

Antibiotic Use Practices and Awareness of Antimicrobial Resistance Among Adult Patients Visiting Outpatient Departments in Pakistan

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ABSTRACT

Background: Antibiotic misuse contributes substantially to antimicrobial resistance, particularly in settings where antibiotics may be used without adequate medical supervision, discontinued prematurely, or taken for viral illnesses. Adult outpatients represent an important population for assessing antibiotic-related awareness and practices because outpatient encounters are common points of antibiotic prescribing, patient demand, and self-medication. **Objective:** This study aimed to assess antibiotic-use practices and awareness of antimicrobial resistance among adult patients attending general medicine and family medicine outpatient departments at Ittefaq Hospital, Lahore, Pakistan. **Methods:** A hospital-based cross-sectional study was conducted over six months among 322 adult outpatient patients selected through non-probability consecutive sampling. Data were collected using a structured questionnaire assessing antibiotic awareness, correct antibiotic knowledge, antimicrobial-resistance awareness, correct understanding of antimicrobial resistance, self-medication, and completion of prescribed antibiotic courses. Data were analyzed using IBM SPSS Statistics version 27, and categorical variables were summarized as frequencies, percentages, and 95% confidence intervals. **Results:** Antibiotic awareness was reported by 300 participants (93.1%), while correct antibiotic knowledge was present in 116 participants (35.9%). Awareness of antimicrobial resistance was reported by 188 participants (58.3%), and correct understanding of antimicrobial resistance was present in 158 participants (49.0%). Self-medication with antibiotics was reported by 61 participants (18.9%), and incomplete completion of prescribed antibiotic courses was reported by 97 participants (30.1%). **Conclusion:** Although general antibiotic awareness was high, correct knowledge of antibiotic use and antimicrobial resistance remained limited, and inappropriate antibiotic-use practices were reported by a meaningful proportion of adult OPD patients. Targeted outpatient counselling, patient education, pharmacist involvement, and antimicrobial-stewardship interventions are needed to improve rational antibiotic use. **Keywords:** Antibiotics; Antimicrobial Resistance; Awareness; Self-Medication; Adherence; Outpatients; Pakistan.

INTRODUCTION

Antibiotics remain essential therapeutic agents for the management of bacterial infections and continue to play a central role in reducing infection-related morbidity and mortality. Their clinical effectiveness, however, is increasingly threatened by inappropriate use, including self-medication, unnecessary use for viral illnesses, premature discontinuation of prescribed courses, reuse of leftover antibiotics, and access to antibiotics without adequate medical supervision. These practices contribute to antimicrobial resistance, a process in which microorganisms become less responsive to medicines that were previously effective, resulting in treatment failure, prolonged illness, complications, increased healthcare costs, and avoidable mortality. The problem is particularly relevant in low- and middle-income countries, where

infectious diseases remain common, regulatory control over antibiotic access may be inconsistent, and antimicrobials are frequently used across both formal and informal healthcare settings (1).

Pakistan faces a substantial antimicrobial-resistance challenge shaped by patient-level behaviors, prescribing practices, pharmacy access, and health-system constraints. Previous studies from Pakistan have reported gaps in public knowledge of antibiotic indications, variable understanding of antimicrobial resistance, self-medication with antibiotics, and inconsistent adherence to prescribed antibiotic regimens (2,3). Antibiotic misuse is further reinforced by limited differentiation between bacterial and viral infections, previous positive experiences with antibiotics, retention of leftover medicines, informal advice from family members or peers, and the ability to obtain antibiotics from community pharmacies without a valid prescription (4,5). These factors are especially concerning because antibiotics are often used for symptoms such as cold, influenza, cough, sore throat, fever, and other respiratory complaints that are commonly viral and do not routinely require antibacterial therapy (6).

Adult patients attending outpatient departments represent an important population for evaluating antibiotic-related awareness and practices because outpatient encounters are often the first point of contact for common medical complaints. In general medicine and family medicine clinics, patients may present with fever, respiratory symptoms, gastrointestinal complaints, urinary symptoms, and nonspecific illnesses for which antibiotics may be prescribed, requested, purchased independently, or reused from previous prescriptions. This outpatient context creates a critical interface between patient expectations, physician counselling, pharmacy access, and antimicrobial stewardship. Although awareness of antibiotics as medicines may be high, awareness alone does not necessarily indicate correct understanding of their appropriate indications, duration of use, or consequences of misuse. Therefore, assessing both awareness and actual self-reported practices is necessary to identify clinically relevant gaps between knowledge and behavior.

