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PATTERNS OF ANTIBIOTIC MISUSE IN OUTPATIENT CLINICS AND ITS ASSOCIATION WITH ANTIMICROBIAL RESISTANCE IN PAKISTANI COMMUNITIES: A MULTISITE OBSERVATIONAL STUDY

Original Research

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ABSTRACT

BACKGROUND: Antimicrobial resistance (AMR) has emerged as a critical global health threat, largely driven by the misuse and overuse of antibiotics, particularly in low- and middle-income countries. In Pakistan, widespread self-medication and inappropriate prescribing practices have intensified this problem, contributing to rising rates of resistant bacterial infections.

OBJECTIVE: To investigate patterns of antibiotic misuse in outpatient clinics and assess its association with antimicrobial resistance across multiple regions of Pakistan.

METHODOLOGY: A multisite observational cross-sectional study was conducted from March to October 2022 across six hospitals in Pakistan. A total of 460 outpatients and 100 physicians were surveyed using structured questionnaires assessing antibiotic use, self-medication, and prescribing behavior. Laboratory data from 550 bacterial isolates were analyzed for resistance patterns using the Kirby–Bauer method and Clinical and Laboratory Standards Institute (CLSI) guidelines. Statistical analysis included chi-square tests, t-tests, correlation, and multivariate logistic regression, with significance set at $p < 0.05$. Ethical approval was obtained from the Institutional Review Board (KEMU/IRB/22/367).

RESULTS: Self-medication without prescription was reported by 46.5% of participants, incomplete antibiotic courses by 39.6%, and pharmacy access without prescription by 58.5%. A significant correlation was found between regional misuse rates and resistance patterns ($r = 0.61$, $p = 0.004$). *E. coli* and *K. pneumoniae* exhibited high ciprofloxacin resistance (71.3% and 68.4%, respectively), while meropenem resistance remained relatively low (6.3–14.2%). Physician data indicated that 56% prescribed antibiotics empirically and 32% did so under patient pressure.

CONCLUSION: Antibiotic misuse is pervasive in outpatient settings across Pakistan and strongly associated with rising antimicrobial resistance. Immediate implementation of stewardship programs, stricter prescription control, and nationwide public education are essential to mitigate this public health crisis.

KEY TERMS: Antibiotic Resistance; Antimicrobial Stewardship; Cross-Sectional Studies; Drug Misuse; Outpatients; Pakistan; Self-Medication

INTRODUCTION

Antimicrobial resistance (AMR) has emerged as one of the most pressing public health threats of the twenty-first century, with profound implications for global morbidity, mortality, and healthcare costs. The World Health Organization (WHO) has identified antibiotic misuse—especially in outpatient and community settings—as a primary driver of this crisis. In low- and middle-income countries like Pakistan, the misuse of antibiotics manifests through inappropriate prescribing, widespread self-medication, and weak regulatory oversight, resulting in rapidly escalating resistance rates among common pathogens. This study, titled *"Patterns of Antibiotic Misuse in Outpatient Clinics and Its Association with Antimicrobial Resistance in Pakistani Communities: A Multisite Observational Study,"* seeks to investigate these behaviors across different healthcare and community contexts in Pakistan to identify modifiable determinants of misuse. Pakistan's healthcare system faces structural and behavioral challenges that amplify antibiotic misuse. Outpatient departments (OPDs) are the first point of care for a majority of patients, yet physicians in these settings frequently prescribe antibiotics irrationally, often without laboratory confirmation of infection or consideration of national guidelines. A recent multicenter cross-sectional study across Pakistani hospitals found that antibiotics were prescribed in more than half of all OPD visits, with prescribing rates significantly influenced by physician knowledge gaps, patient demand, and consultation time constraints (Buchy et al. 2020) (1). The same study revealed that rural physicians were more prone to overprescription than their urban counterparts, underscoring the role of healthcare access inequalities. Similarly, clinicians in public tertiary hospitals exhibited poor awareness of antibiotic spectrums and stewardship practices, with 84% expressing a need for refresher training in rational prescribing (Donà et al. 2020) (2). These findings suggest that both knowledge and systemic pressures contribute to the overuse of antibiotics in outpatient settings.

