response categories must be corrected.

Table 10. Reported Antibiotic Discontinuation Patterns

Discontinuation-Related Response	Reported %
Completed course	31.8
Stopped after doctor consultation	29.3
Thought antibiotic was ineffective	16.2
Supply ran out	11.1
Side effects	6.0
Thought recovered	5.6

The most frequently reported discontinuation-related response was completion of the antibiotic course at 31.8%, followed by stopping after doctor consultation at 29.3%. Other responses included stopping because the antibiotic was thought to be ineffective, supply ran out, side effects occurred, or the participant thought they had recovered. These results suggest that antibiotic stopping behavior was heterogeneous and included both appropriate and potentially inappropriate reasons.

Reviewer-style note: The manuscript elsewhere states that 31.8% discontinued antibiotics upon symptom improvement, but Table 10 indicates 31.8% completed the course and only 5.6% stopped because they

thought they had recovered. This inconsistency must be corrected after checking the original dataset and questionnaire labels.

A total of 215 participants (47.8%) reported that doctors always asked about previous antibiotic history, while 179 participants (39.8%) reported that doctors never asked. Most participants, 390 (86.7%), believed that strong antibiotic knowledge is important for patient care. However, only 185 participants (41.1%) believed that coordination among healthcare providers reduces antimicrobial resistance, indicating uncertainty about the practical role of coordinated antimicrobial stewardship.

Table 11. Healthcare-Provider Coordination and Perceived Role in Reducing Antimicrobial Resistance

Variable	Category	n (%)
Doctor asked about previous antibiotic history	Always	215 (47.8)
Doctor asked about previous antibiotic history	Sometimes	56 (12.4)
Doctor asked about previous antibiotic history	Never	179 (39.8)
Strong antibiotic knowledge important for patient care	Yes	390 (86.7)
Strong antibiotic knowledge important for patient care	Maybe	26 (5.7)
Strong antibiotic knowledge important for patient care	No	34 (7.6)
Healthcare-provider coordination reduces AMR	Yes	185 (41.1)
Healthcare-provider coordination reduces AMR	Maybe	126 (28.0)
Healthcare-provider coordination reduces AMR	No	139 (30.8)

