

KAP REGARDING ANTIMICROBIAL RESISTANCE IN PAKISTAN: A SYSTEMATIC REVIEW OF SOCIAL DETERMINANTS

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ABSTRACT:

Antimicrobial resistance (AMR) is a serious and growing public health problem in Pakistan. There are several individual-level, social-level, economic, and health care-related factors that fuel inappropriate antibiotic use. This systematic review discusses knowledge, attitudes, and practices (KAP) related to AMR and antibiotic use and describes the factors related to inappropriate antibiotic-related behavior. A systematic search of PubMed/MEDLINE and Scopus was conducted for peer-reviewed articles published from January 2015 to December 2025. The studies were conducted from Pakistan and provided evidence related to KAP on AMR and associated behavioral and social factors. The process was done according to the PRISMA 2020 statement. Evaluation of methodological quality was based on the assessment instruments. The summary of results was done by quantitative and thematic synthesis.

Ten studies were selected. The mean of appropriate knowledge was 59.88%, while the mean of positive attitudes was 68.52%. Inappropriate practices persisted at the level of 40.38%. Self-medication, informal use of antibiotics, inadequate adherence to treatment, inappropriate dispensing, and empirical prescribing were reported. Knowledge and attitudes were more appropriate than practices. Multiple social and economic factors, limited access to health care, patient expectations, pressure on commerce, and professional factors and poor regulation influenced antibiotic use. To address AMR in Pakistan, multiple strategies other than education are required. These include strengthened pharmacy practice regulation, training, and awareness along with Public education, affordable healthcare, and improved diagnostics and antimicrobial stewardship.

KEYWORDS: Antimicrobial resistance; Knowledge, attitudes and practices; Social determinants of health; Antimicrobial stewardship; Pakistan.

INTRODUCTION

Antimicrobial resistance (AMR) is one of the most serious public health challenges in the modern world. AMR develops when microbes acquire resistance to the drugs previously successful against them.^{1,2} So routine infections become difficult to treat. Increased cases of AMR lead to more cases of illnesses, treatment costs, length of stay at hospitals, and deaths.^{1,3} The problem also creates danger for many medical processes such as surgery, cancer therapy, intensive care, and organ transplantation that heavily rely on antimicrobial medicines.^{1,2} Antimicrobial resistance isn't only a microbiological and clinical issue; it is also influenced by social conditions.^{4,5} The use of antibiotics depends on knowledge, beliefs, economic conditions, access to healthcare, cultural practices, and health-system factors.⁵⁻⁸ Understanding AMR requires examining both resistance patterns and the social, clinical, and policy contexts of antibiotic use.^{4,5}

The inappropriate use of antibiotics is one of the major drivers of AMR. This involves self-medication, antibiotic use without prescription, incorrect dosage, unnecessary treatment, sharing of medicines, effect of leftover antibiotics, and incomplete treatment.⁹⁻¹² In various countries, these facts are prevalent, especially in low- and middle-income countries (LMICs).^{10,13,14} Meta-analysis and more international studies revealed that antibiotic self-medication was correlated with multiple factors, including previous experiences, simple access to medicines, healthcare expenditure, personal beliefs, and misunderstanding of proper antibiotic use.^{9,15,16,17} Knowledge, attitudes, and practices (KAP) are commonly used for studying antibiotic-related behavior. Knowledge refers to what people know about the antibiotic and AMR, attitudes describe the beliefs and impressions, while practices indicate behaviors.^{18,19} Nonetheless, good knowledge does not imply appropriate

practice.^{5,18,20} A person can be knowledgeable about the need to consume antibiotics in a prudent way but still self-medicate because professional care is expensive, inaccessible and time-consuming.^{7,9,21} This difference between knowledge and behaviour is important for AMR prevention.