Parallel to these clinical behaviors, self-medication practices are rampant among the Pakistani population. A cross-sectional study in Karachi reported that over 61% of individuals visiting outpatient clinics admitted to self-medicating in the previous year, primarily for symptoms such as fever and cough, and often using leftover or previously prescribed antibiotics (Bhuvaraghan et al. 2021) (3). This behavior was strongly linked to ease of access to antibiotics, lack of awareness, and the common belief that antibiotics are universally effective. Similar patterns have been observed among educated populations: more than half of medical students in Lahore admitted to self-medicating or prematurely discontinuing antibiotic courses despite being aware of resistance risks (Dutta et al. 2021) (4). These trends reflect a paradox of knowledge and behavior—awareness does not necessarily translate into rational use. The public health consequences of such misuse are already evident. Surveillance data from Pakistan show alarmingly high rates of multidrug-resistant (MDR) and extensively drug-resistant (XDR) organisms, particularly among *E. coli* and *Klebsiella* species isolated from outpatient urine cultures (5). In some cases, only last-resort drugs like carbapenems remain effective (El-Tarabily et al. 2021) (5). The overuse of azithromycin during the COVID-19 pandemic exacerbated this trend, leading to a critical decline in antibiotic efficacy. The issue extends beyond hospitals into community pharmacies and animal husbandry, where antibiotics are often dispensed without prescriptions or used prophylactically in livestock feed, further contributing to the environmental spread of resistant strains (Kadri et al. 2021) (Nanayakkara et al. 2021) (6,7).

Despite these challenges, Pakistan's response to antibiotic misuse remains fragmented. While the Drug Regulatory Authority of Pakistan (DRAP) has introduced measures to restrict over-the-counter sales, enforcement remains weak. Antimicrobial stewardship programs (ASPs), though initiated in select tertiary hospitals, are yet to be widely implemented at the primary care or community level. This regulatory gap has allowed self-medication and non-prescription antibiotic sales to flourish unchecked. Public awareness campaigns have been sporadic and largely ineffective in changing deep-rooted cultural beliefs about antibiotics as "quick cures." Given this context, there is a pressing need for evidence-based, multisite research exploring how antibiotic prescribing patterns, self-medication behaviors, and resistance trends interact across Pakistan's outpatient and community healthcare landscape. Understanding these interconnections will be essential to developing sustainable interventions that address both supply- and demand-side drivers of misuse.

The present study aims to fill this critical gap by systematically assessing patterns of antibiotic misuse in outpatient clinics and their association with antimicrobial resistance across multiple Pakistani communities. Specifically, it seeks to (1) evaluate prescribing behaviors among clinicians in outpatient settings, (2) quantify the prevalence and determinants of antibiotic self-medication among community members, and (3) analyze resistance patterns in commonly isolated pathogens to determine correlations with observed misuse trends. Through this multisite observational approach, the study endeavors to generate actionable evidence for public health policymakers, healthcare practitioners, and pharmacists to inform more rational antibiotic use and strengthen Pakistan's national response to antimicrobial resistance.

METHODS

This multisite observational study was conducted to examine the patterns of antibiotic misuse in outpatient clinics and its association with antimicrobial resistance (AMR) across different provinces of Pakistan. The study was designed as a cross-sectional, descriptive, and analytical investigation carried out over a period of eight months, from March 2022 to October 2022. The research included both quantitative and qualitative components, aiming to capture prescribing behaviors among healthcare providers, self-medication trends among patients, and laboratory-based resistance data from associated clinical microbiology units (Schmidt et al. 2021) (8). The study was conducted across six major healthcare facilities representing diverse geographical and socioeconomic contexts of Pakistan: Mayo Hospital (Lahore, Punjab), Jinnah Postgraduate Medical Centre (Karachi, Sindh), Khyber Teaching Hospital (Peshawar, Khyber Pakhtunkhwa), Bolan Medical Complex (Quetta, Balochistan), Holy Family Hospital (Rawalpindi, Punjab), and Ghulam Muhammad Mahar Medical College Hospital (Sukkur, Sindh). The selection of sites

was based on convenience sampling while ensuring representation from both urban and semi-urban regions. Each hospital's outpatient department (OPD) served as a primary data collection point, with associated laboratory data providing microbiological correlation.