Existing Pakistani literature has examined antibiotic use, antimicrobial-resistance knowledge, stewardship perceptions, and self-medication among the general population, healthcare professionals, pharmacy students, pharmacy technicians, and community pharmacists (7–12). However, fewer setting-specific data are available from adult patients attending general medicine and family medicine outpatient departments, despite the fact that this group is highly relevant to antibiotic decision-making at the point of care. Evidence from tertiary-care outpatient settings can help clarify whether patients understand the difference between appropriate and inappropriate antibiotic use, whether they recognize antimicrobial resistance as reduced antibiotic effectiveness against bacteria, and how commonly they report behaviors such as self-medication or incomplete treatment courses. Such information is essential for designing practical interventions that target patients during routine clinical encounters, including structured counselling by physicians, pharmacist-supported education, improved prescription regulation, and outpatient antimicrobial-stewardship strategies.

Using a PICO framework, the population of interest in the present study was adult patients attending general medicine and family medicine outpatient departments; the exposure or focus of assessment was patients' awareness and understanding of antibiotics and antimicrobial resistance; the comparison was between correct and incorrect knowledge as well as appropriate and inappropriate antibiotic-use practices; and the outcomes were antibiotic awareness, correct antibiotic knowledge, antimicrobial-resistance awareness, correct understanding of antimicrobial resistance, self-medication with antibiotics, and completion of prescribed antibiotic courses. Therefore, this study aimed to assess antibiotic-use practices and awareness of antimicrobial resistance among adult patients visiting the general medicine and family medicine outpatient departments of Ittefaq Hospital, Lahore, Pakistan.

MATERIAL AND METHODS

This hospital-based cross-sectional observational study was conducted among adult patients attending the general medicine and family medicine outpatient departments of Ittefaq Hospital, Lahore, Pakistan. The cross-sectional design was selected because it was appropriate for estimating the frequency of antibiotic-related awareness, antimicrobial-resistance awareness, and self-reported antibiotic-use practices at a defined point of outpatient care. The study was carried out over a six-month period during routine outpatient services. The general medicine and family medicine departments were selected because they receive a broad range of adult patients presenting with common clinical complaints, including fever, cough, sore throat, respiratory symptoms, gastrointestinal complaints, urinary symptoms, and nonspecific illnesses for which antibiotics may be prescribed, requested, previously used, or obtained without medical consultation.

The study population consisted of adult patients aged 18 years or older who attended the general medicine or family medicine outpatient departments during the study period. Patients were eligible for inclusion if they were aged 18 years or above, were attending either of the selected outpatient departments, were willing to participate, and were able to provide informed consent. Both male and female patients were eligible. Patients were excluded if they were younger than 18 years, critically ill, unable to respond to the questionnaire, had cognitive impairment or communication difficulty preventing reliable participation, refused informed consent, or submitted incomplete responses that could not be used for analysis. A non-probability consecutive sampling technique was used, whereby eligible patients presenting to the selected outpatient departments during routine clinical hours were approached consecutively until the required sample size was achieved. This sampling strategy was considered practical for a hospital-based outpatient setting and allowed recruitment of patients who were active users of outpatient healthcare services.

The required sample size was calculated using the single population proportion formula, $n = Z^2p(1 - p)/d^2$, where n represented the required sample size, Z represented the standard normal value at a 95% confidence level, p represented the expected proportion of the key outcome, and d represented the desired margin of error. A 95% confidence level was used, corresponding to a Z value of 1.96. The expected proportion was taken as 30%, based on previously reported inappropriate antibiotic-use practices, including self-medication and non-adherence, among adult patients and the general population in Pakistan. The margin of error was set at 5%. Using these assumptions, the calculated sample size was $n = (1.96)^2 \times 0.30 \times 0.70 / (0.05)^2 = 322.68$. Therefore, a final sample size of 322 adult outpatient patients was included in the analysis.

Data were collected using a structured standardized questionnaire developed after reviewing relevant literature on antibiotic use, self-medication, adherence to prescribed antibiotic regimens, and awareness of antimicrobial resistance. The questionnaire included sections on sociodemographic characteristics, awareness and knowledge of antibiotics, awareness and understanding of antimicrobial resistance, and antibiotic-use practices. Sociodemographic variables included age, gender, education level, occupation, and other relevant background characteristics. The antibiotic-awareness section assessed whether participants had heard of antibiotics, whether they knew that antibiotics are used for bacterial infections, and whether they believed antibiotics are useful for viral illnesses such as cold and influenza. The antimicrobial-resistance section assessed whether participants had heard of antimicrobial resistance or antibiotic resistance and whether they correctly understood resistance as reduced responsiveness of bacteria to antibiotic treatment. The practice section assessed self-medication with antibiotics, use of antibiotics without prescription, completion of prescribed antibiotic courses, use of leftover antibiotics, and other antibiotic-related behaviors.