In recent years, multiple studies have emphasized the role of the social determinants of AMR. Social determinants include education, income, employment, living conditions, access to healthcare, sanitation, location and institutional conditions may influence antibiotic related behavior.^{4,5,22} Unsatisfactory sanitary conditions and living have increased the incidence of diseases and hence the need for antibiotics.^{23,24} Education and health literacy are another important factor. Limited health literacy means that people do not understand when they should take antibiotics or why antibiotics should not be prescribed for viral diseases.^{18,25} Multiple studies and systematic reviews showed that the increase of knowledge does not automatically translate into better practices.^{18,20,25}

Medical practitioners operate within complex social, clinical, and institutional environments that can significantly influence antibiotic prescribing practices. There are factors such as difficulties with diagnosis, limited laboratory capabilities, patient anticipation, workload, and necessity for quick acting that affect the way antibiotics are prescribed.²⁶⁻²⁸ In resource-limited countries, the situation is even worse. Antimicrobial stewardship program improves awareness and prescribing but requires strong organizational support and healthcare infrastructure.^{29,30} The role of community pharmacies in antibiotics access is crucial.^{12,14,31} Global Studies by Li et al. (2023) and NT et al. (2021) stated that non-prescription antibiotic dispensing remains common in many community settings.^{12,14} Many factors may have an impact on this practice, including customer demand, commercial pressure, economic dependence, lack of control, and poor access to affordable healthcare.^{14,31,32}

Pakistan is confronted with many issues that might escalate the likelihood of misuse of antibiotics. These factors include self-medication, unequal accessibility to healthcare facilities, availability of antibiotics without a prescription, absence of diagnostic facilities, social inequities, and law enforcement inefficiencies.³³⁻³⁷ Apart from all that, the country has to cope with numerous diseases that cause the increased need for antibiotics.^{24,33} Many studies conducted in Pakistan have indicated multiple issues associated with AMR including use of antibiotics, access to health care, pharmacies operations, and the implementation of stewardship programs.^{33,38} The perspective on social determinants is valuable. People may make wrong healthcare decisions because they do not have enough choices.^{4,5,7} For instance, in some cases, people get antibiotics on their own since they cannot afford to visit the doctor. Still, healthcare providers can prescribe antibiotics due to the challenges with diagnosis and the necessity of fast recovery of the patient.^{7,26,31} Cultural beliefs and social relationships can also influence antibiotic use. Family, past prescriptions, friends, and social norms may be responsible for treatment choices.¹⁹ Risk perception also plays an important role.³⁹ People might know about AMR but posed as risk.⁴⁰ Therefore, communication strategies should cater to the demands, beliefs, and conditions of different societies.⁴¹ It is evident from multiple studies around the globe that AMR is dependent on infrastructure, governance, economic factors, and health system capabilities.^{22,42} Favorable sanitations, availability of diagnostics, regulations, and medical care correspond to low AMR.⁴² Nevertheless, there is still a significant gap despite numerous statistics already collected. Many KAP studies only provide information about knowledge and actions of people but ignore the reasons behind their decisions.^{4,5,18} This gap can be due to poverty levels, education, possibility of people to afford medicine, geographical location, cultural beliefs, access to pharmaceuticals, professional problems, and poor regulations.^{4,5,22}

The knowledge of social determinants of AMR is crucial for public health interventions. To be effective, interventions must combine public education with accessibility to quality healthcare, diagnostics, antimicrobial stewardship, pharmacy regulations, surveillance, and health system reforms.^{24,29,33,35} A comprehensive approach is particularly important in Pakistan, where individual decisions about antibiotics are closely connected with wider social and structural conditions. This systematic review assessed KAP related to AMR and antibiotic use in Pakistan, with particular emphasis on antibiotic-use behaviours and the social, socioeconomic, healthcare, professional, and regulatory factors associated with inappropriate antibiotic use.^{4,5,29}

Study Objective: To systematically synthesize evidence on how social and structural determinants influence KAP related to antimicrobial resistance and antibiotic use in Pakistan.

Review Question: How do socioeconomic, educational, cultural, healthcare, and institutional factors influence antimicrobial resistance-related KAP in Pakistan?

METHODOLOGY

Study Design

This study was conducted as a systematic literature review (SLR). The review aimed to identify, assess, and synthesize empirical evidence on the social determinants influencing KAP related to AMR and antibiotic use in Pakistan. AMR is influenced by factors beyond microbiological and clinical conditions. Social determinants such as socioeconomic status, education, healthcare access, cultural beliefs, and health literacy can influence antibiotic-related knowledge and behaviours.^{4-6,22,25} Therefore, a systematic review was considered appropriate to examine these interconnected factors in the Pakistani context. A systematic approach was selected to ensure a transparent, structured, and reproducible review process. The review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) principles.

Review Framework

The Population, Exposure, and Outcome (PEO) framework was used to develop the research question and guide the search strategy explained in Table 1. The sample was made up of people from the community and included patients, students, and health workers in Pakistan. The exposures were social and structural variables like education level, income level, culture, access to health service, place, and inequality. The outcomes included KAP related to AMR, in particular self-medication, prescribing, dispensing, compliance and stewardship.