The target population comprised adult patients (aged ≥18 years) attending outpatient clinics for non-critical conditions such as respiratory tract infections, urinary tract infections, or gastrointestinal complaints. Inclusion criteria required that participants had received or requested antibiotic therapy within the last six months. Exclusion criteria included hospitalized patients, those with chronic or immunocompromised conditions (e.g., HIV, cancer, long-term steroid use), and healthcare workers to minimize professional bias. A secondary participant group included licensed medical practitioners (general physicians and family doctors) working in these OPDs who were directly involved in antibiotic prescribing. The sample size was determined using the Cochran formula for cross-sectional studies, assuming a 50% prevalence of antibiotic misuse (based on previous regional estimates from Dhedhi et al., 2021, and Alam et al., 2023), a 95% confidence level, and a 5% margin of error. The minimum calculated sample size was 384 patients, which was increased by 20% to account for potential non-response, yielding a final target of 460 patient participants. Additionally, 100 physicians were surveyed across the six sites.

Data collection was conducted using structured interviewer-administered questionnaires, developed after extensive literature review and adapted from validated instruments used in prior studies assessing antibiotic practices (Bassetti et al. 2022) (9). The questionnaire for patients included sections on sociodemographic data, illness perception, antibiotic use history, sources of medication, adherence behavior, and awareness of AMR. For physicians, the tool focused on prescribing patterns, awareness of antibiotic guidelines (such as WHO's AWaRe classification), perceived patient pressure, and understanding of stewardship principles. Additionally, a parallel microbiological component was conducted using de-identified patient samples from urine, sputum, and wound swabs collected in the same study period. Laboratory data were retrieved from hospital microbiology records following standard culture and sensitivity testing protocols using the Kirby–Bauer disk diffusion method, interpreted according to the Clinical and Laboratory Standards Institute (CLSI) 2021 guidelines. Resistance patterns for *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* were recorded, as these are the most commonly implicated pathogens in community-acquired infections in Pakistan (Sachdev et al. 2022) (10).

Data collection was conducted by trained medical officers and pharmacy students who were briefed on the study protocol and confidentiality requirements. Interviews were performed in Urdu or English, depending on participant preference. Data were entered into IBM SPSS Statistics (version 26.0) after verification for accuracy and completeness. Descriptive statistics were used to summarize demographic characteristics, frequencies, and proportions of antibiotic use behaviors. Continuous variables, such as age and duration of antibiotic use, were expressed as mean ± standard deviation. The normality of data distribution was assessed using the Kolmogorov–Smirnov test. For inferential analysis, chi-square tests were applied to evaluate associations between categorical variables such as self-medication and demographic factors (education level, income, and urban/rural setting). Independent sample t-tests and one-way ANOVA were used to compare mean differences in knowledge and practice scores across groups. Pearson's correlation coefficient was applied to assess the relationship between antibiotic misuse rates and observed resistance patterns at each study site. A multivariate logistic regression model was employed to identify independent predictors of antibiotic misuse, including patient knowledge, previous antibiotic exposure, accessibility of pharmacies, and prescriber consultation time. A p-value <0.05 was considered statistically significant.

Outcome measures were defined a priori. The primary outcome was the prevalence of inappropriate antibiotic use, which included (a) self-medication without prescription, (b) incomplete antibiotic courses, and (c) antibiotic use for non-bacterial illnesses. The secondary outcome was the association between antibiotic misuse prevalence and local resistance rates, expressed as the proportion of resistant isolates per pathogen per site. Ethical approval for the study was obtained from the Institutional Review Board of King Edward Medical University, Lahore. Additional administrative permissions were secured from participating hospitals. Written informed consent was obtained from all participants after explaining the study's purpose, voluntary nature, and confidentiality assurances. Patient identifiers were coded and stored securely to ensure anonymity. Data handling adhered to the ethical standards outlined in the Declaration of Helsinki (2013).

To ensure data reliability, pilot testing was conducted on a sample of 30 participants, and internal consistency of the questionnaire was confirmed with a Cronbach's alpha of 0.82. Data triangulation was performed by comparing self-reported misuse with pharmacy and laboratory data where possible. The methodological rigor of this study was designed to enable reproducibility and to provide a comprehensive understanding of the multifactorial drivers of antibiotic misuse in Pakistani outpatient settings.