Eligible patients were identified in the outpatient departments during routine clinical hours. After the purpose of the study had been explained, informed consent was obtained before questionnaire

administration. Participants who were able to read and complete the questionnaire did so themselves. For participants who had difficulty reading or writing, the questionnaire was administered by the data collector in the local language while maintaining neutrality and avoiding leading responses. Completed questionnaires were checked for completeness before data entry, and incomplete responses that could not be used for analysis were excluded according to the predefined eligibility criteria. These procedures were used to reduce information bias, improve completeness of responses, and maintain consistency in data collection.

Antibiotic awareness was operationally defined as having heard of antibiotics or being able to recognize antibiotics as medicines used for infections. Correct antibiotic knowledge was defined as correctly identifying antibiotics as medicines used for bacterial infections and not for viral illnesses such as cold or influenza. Awareness of antimicrobial resistance was defined as having heard of antibiotic resistance or antimicrobial resistance. Correct understanding of antimicrobial resistance was defined as recognizing that antibiotic resistance occurs when bacteria become less responsive to antibiotic treatment. Self-medication with antibiotics was defined as the use of antibiotics without consultation with a qualified medical practitioner or without a current valid prescription. Non-adherence was defined as failure to complete a prescribed antibiotic course according to the physician's instructions.

The main outcome variables were awareness of antibiotics, correct antibiotic knowledge, awareness of antimicrobial resistance, correct understanding of antimicrobial resistance, self-medication with antibiotics, and completion of prescribed antibiotic courses. Independent variables included age, gender, education level, occupation, outpatient department, prior antibiotic use, source of antibiotic information, and previous experience with antibiotic treatment. Potential confounding by sociodemographic characteristics and prior antibiotic-related experience was addressed analytically by identifying these variables as independent variables for association testing and, where applicable, multivariable analysis.

Data were entered, cleaned, and analyzed using IBM SPSS Statistics version 26. Categorical variables were summarized as frequencies and percentages. The final sample size for analysis was 322, and percentages were calculated using 322 as the denominator unless otherwise specified. For key outcome variables, 95% confidence intervals were calculated to assess the precision of estimated proportions. Associations between categorical variables were assessed using the chi-square test, while Fisher's exact test was used when expected cell counts were less than five. Variables assessed for possible associations included gender, age group, education level, occupation, antibiotic knowledge, antimicrobial-resistance awareness, self-medication, and adherence to prescribed antibiotic courses. Binary logistic regression was planned for dichotomous outcomes, including self-medication with antibiotics, incomplete antibiotic-course use, correct antibiotic knowledge, and correct understanding of antimicrobial resistance. Crude odds ratios and adjusted odds ratios with 95% confidence intervals were to be reported where applicable. A p-value of less than 0.05 was considered statistically significant.

Ethical approval was obtained from the Institutional Ethical Review Committee of Ittefaq Hospital, Lahore, Pakistan, before data collection. Participation was voluntary, and informed consent was obtained from all participants before inclusion in the study. Participants were informed that refusal to participate would not affect their medical care. Confidentiality and anonymity were maintained throughout the study, and collected data were used only for research purposes. Data integrity was supported by checking completed questionnaires for completeness before entry, applying predefined operational definitions, using a consistent denominator for percentage calculations, and restricting analysis to responses suitable for inclusion in the final dataset.

RESULTS

A total of 322 adult patients attending the general medicine and family medicine outpatient departments were included in the final analysis. Percentages were calculated using the total sample size of 322 as the denominator. The main outcomes assessed were awareness of antibiotics, correct antibiotic knowledge,

awareness and understanding of antimicrobial resistance, self-medication with antibiotics, and completion of prescribed antibiotic courses.

Table 1. Awareness of Antibiotics and Antimicrobial Resistance Among Adult OPD Patients, N = 322

Variable	Response	n	%	95% CI
Aware of antibiotics	Yes	300	93.1	89.9–95.4
Aware of antibiotics	No	22	6.9	4.6–10.1
Correct antibiotic knowledge	Yes	116	35.9	31.0–41.4
Correct antibiotic knowledge	No	206	64.1	58.6–69.0
Aware of antimicrobial resistance	Yes	188	58.3	52.9–63.6
Aware of antimicrobial resistance	No	134	41.7	36.4–47.1
Correct understanding of antimicrobial resistance	Yes	158	49.0	43.7–54.5
Correct understanding of antimicrobial resistance	No	164	51.0	45.5–56.3

Among 322 adult OPD patients, general awareness of antibiotics was high, with 300 participants reporting that they were aware of antibiotics, corresponding to 93.1% of the sample. However, correct antibiotic knowledge was substantially lower, as only 116 participants, representing 35.9%, correctly identified appropriate antibiotic use. Awareness of antimicrobial resistance was reported by 188 participants, corresponding to 58.3%, while correct understanding of antimicrobial resistance was present in 158 participants, representing 49.0% of the study population. These findings indicate a clear gap between general awareness of antibiotics and accurate understanding of their appropriate use and resistance-related consequences.