Table 1: PEO Framework for studies examining KAP related AMR.

Element	Operational Definition	Inclusion Criteria
Population	Individuals or groups whose AMR-related KAP has been investigated	Community populations, patients, caregivers, students, healthcare professionals, prescribers, pharmacists, nurses, physicians
Exposure	Upstream structural and social determinants affecting antimicrobial-related behaviors	SE factors, educational attainment, cultural influences, healthcare access, institutional policies, social inequalities, geographic location
Outcome	Measured KAP outcomes concerning AMR and antibiotic utilization	Knowledge scores, awareness levels, attitudes toward AMR, antibiotic prescribing practices, self-medication, adherence behaviors, stewardship participation

Search Strategy

A systematized electronic search was performed to find appropriate articles published in peer-reviewed journals. The two major databases that we consulted were PubMed/MEDLINE and Scopus, since they cover a wide range of fields. Our search included studies published between January 2015 and December 2025 that published in English. Terms were derived from the significant terms found in the PEO framework. Synonyms and related terms were combined using Boolean operators such as AND/OR.

The main search concepts included: ("public" OR "community" OR "patient" OR "physician" AND ("social determinants" OR "socioeconomic status" OR "education*" OR "literacy" OR "culture" OR "cultural beliefs") AND ("knowledge" OR "attitude*" OR "practice*" OR "KAP" OR "misuse" OR "self-medication") AND ("antimicrobial resistance" OR "antibiotic resistance" OR "AMR") AND ("Pakistan"). Additional keywords included antimicrobial resistance, social determinants of health, socioeconomic status, prescribing behaviour, health literacy, self-medication, and Pakistan. These concepts were selected because previous literature has identified social, behavioral, and healthcare-related factors as important determinants of Antibiotic use related practices.^{4,5,8,9,23,42}

Eligibility Criteria

To be included, studies must: (1) Be empirical, quantitative, qualitative, or mixed-method studies, (2) Examine knowledge, attitudes, practices or any 2 variables, (3) Explore social, economic, educational, cultural, healthcare, or institutional factors, (4) Be based in Pakistan, (5) Be published within the 2015-2025 timeframe, (6) Be published in peer-reviewed English-language journals, (7) Be available as full-text articles. The inclusion criteria were designed to capture evidence on both individual KAP and wider determinants affecting antibiotic-related behaviours.^{4,5,6,22,25,40}

To be excluded, studies must: (1) Be review articles, editorials, conference abstracts, commentaries, or opinion pieces, (2) Only focus on microbiology laboratory or antimicrobial susceptibility testing, (3) Study only drug efficacy without any consideration of human behaviours or social factors, (4) Not provide AMR outcomes, (5) Not include pertinent factors (6) Be conducted outside of Pakistan, (7) Be published in different languages or as non-full texts.

Study Selection

The study selection process followed PRISMA 2020 principles. The database search initially identified 210 records. After removing 40 duplicate records, 170 articles remained for title and abstract screening. The study selection process is presented in Figure 1.