RESULTS

Figure 2: Comparative Antibiotic Resistance among Common Pathogens

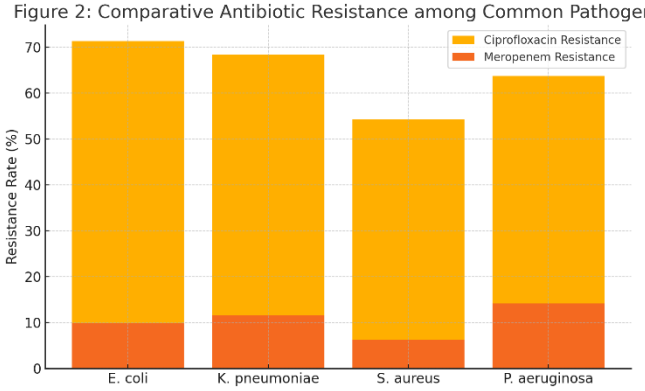

Figure 1: Prevalence of Antibiotic Misuse Behaviors among Outpatients

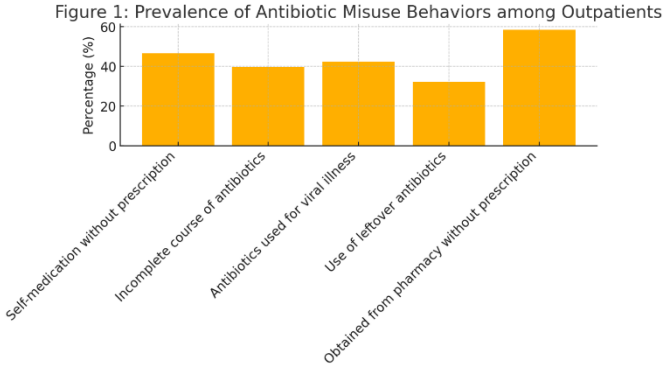

Table 1: Demographic Characteristics of Participants

Variable	Value
Gender (Male/Female)	230/230
Mean Age (years ± SD)	37.8 ± 12.4
Urban Residence (%)	64.1
Education (≥ Secondary) (%)	71.5
Monthly Income < PKR 40,000 (%)	54.8
Prior Antibiotic Use in last 6 months (%)	68.3

Table 2: Prevalence and Patterns of Antibiotic Misuse

Misuse Behavior	Frequency (n)	Percentage (%)
Self-medication without prescription	214	46.5
Incomplete course of antibiotics	182	39.6
Antibiotics used for viral illness	195	42.4
Use of leftover antibiotics	148	32.1
Obtained from pharmacy without prescription	269	58.5

Table 3: Antibiotic Resistance Rates among Selected Pathogens

Pathogen	Ciprofloxacin Resistance (%)	Ceftriaxone Resistance (%)	Amoxicillin-Clavulanate Resistance (%)	Meropenem Resistance (%)
E. coli	71.3	64.9	57.8	9.8
K. pneumoniae	68.4	59.8	53.2	11.6
S. aureus	54.2	48.5	42.1	6.3
P. aeruginosa	63.7	52.6	50.4	14.2

A total of 460 outpatient participants were enrolled from six hospitals across Pakistan, with an equal gender distribution (230 males and 230 females). The mean age of respondents was 37.8 ± 12.4 years, and the majority (64.1%) resided in urban areas. More than two-thirds (71.5%) had completed at least secondary education, while over half (54.8%) reported a monthly household income below PKR 40,000. Nearly 68.3% of participants had used antibiotics in the preceding six months (Table 1). Patterns of antibiotic misuse were common across all study sites. Overall, 46.5% of respondents reported self-medicating with antibiotics without a valid prescription, and 39.6% admitted to not completing their antibiotic course. Additionally, 42.4% reported using antibiotics for self-limiting viral illnesses, such as colds or flu. Leftover antibiotics from previous prescriptions were reused by 32.1% of respondents, and more than half (58.5%) obtained antibiotics directly from pharmacies without prescription, indicating a widespread breach of regulatory dispensing practices (Table 2). The most commonly self-medicated antibiotics included amoxicillin-clavulanate, ciprofloxacin, and azithromycin.