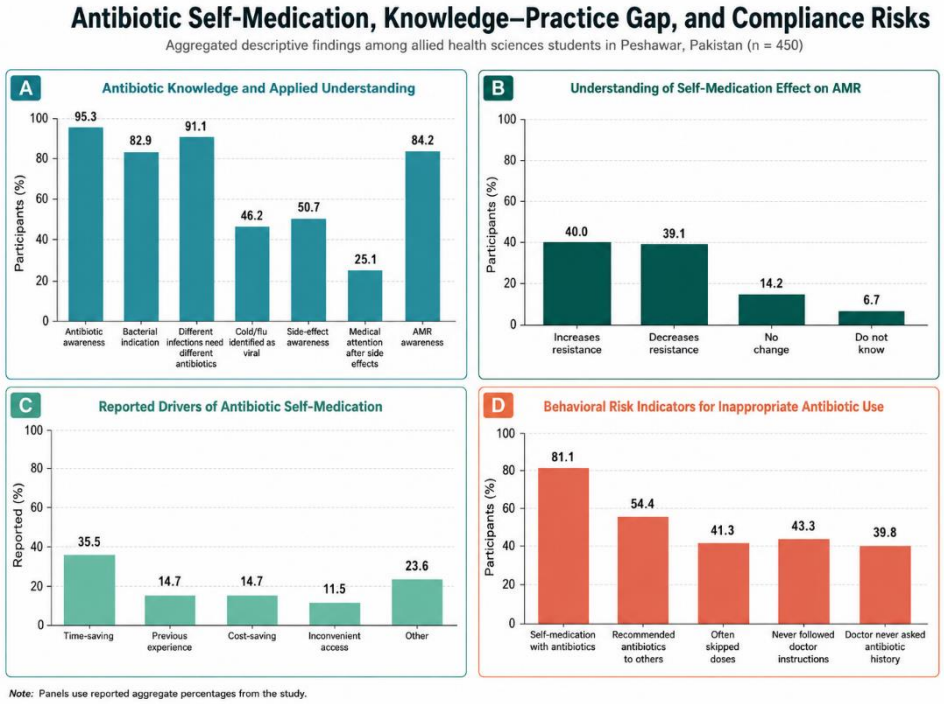

Figure 1 The panelled figure summarizes key descriptive findings from 450 allied health sciences students. Panel A shows high general antibiotic awareness, including antibiotic awareness among 95.3% of participants and recognition that different infections require different antibiotics among 91.1%, but applied knowledge was weaker, with only 46.2% correctly identifying cold/flu as viral illness and 25.1% seeking prompt medical attention after side effects. Panel B demonstrates a major antimicrobial-resistance misconception, as only 40.0% correctly reported that antibiotic self-medication increases resistance, while 39.1% incorrectly believed it decreases resistance. Panel C shows that time-saving was the leading reported driver of self-medication at 35.5%, followed by previous experience and cost-saving at 14.7% each. Panel D highlights behavioral risk indicators, including antibiotic self-medication among 81.1%, recommending antibiotics to others among 54.4%, often skipping doses among 41.3%, and never following doctors' instructions among 43.3%.

Overall, the results show a high frequency of self-medication with antibiotics among allied health sciences students, alongside substantial non-compliance and important misconceptions about antimicrobial resistance. Although general awareness of antibiotics was high, applied knowledge regarding viral illness, side effects, resistance mechanisms, and safe antibiotic-use behavior remained limited. The findings support the presence of a knowledge-practice gap and indicate the need for

targeted antimicrobial stewardship education, clearer student guidance on antibiotic use, and stronger institutional attention to rational antibiotic practices.

DISCUSSION

This institution-based cross-sectional study found a high frequency of self-medication with antibiotics among allied health sciences students in Peshawar, with 81.1% of participants reporting antibiotic use without appropriate prescription or medical consultation. This finding is concerning because the study population consisted of health sciences students who are expected to develop rational medicine-use behavior and, in future professional roles, contribute to antimicrobial stewardship. The high level of general antibiotic awareness observed in this study did not translate into safer antibiotic-related practices, indicating a clear knowledge-practice gap. Although 95.3% of participants were aware of antibiotics, 91.1% recognized that different infections require different antibiotics, and 84.2% had heard of antibiotic resistance, only 40.0% correctly understood that self-medication with antibiotics increases resistance. This discrepancy suggests that awareness alone is insufficient unless students also understand the mechanisms, clinical consequences, and ethical implications of inappropriate antibiotic use.

The observed self-medication frequency is consistent with the broader pattern reported in Pakistan and other low- and middle-income settings, where antibiotics remain accessible through informal or semi-formal channels and prescription-only regulations are inconsistently enforced. Previous regional and national studies have reported substantial antibiotic self-medication among health-related students and the general public, supporting the view that non-prescription antibiotic use is not merely an individual behavior but a system-level public health problem shaped by availability, cost, convenience, and social norms (18–24). In the present study, community pharmacies were the most common reported source of antibiotics, followed by hospital pharmacies, relatives or friends, and leftover medicines at home. This pattern reflects a mixed access pathway in which students may obtain antibiotics both through pharmacy-based dispensing and through informal household or peer networks. Such access pathways are particularly important because they bypass clinical assessment, diagnostic confirmation, dose optimization, and follow-up.

Time-saving was the leading reported reason for antibiotic self-medication, followed by previous experience, cost-saving, and inconvenient healthcare access. These findings indicate that self-medication was not driven only by lack of awareness; rather, it was also influenced by structural and behavioral factors that make formal healthcare consultation less attractive or less accessible. Students may perceive antibiotics as a quick solution for common symptoms, especially when previous use has been associated with perceived recovery. However, this perception can reinforce inappropriate treatment habits, particularly for symptoms such as cough, cold, sore throat, and runny nose, which are frequently viral or self-limiting and may not require antibiotic therapy. The reported use of antibiotics for cough/cold and upper respiratory symptoms therefore raises important stewardship concerns.

The findings also highlight the role of social influence in antibiotic misuse. More than half of the participants reported recommending antibiotics to family or friends without prescription, while friends/relatives and community pharmacists were the leading sources of antibiotic recommendations. This is particularly important in a student population because health sciences students may be perceived by their families and communities as credible sources of health advice, even before they are clinically qualified to prescribe or recommend antimicrobial therapy. Inappropriate advice from students can therefore extend antibiotic misuse beyond personal behavior and contribute to wider community-level misuse. This pattern supports the need for stewardship education that goes beyond factual knowledge and includes communication skills, professional boundaries, ethical decision-making, and practical counseling strategies to discourage non-prescription antibiotic use.