Table 2. Antibiotic-Use Practices Among Adult OPD Patients, N = 322

Variable	Response	n	%	95% CI
Self-medication with antibiotics	Yes	61	18.9	15.0–23.6
Self-medication with antibiotics	No	261	81.1	76.4–85.0
Did not complete prescribed antibiotic course	Yes	97	30.1	25.4–35.3
Did not complete prescribed antibiotic course	No	225	69.9	64.7–74.6

Self-medication with antibiotics was reported by 61 participants, corresponding to 18.9% of the total sample, while 261 participants, representing 81.1%, did not report self-medication. Incomplete adherence to prescribed antibiotic courses was more frequent than self-medication, with 97 participants, or 30.1%, reporting that they did not complete a prescribed antibiotic course. Conversely, 225 participants, representing 69.9%, reported completing their prescribed antibiotic course. These findings suggest that although most participants did not report self-medication, incomplete antibiotic-course completion remained a common inappropriate antibiotic-use practice.

Table 3. Summary of Key Awareness and Practice Indicators Among Adult OPD Patients, N = 322

Outcome	n	%	95% CI
Aware of antibiotics	300	93.1	89.9–95.4
Correct antibiotic knowledge	116	35.9	31.0–41.4
Aware of antimicrobial resistance	188	58.3	52.9–63.6
Correct understanding of antimicrobial resistance	158	49.0	43.7–54.5
Self-medication with antibiotics	61	18.9	15.0–23.6
Incomplete antibiotic-course use	97	30.1	25.4–35.3

The summary of key indicators shows that antibiotic awareness was the most frequently reported positive indicator, present in 300 participants, or 93.1% of the sample. In contrast, correct antibiotic knowledge was observed in only 116 participants, corresponding to 35.9%. Awareness of antimicrobial resistance was reported by 188 participants, or 58.3%, while correct understanding of antimicrobial resistance was reported by 158 participants, or 49.0%. Regarding practices, 61 participants, representing 18.9%, reported self-medication with antibiotics, and 97 participants, representing 30.1%, reported incomplete antibiotic-course use. These findings demonstrate that knowledge-related gaps were more prominent than general awareness gaps, while incomplete treatment adherence was more common than self-medication.

Table 4. Positive and Negative Indicator Classification Among Adult OPD Patients, N = 322

Indicator	Positive n	Positive %	Negative n	Negative %
General antibiotic awareness	300	93.1	22	6.9
Correct antibiotic knowledge	116	35.9	206	64.1
Antimicrobial-resistance awareness	188	58.3	134	41.7
Correct antimicrobial-resistance understanding	158	49.0	164	51.0
No self-medication with antibiotics	261	81.1	61	18.9
Completed prescribed antibiotic course	225	69.9	97	30.1

When indicators were classified into positive and negative categories, general antibiotic awareness showed the highest positive response, with 300 participants, or 93.1%, reporting awareness. However, correct antibiotic knowledge showed a substantially lower positive response, with only 116 participants, or 35.9%, meeting the definition of correct knowledge, while 206 participants, or 64.1%, did not. For antimicrobial resistance, 188 participants, or 58.3%, were aware of the concept, but only 158 participants, or 49.0%, correctly understood it. Favorable practice indicators were more frequent than knowledge indicators, with 261 participants, or 81.1%, reporting no self-medication and 225 participants, or 69.9%, reporting completion of prescribed antibiotic courses.

Table 5. Gap Analysis of Awareness, Knowledge, and Practice Indicators Among Adult OPD Patients, N = 322

Comparison	Difference in n	Difference in %
Antibiotic awareness minus correct antibiotic knowledge	184	57.2
Antibiotic awareness minus antimicrobial-resistance awareness	112	34.8
Antibiotic awareness minus correct antimicrobial-resistance understanding	142	44.1
Antimicrobial-resistance awareness minus correct antimicrobial-resistance understanding	30	9.3
Incomplete antibiotic-course use minus self-medication with antibiotics	36	11.2

The largest observed gap was between general antibiotic awareness and correct antibiotic knowledge, with a difference of 184 participants, corresponding to 57.2 percentage points. The difference between antibiotic awareness and antimicrobial-resistance awareness was 112 participants, or 34.8 percentage points, while the difference between antibiotic awareness and correct antimicrobial-resistance understanding was 142 participants, or 44.1 percentage points. Among participants aware of antimicrobial resistance, the gap between awareness and correct understanding was smaller, with a difference of 30 participants, or 9.3 percentage points. Inappropriate practice patterns also differed, with incomplete antibiotic-course use exceeding self-medication by 36 participants, or 11.2 percentage points. These results indicate that the principal deficit was not simple recognition of antibiotics but accurate knowledge of appropriate use and resistance-related implications.