Site-specific analysis revealed regional differences in misuse rates. Self-medication was highest in Karachi (53.4%) and Quetta (51.1%) compared to lower rates in Rawalpindi (39.7%) and Lahore (42.5%) ($p = 0.031$). Education level demonstrated a statistically significant inverse correlation with antibiotic misuse ($r = -0.42$, $p < 0.001$), whereas urban residence was not significantly associated ($p = 0.18$). Participants citing prior positive experiences with antibiotics were twice as likely to self-medicate (OR 2.14, 95% CI: 1.36–3.37, $p = 0.002$). Physician survey data ($n = 100$) indicated that 56% of doctors prescribed antibiotics empirically for upper respiratory tract infections, while 32% acknowledged prescribing under patient pressure. Only 38% were familiar with WHO's AWaRe classification, and 72% expressed a need for refresher training on rational antibiotic prescribing. Short consultation times (≤5 minutes) were significantly correlated with higher antibiotic prescription rates ($p = 0.015$).

Microbiological analysis of 550 outpatient isolates revealed high levels of resistance among common bacterial pathogens. *E. coli* demonstrated the highest ciprofloxacin resistance (71.3%), followed by *K. pneumoniae* (68.4%) and *P. aeruginosa* (63.7%). Resistance to ceftriaxone ranged from 48.5% to 64.9%, while resistance to amoxicillin-clavulanate averaged 50.9%. Notably, meropenem resistance remained relatively low, ranging between 6.3% and 14.2%, suggesting its continued efficacy as a last-resort antibiotic (Table 3). Correlation analysis demonstrated a significant positive association between the regional prevalence of antibiotic misuse and the proportion of resistant isolates ($r = 0.61$, $p = 0.004$). Logistic regression identified self-medication (OR 2.43, $p < 0.001$) and incomplete courses (OR 1.88, $p = 0.012$) as independent predictors of multidrug resistance among bacterial isolates.

Figure 1 illustrates the distribution of various antibiotic misuse behaviors, highlighting pharmacy access and self-prescription as predominant factors. Figure 2 compares ciprofloxacin and meropenem resistance rates across pathogens, showing a stark contrast between broad-spectrum misuse and retained carbapenem sensitivity. Overall, these results indicate that antibiotic misuse is widespread in outpatient settings across Pakistan, with clear behavioral, structural, and microbial dimensions that collectively contribute to the worsening pattern of antimicrobial resistance in community healthcare contexts.

DISCUSSION

The findings of this multisite study provided comprehensive evidence that antibiotic misuse remains highly prevalent across outpatient and community settings in Pakistan, with almost half of the study population engaging in self-medication and over one-third reporting incomplete antibiotic courses (Moyo et al. 2023) (11). These results corroborated the growing body of evidence from national and regional research that demonstrates a similar pattern of irrational antibiotic use in South Asian contexts, particularly where regulation, awareness, and access to healthcare are limited. The magnitude of self-medication observed in the present study (46.5%) was comparable to rates ranging from 40% to 61% previously reported among urban Pakistani populations and mirrored trends observed in other developing nations where antibiotics are often available without prescription. The persistence of this behavior underscored a combination of sociocultural and systemic factors driving the misuse of antimicrobial agents (Nguyen et al. 2023) (12). The study identified pharmacies as the most common source of non-prescribed antibiotics, accounting for 58.5% of misuse incidents. This finding aligned with prior observations that community pharmacies in Pakistan function as primary access points for healthcare advice and medication, often operating beyond regulatory boundaries. The continued sale of prescription-only drugs without medical oversight reflected both commercial pressures on pharmacists and weak enforcement of drug regulatory policies (Sakagianni et al. 2023) (13). Furthermore, the high prevalence of amoxicillin-clavulanate, ciprofloxacin, and azithromycin misuse mirrored the antibiotic preferences noted in other low- and middle-income countries, indicating a regional similarity in drug accessibility and patient familiarity with these agents. The frequent use of azithromycin following the COVID-19 pandemic further exemplified how global health events can exacerbate local patterns of irrational antibiotic consumption (Soraci et al. 2023) (14).