The study also identified substantial antibiotic non-compliance. A large proportion of participants reported often skipping doses, and a similarly concerning proportion reported never following doctors'

instructions. Although these values should be verified against the original questionnaire coding before final publication, the overall pattern suggests that non-adherence is an important issue in this population. Poor adherence to antibiotic regimens can result in subtherapeutic exposure, treatment failure, recurrence of infection, and selection of resistant organisms, especially when antibiotics are stopped prematurely, taken irregularly, or used for inappropriate indications (31–36). In addition, only one-quarter of participants reported seeking prompt medical attention after experiencing antibiotic side effects, indicating gaps in safety behavior and post-use response. These findings emphasize that antimicrobial stewardship education should address not only when antibiotics are needed but also how they should be taken, when they should be stopped, and when medical reassessment is required.

A particularly important finding was the misconception regarding the effect of self-medication on antimicrobial resistance. While most participants had heard of antibiotic resistance, only 40.0% correctly identified that self-medication increases resistance, and 39.1% incorrectly believed that self-medication decreases resistance. This conceptual misunderstanding is serious because it may lead students to underestimate the population-level consequences of their own antibiotic practices. Antimicrobial resistance is often difficult for individuals to perceive directly because its consequences may occur later, in other patients, or at the community level. Therefore, educational interventions should explain resistance using clinically relatable examples, including recurrent infections, treatment failure, resistant urinary tract infections, and the need for broader-spectrum or more toxic antibiotics. International evidence also suggests that factual awareness of antimicrobial resistance does not reliably produce responsible antibiotic behavior unless it is paired with practical decision-making training and behavioral reinforcement (37–40).

The use of antibiotic classes such as fluoroquinolones, macrolides, tetracyclines, and cephalosporins is also relevant from a stewardship perspective. These agents should be used according to clinical indication, local resistance patterns, and prescription guidance, particularly because inappropriate use of broad-spectrum or Watch-category antibiotics may accelerate resistance pressure at the community level (41–43). Although the present study did not assess dose, duration, brand, prescription status for each antibiotic class, or culture-guided use, the reported pattern suggests that future research should examine not only whether students self-medicate but also whether the selected antibiotic, dose, frequency, and duration are clinically appropriate.

The findings have direct implications for health sciences curricula and institutional policy. Antimicrobial stewardship should be integrated across allied health and pharmacy-related programs as a competency-based topic rather than as isolated theoretical content. Teaching should include case-based learning, prescription interpretation, recognition of viral versus bacterial syndromes, adverse-effect counseling, antimicrobial resistance mechanisms, and communication strategies for refusing inappropriate antibiotic requests from family, friends, or patients. In addition, universities can implement student-level awareness campaigns, pharmacy collaboration, and referral pathways that encourage students to seek professional medical advice rather than self-medicate. At the regulatory level, stronger enforcement of prescription-only antibiotic dispensing, training of pharmacy staff, and public education campaigns remain essential for reducing antibiotic misuse in the community (39–44).

This study has several limitations. The use of purposive sampling limits generalizability beyond the selected institutions and programs. The single-city design also restricts extrapolation to all health sciences students in Pakistan. Self-reported responses may be affected by recall bias and social desirability bias, particularly for sensitive behaviors such as antibiotic self-medication and non-compliance. The cross-sectional design prevents assessment of causality or temporal relationships between knowledge and practice. In addition, the analysis was primarily descriptive, and the available results do not include adjusted associations or predictors of self-medication. Some response categories, especially those related to compliance and discontinuation, require verification against the original questionnaire coding to ensure that labels and denominators are accurate before final submission.

Despite these limitations, the study provides useful evidence on antibiotic self-medication, non-compliance, and antimicrobial-resistance misconceptions among allied health sciences students in Peshawar, and it identifies specific areas for educational and regulatory intervention.

CONCLUSION

This study found a high frequency of antibiotic self-medication among allied health sciences students in Peshawar, despite high general awareness of antibiotics and antimicrobial resistance. The findings demonstrate a substantial knowledge-practice gap, with frequent non-prescription antibiotic use, recommendations of antibiotics to others, dose skipping, uncertain compliance with doctors' instructions, and major misconceptions regarding the relationship between self-medication and antimicrobial resistance. Time-saving, previous experience, cost-saving, inconvenient healthcare access, community pharmacy availability, and peer or family recommendations were important contributors to inappropriate antibiotic use. These findings support the need for competency-based antimicrobial stewardship education in allied health curricula, stronger student counseling on responsible antibiotic behavior, improved access to professional healthcare advice, and stricter enforcement of prescription-only antibiotic dispensing policies.

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