Reviewer-style note: Sociodemographic characteristics, group-wise comparisons, chi-square statistics, p-values, crude odds ratios, adjusted odds ratios, and regression model outputs were not included in the supplied manuscript data. Therefore, these statistics have not been added to the tables. If participant-level data are available, additional analyses should be performed to assess factors associated with correct antibiotic knowledge, antimicrobial-resistance awareness, self-medication, and incomplete antibiotic-course use.

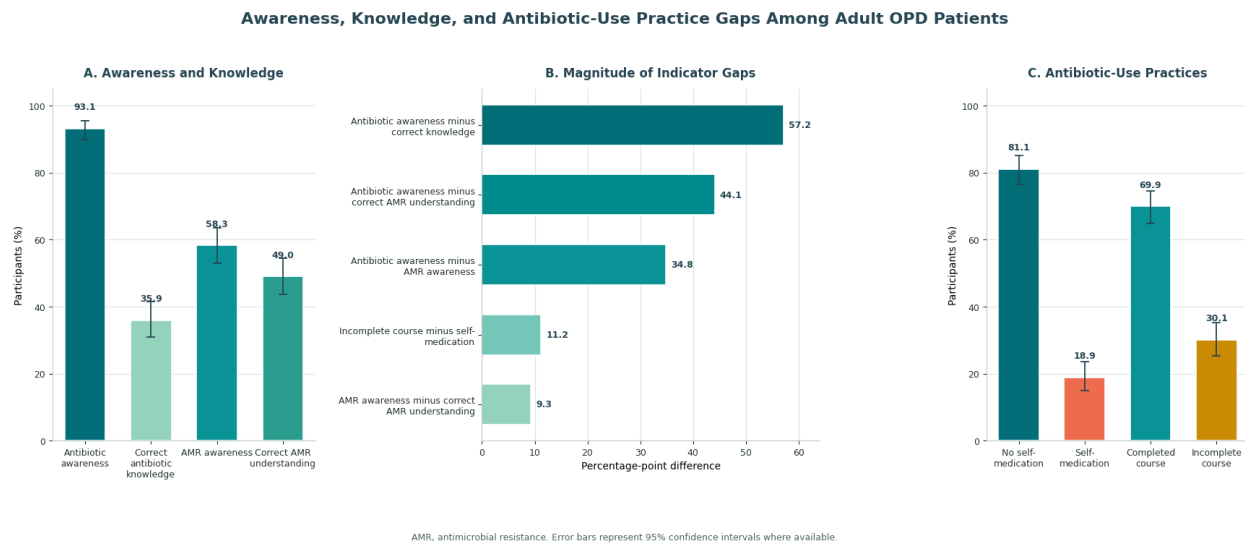


Figure 1. Awareness, Knowledge, and Antibiotic-Use Practice Gaps Among Adult OPD Patients

The panelled figure demonstrates a marked discrepancy between general awareness and accurate knowledge among adult OPD patients. In Panel A, antibiotic awareness was high at 93.1%, whereas correct antibiotic knowledge was substantially lower at 35.9%; antimicrobial-resistance awareness was reported by 58.3%, while correct antimicrobial-resistance understanding was present in 49.0%. Panel B shows that the largest gap was between antibiotic awareness and correct antibiotic knowledge, with a 57.2 percentage-point difference, followed by the gap between antibiotic awareness and correct antimicrobial-resistance understanding at 44.1 percentage points. Panel C shows that favorable practice indicators were more common than unfavorable practices, with 81.1% reporting no self-medication and 69.9% reporting completion of prescribed antibiotic courses; however, 18.9% reported self-medication and 30.1% reported incomplete antibiotic-course use, indicating persistent behavioral targets for outpatient antimicrobial-stewardship interventions.