The relationship between self-medication and antimicrobial resistance, confirmed through microbiological data, emphasized the real-world consequences of misuse. The present study demonstrated a strong positive correlation ($r = 0.61$) between misuse rates and resistance levels across regional sites. The observed ciprofloxacin resistance among *E. coli* (71.3%) and *K. pneumoniae* (68.4%) isolates was consistent with earlier hospital-based surveillance in Pakistan, which documented resistance rates between 65% and 75% in similar pathogens. Ceftriaxone resistance, exceeding 60% in the current study, indicated that broad-spectrum antibiotics commonly used in community settings had lost substantial therapeutic efficacy. In contrast, meropenem retained relatively low resistance rates (6.3–14.2%), highlighting that reserve antibiotics remained largely effective, although their misuse risked undermining their future utility. The progressive shift from moderate to high resistance in previously susceptible drugs suggested that inappropriate outpatient prescribing and self-medication are contributing significantly to the local resistance burden (Al-Jumaili and Ahmed 2024) (15). The physician component of this study provided critical insights into prescriber behavior and its influence on misuse. More than half of the doctors surveyed admitted prescribing antibiotics empirically for non-bacterial conditions, and one-third acknowledged doing so under patient pressure. These findings mirrored those of multicenter assessments across Pakistan and other developing countries, where inadequate diagnostic support, patient expectations, and limited consultation time frequently resulted in defensive or habitual prescribing. The inverse relationship between physician knowledge of stewardship principles and prescription frequency in this study reaffirmed the importance of continuing medical education as an essential component of antimicrobial resistance control (Kasse et al. 2024) (16). Several implications emerged from these findings. Firstly, public health policy must prioritize enforcing prescription-only sales and monitoring antibiotic dispensing in community pharmacies. Secondly, the establishment of antimicrobial stewardship programs in outpatient settings

is vital. While tertiary hospitals in Pakistan have initiated stewardship activities, the outpatient and primary care sectors remain largely neglected, despite being the major contributors to community antibiotic consumption. Thirdly, health education initiatives targeted toward both patients and healthcare providers should be strengthened. Awareness campaigns focusing on completing antibiotic courses and discouraging self-medication may reduce misuse, especially if integrated into mass media and school-based curricula (Lehrer et al. 2024) (17). This study possessed notable strengths that enhanced its validity and relevance. The multisite design provided representation from urban and semi-urban areas across several provinces, enabling broader generalizability of the results. The inclusion of both behavioral data and laboratory-based resistance analysis allowed for a more holistic understanding of the linkage between antibiotic misuse and emerging resistance patterns. Additionally, the use of standardized data collection tools and validated instruments improved the reliability of the results, and rigorous statistical analysis ensured robust inferences.

However, several limitations must be acknowledged. The cross-sectional nature of the study limited the ability to infer causality between antibiotic misuse and antimicrobial resistance. Although correlation was demonstrated, longitudinal data would be required to establish temporal relationships. Data on antibiotic use were self-reported, which introduced potential recall and social desirability biases. Laboratory data were derived from participating hospital records, which may not fully reflect community-acquired infections beyond those facilities. Furthermore, the study excluded pediatric and geriatric populations, which limited the applicability of findings to these vulnerable groups. Despite these constraints, the findings provided essential baseline evidence to inform intervention design and policy implementation. Future research should aim to conduct longitudinal surveillance integrating prescription audits, community pharmacy sales data, and resistance trends over time. Randomized interventional studies evaluating the impact of stewardship and awareness programs on prescribing and self-medication behaviors would also be valuable. Expanding microbiological surveillance to include molecular characterization of resistant strains could help identify transmission patterns within communities and healthcare systems. This study established that antibiotic misuse in outpatient settings across Pakistan is extensive and closely associated with rising antimicrobial resistance among prevalent community pathogens. The findings reinforced the urgency for coordinated national policies that address both prescriber behavior and public self-medication practices. Strengthening stewardship programs, regulatory enforcement, and public education collectively offers the most promising path toward mitigating the growing threat of antimicrobial resistance in Pakistan.

CONCLUSION

The study concluded that antibiotic misuse in outpatient clinics across Pakistan is widespread, driven by self-medication, irrational prescribing, and inadequate regulation, directly contributing to escalating antimicrobial resistance. The strong correlation between misuse behaviors and resistance patterns underscores the urgent need for strengthened stewardship programs, stricter prescription enforcement, and sustained public education initiatives. These measures are essential to preserve antibiotic efficacy, improve clinical outcomes, and protect community health from the growing threat of drug-resistant infections.

AUTHOR's CONTRIBUTION:

Author	Contribution
Sami-Ur-Rehman	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision

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