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DISCUSSION

The present study evaluated antibiotic-use practices and awareness of antimicrobial resistance among adult patients attending general medicine and family medicine outpatient departments at a tertiary-care hospital in Lahore, Pakistan. The findings demonstrate that general awareness of antibiotics was high, with 93.1% of participants reporting awareness of antibiotics, but this awareness did not translate into accurate knowledge of appropriate antibiotic use. Only 35.9% of participants had correct antibiotic knowledge, indicating a 57.2 percentage-point gap between recognition of antibiotics and correct understanding of their appropriate indications. This distinction is clinically important because superficial familiarity with antibiotics may reinforce inappropriate expectations, particularly when patients associate antibiotics with rapid symptom relief for common illnesses without understanding that most colds, influenza-like illnesses, and many upper respiratory symptoms are viral and do not routinely require antibacterial therapy.

The observed gap between antibiotic awareness and correct antibiotic knowledge is consistent with the broader antimicrobial-resistance challenge in Pakistan, where inappropriate antibiotic use is influenced by patient expectations, variable prescribing practices, incomplete counselling, and community-level access to antibiotics. Previous work from Pakistan has shown that knowledge deficits, informal antibiotic use, and inconsistent adherence remain important contributors to irrational antibiotic consumption, even among populations that may have heard of antibiotics or previously used them (13). In the present study, the high level of general awareness may reflect the widespread availability and frequent use of antibiotics in outpatient and community settings, whereas the much lower level of correct knowledge suggests that awareness alone is insufficient as a public-health indicator. For antimicrobial-stewardship

interventions, this finding emphasizes the need to move beyond simple awareness campaigns and toward targeted education that explains when antibiotics are indicated, when they are ineffective, why courses should be completed as prescribed, and how misuse contributes to resistance.

Awareness of antimicrobial resistance was reported by 58.3% of participants, while correct understanding of antimicrobial resistance was present in 49.0%. The smaller gap between antimicrobial-resistance awareness and correct understanding, compared with the much larger gap between antibiotic awareness and correct antibiotic knowledge, suggests that participants who had heard of antimicrobial resistance were somewhat more likely to understand its meaning. However, approximately half of the study population still lacked correct understanding of antimicrobial resistance. This is concerning because patients who do not understand resistance as reduced bacterial responsiveness to antibiotics may not recognize the long-term consequences of self-medication, premature discontinuation, or unnecessary antibiotic use. Similar concerns have been reported in regional and international literature, where antimicrobial resistance is often recognized as a term but misunderstood in relation to individual behavior, community transmission, treatment failure, and future antibiotic effectiveness (14,15).

Self-medication with antibiotics was reported by 18.9% of participants. Although this proportion was lower than the proportion reporting incomplete antibiotic-course use, it remains clinically meaningful because nearly one in five participants reported antibiotic use without consultation with a qualified medical practitioner or without a current valid prescription. In Pakistan, access to antibiotics without prescription has been documented as a persistent problem, particularly through community pharmacies and informal medicine sources (16). Such access may encourage patients to repeat previous prescriptions, use antibiotics for viral or self-limiting conditions, share medicines with family members, or stop treatment once symptoms improve. Even when the proportion of self-medication appears moderate, its public-health impact may be substantial because inappropriate antibiotic exposure contributes to selection pressure for resistant organisms and may delay proper diagnosis and treatment.

Incomplete antibiotic-course use was reported by 30.1% of participants, exceeding self-medication by 11.2 percentage points. This indicates that non-adherence to prescribed antibiotic regimens may be a more frequent behavioral concern in this outpatient population than self-directed antibiotic initiation. Patients may discontinue antibiotics when symptoms improve, when adverse effects occur, when cost becomes a barrier, or when they do not receive adequate counselling about treatment duration. This finding is important for outpatient clinical practice because adherence is directly modifiable at the point of prescribing. Physicians and pharmacists should provide clear instructions on dose, frequency, duration, expected clinical response, possible adverse effects, and the importance of not retaining leftover antibiotics for future use. Strengthening communication during outpatient encounters may therefore improve antibiotic-use behavior even when broader regulatory interventions are still developing.

The findings also highlight the value of general medicine and family medicine outpatient departments as strategic sites for antimicrobial-stewardship interventions. These clinics manage a large volume of undifferentiated symptoms, including fever, cough, sore throat, respiratory complaints, gastrointestinal symptoms, urinary symptoms, and nonspecific illnesses. In such settings, antibiotic decisions may be influenced not only by clinical assessment but also by patient expectations, prior antibiotic experience, and perceived pressure to prescribe. Outpatient antimicrobial stewardship should therefore include patient-facing components, such as brief counselling scripts, printed educational materials, delayed prescribing strategies where appropriate, and explicit explanation of why antibiotics are not needed for likely viral illnesses. The findings support the need for stewardship approaches that address both prescriber behavior and patient knowledge, because inappropriate antibiotic use is often produced by the interaction of clinical uncertainty, patient demand, and easy medicine access (17).

The study has several strengths. It focused on adult patients attending active outpatient clinical services, making the findings directly relevant to routine patient counselling and outpatient stewardship. The

sample size was calculated using a formal single-proportion formula, and the final analysis included 322 participants. The study also assessed multiple related but distinct outcomes, including general antibiotic awareness, correct antibiotic knowledge, antimicrobial-resistance awareness, correct antimicrobial-resistance understanding, self-medication, and completion of prescribed antibiotic courses. This allowed identification of specific awareness-practice gaps rather than treating antibiotic knowledge as a single broad construct.

Nevertheless, several limitations should be considered when interpreting the findings. The study used a hospital-based cross-sectional design, so causal relationships between awareness, knowledge, and antibiotic-use practices cannot be inferred. The use of non-probability consecutive sampling from a single tertiary-care hospital in Lahore limits generalizability to all outpatient patients in Pakistan, particularly those attending public-sector facilities, rural clinics, or community pharmacies. Antibiotic-use practices were self-reported and may therefore be affected by recall bias or social desirability bias, especially for behaviors such as self-medication or non-adherence. The manuscript also does not provide sociodemographic subgroup results or regression outputs, so factors independently associated with poor knowledge, self-medication, or incomplete-course use could not be interpreted from the available results. Future studies should include validated questionnaires, broader multicenter sampling, and multivariable analyses to identify high-risk groups requiring targeted intervention.

Overall, the study shows that adult OPD patients in this tertiary-care setting commonly recognize antibiotics, but many lack correct knowledge of appropriate antibiotic indications and antimicrobial resistance. The combination of high antibiotic awareness, lower correct knowledge, moderate antimicrobial-resistance understanding, and persistent inappropriate practices suggests that awareness-based messaging alone is unlikely to be sufficient. Practical outpatient interventions should prioritize clear patient education, improved physician counselling, pharmacist involvement, discouragement of non-prescription antibiotic access, and reinforcement of adherence to prescribed antibiotic courses. These measures are particularly important in Pakistan, where antimicrobial resistance remains a major public-health concern and where outpatient antibiotic use represents a critical opportunity for prevention-focused stewardship (18–20).

CONCLUSION

This study found that adult patients attending general medicine and family medicine outpatient departments at a tertiary-care hospital in Lahore had high general awareness of antibiotics, but substantially lower correct knowledge of appropriate antibiotic use and antimicrobial resistance. Although 93.1% of participants were aware of antibiotics, only 35.9% had correct antibiotic knowledge, and while 58.3% were aware of antimicrobial resistance, only 49.0% correctly understood it. Self-medication with antibiotics was reported by 18.9% of participants, and incomplete completion of prescribed antibiotic courses was reported by 30.1%, indicating persistent inappropriate antibiotic-use practices in the outpatient population. These findings highlight an important gap between awareness and accurate understanding, suggesting that patient education should move beyond general awareness and focus on correct antibiotic indications, avoidance of unnecessary antibiotic use for viral illnesses, adherence to prescribed courses, and the consequences of antimicrobial resistance. Strengthening outpatient counselling, pharmacist involvement, prescription regulation, and antimicrobial-stewardship interventions may help improve rational antibiotic use and reduce resistance-related risks in similar clinical settings.

Saif A, Khan TM, Bukhsh A, Yaseen M, Saif A. Cross-sectional survey to explore knowledge, attitude, practices and impact of an intervention programme related to antibiotic misuse and self-medication among general population of Pakistan. *BMJ Public Health*. 2024. doi:10.1136/bmjph-2023-000758.

Hayat K, Rosenthal MM, Gillani A, Chang J, Ji W, Yang C, et al. Perspective of key healthcare professionals on antimicrobial resistance and stewardship programs: a multicenter cross-sectional study from Pakistan. *Front Pharmacol*. 2020. doi:10.3389/fphar.2019.01520.

Hayat K, Jamshed S, Rosenthal MM, Haq N, Chang J, Rasool M, et al. Understanding of pharmacy students towards antibiotic use, antibiotic resistance and antibiotic stewardship programs: a cross-sectional study from Punjab, Pakistan. *Antibiotics*. 2021;10(1):66. doi:10.3390/antibiotics10010066.

Atif M, Ihsan B, Malik I, Ahmad N, Saleem Z, Sehar A, et al. Antibiotic stewardship program in Pakistan: a multicenter qualitative study exploring medical doctors' knowledge, perception and practices. *BMC Infect Dis*. 2021. doi:10.1186/s12879-021-06043-5.

Alam M, Saleem Z, Haseeb A, Qamar M, Sheikh A, Abuhussain SSA, et al. Tackling antimicrobial resistance in primary care facilities across Pakistan: current challenges and implications for the future. *J Infect Public Health*. 2023. doi:10.1016/j.jiph.2023.10.046.

Arshad H, Gillani A, Akbar J, Abbas H, Ahmed AB, Gillani SMAH, et al. Knowledge on multi-drug resistant pathogens, antibiotic use and self-reported adherence to antibiotic intake: a population-based cross-sectional survey from Pakistan. *Front Pharmacol*. 2022. doi:10.3389/fphar.2022.903503.

Ahmed H, Bhimani S, Khanum I, Khan A, Khetpal A, Abbas M, et al. Knowledge, attitude and perception survey of doctors regarding antibiotic use and resistance in Karachi, Pakistan. *J Pak Med Assoc*. 2020. doi:10.5455/jpma.6239.

Mustafa Z, Nazir M, Majeed HK, Salman M, Hayat K, Khan A, et al. Exploring knowledge of antibiotic use, resistance, and stewardship programs among pharmacy technicians serving in ambulatory care settings in Pakistan and the implications. *Antibiotics*. 2022;11(7):921. doi:10.3390/antibiotics11070921.

Khan F, Khan F, Hayat K, Ahmad T, Khan A, Chang J, et al. Knowledge, attitude, and practice on antibiotics and its resistance: a two-phase mixed-methods online study among Pakistani community pharmacists to promote rational antibiotic use. *Int J Environ Res Public Health*. 2021;18(3):1320. doi:10.3390/ijerph18031320.

S MT, K U, S TB. Awareness of antimicrobial resistance and antibiotic use among patients attending the outpatient department of a tertiary care hospital. *Cureus*. 2026. doi:10.7759/cureus.105029.

Saleem Z, Hassali M, Godman B, Fatima M, Ahmad Z, Sajid A, et al. Sale of WHO AWaRe groups antibiotics without a prescription in Pakistan: a simulated client study. *J Pharm Policy Pract*. 2020. doi:10.1186/s40545-020-00233-3.

Aslam A, Zin CS, Jamshed S, Rahman N, Ahmed S, Pallós P, et al. Self-medication with antibiotics: prevalence, practices and related factors among the Pakistani public. *Antibiotics*. 2022;11(6):795. doi:10.3390/antibiotics11060795.

Ashraf S, Ashraf M, Imran M, Ahmad Z, Ht H, Ab A, et al. Knowledge, attitude, and practice of clinicians about antimicrobial stewardship and resistance among hospitals of Pakistan: a multicenter cross-sectional study. *Environ Sci Pollut Res Int*. 2021. doi:10.1007/s11356-021-16178-2.

Ambreen S, Safdar N, Ikram A, Baig M, Farooq A, Amir A, et al. Point prevalence survey of antimicrobial use in selected tertiary care hospitals of Pakistan using WHO methodology: results and inferences. *Medicina*. 2023;59(6):1102. doi:10.3390/medicina59061102.

Saleem Z, Godman B, Azhar F, Kalungia A, Fadare J, Opanga S, et al. Progress on the national action plan of Pakistan on antimicrobial resistance: a narrative review and the implications. *Expert Rev Anti Infect Ther.* 2021. doi:10.1080/14787210.2021.1935238.

Rijal K, Banjara M, Dhungel B, Kafle S, Gautam K, Ghimire B, et al. Use of antimicrobials and antimicrobial resistance in Nepal: a nationwide survey. *Sci Rep.* 2021. doi:10.1038/s41598-021-90812-4.

Khan FU, Khan A, Shah S, Hayat K, Usman A, Khan FU, et al. Exploring undergraduate pharmacy students' perspectives towards antibiotics use, antibiotic resistance, and antibiotic stewardship programs along with the pharmacy teachers' perspectives: a mixed-methods study from Pakistan. *Front Pharmacol.* 2021;12. doi:10.3389/fphar.2021.754000.

Kosiyaporn H, Chanvatik S, Issaramalai T, Kaewkhankhaeng W, Kulthanmanusorn A, Saengruang N, et al. Surveys of knowledge and awareness of antibiotic use and antimicrobial resistance in general population: a systematic review. *PLoS One.* 2020;15(1):e0227973. doi:10.1371/journal.pone.0227973.

Bilal H, Khan MN, Rehman T, Hameed MF, Yang X. Antibiotic resistance in Pakistan: a systematic review of past decade. *BMC Infect Dis.* 2021. doi:10.1186/s12879-021-05906-1.

Mustafa Z, Khan A, Salman M, Sulaiman SSS, Godman B. Antimicrobial utilization among neonates and children: a multicenter point prevalence study from leading children's hospitals in Punjab, Pakistan. *Antibiotics.* 2022;11(8):1056. doi:10.3390/antibiotics11081056.