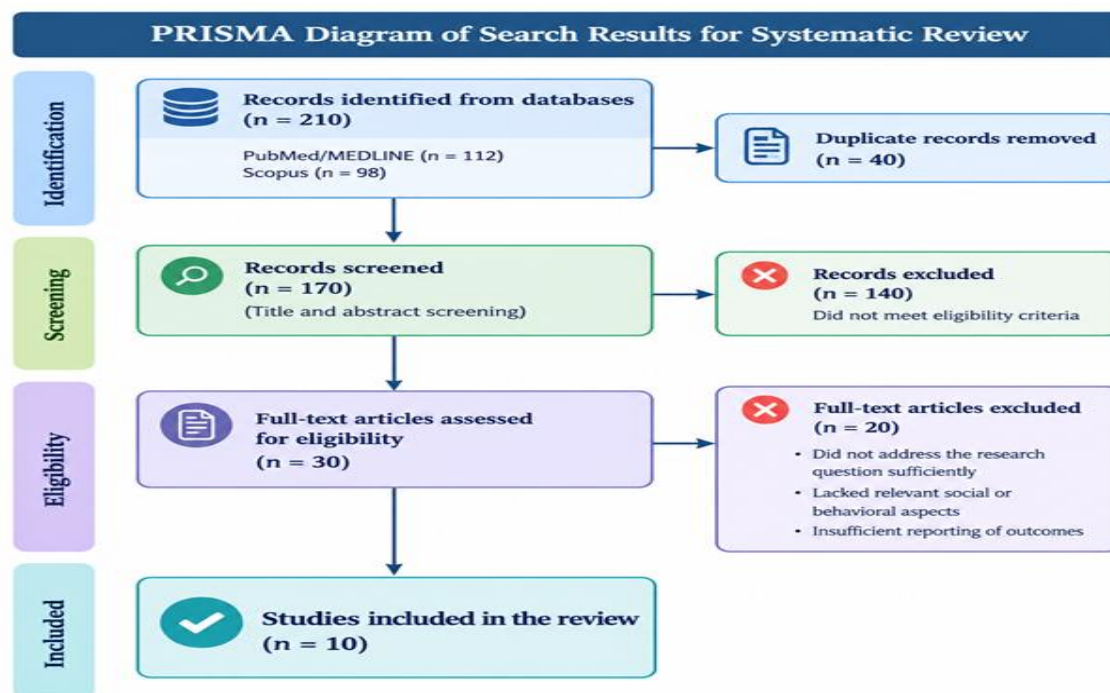


Figure 1: PRISMA diagram of Search Results for Systematic Review

In the study, out of 170 records, 140 records were excluded due to non-fulfilment of eligibility criteria. The remaining 30 full-text articles were evaluated. Exclusions of full-text articles occurred if they did not address the research question sufficiently, lacked relevant social or behavioral aspects or had insufficient reporting of outcomes so 20 more studies were excluded. Finally, 10 studies complied with all eligibility criteria and were included in SLR. The entire process of identification, screening, and establishment has been represented in a PRISMA flow diagram.

Data Extraction

The collection of data was done through a standardized data sheet, which provided an assurance of the quality and accuracy of data collected. The gathered data included author(s), the year of publication, place of research, type of study, participants, sample size, etc. It also included social determinants, KAP result, major findings, and limitations of the research. Data sheet was used for each of the studies. It helped with the comparison of results considerably. The important factors were social status, education, health literacy, access to health system, cultural beliefs, and institutional status.^{4,5,8,9,22,23,31,33}

Quality Assessment

The evaluation of methodological quality of the studies was conducted using appropriate tools for critical appraisal. For studies of quantitative observational designs, JBI Critical Appraisal checklist was used, while Mixed Methods Appraisal Tool (MMAT) was used to assess the studies that adopted qualitative and mixed methods. In the evaluation process, some aspects of research methodology were assessed such as research design, selection of participants, measurement processes, sources of possible bias, confounding variables, methods used in data analysis and general methodological quality of evidence.^{43,44,45}

Data Synthesis

The findings in the included studies were not directly comparable because of differences in their populations, methods and outcomes. Hence, the present findings were synthesized descriptively and thematically. Quantitative results were summarized descriptively when appropriate; qualitative and mixed-method results were analysed to identify key themes. The findings reached in this synthesis highlight the importance of KAP related AMR, as well as the wider social and structural determinants that influence antibiotic use and AMR-related behaviours in Pakistan.^{46,47,48,49}

The study identified several important themes including education and health literacy, socioeconomic conditions, cultural beliefs, access to healthcare, self-medication, practices of antibiotic dispensing, and institutional and regulatory factors. Previous studies show an interconnectivity of such factors and indicate that they might impact on the inappropriate use of antibiotics and AMR-related behaviours.^{6,8,9,10,11,12,22,23,25,35,42}

Statistical Analysis

Descriptive statistical analysis was performed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). The KAP outcomes reported by the included studies were extracted as percentages and summarized using descriptive statistics. Study-level percentages were used to calculate the arithmetic mean, standard deviation, median, and range for KAP outcomes. Practice outcomes were summarized as appropriate or inappropriate percentages, without pooling, due to differences in populations, settings, tools, samples, and definitions.

Ethical Considerations

This review consisted only of secondary published data, and there has been no contact with humans involved, resulting in no need for primary ethical approval. The ethical guidelines were followed through accurate reporting of the methodology and the results and correct acknowledgement of the originating sources.^{50,51,52,53}

RESULTS

Across the included studies, knowledge and attitudes regarding AMR and antibiotic use were generally more favorable than actual antibiotic-use practices. The evidence primarily assessed individual knowledge, attitudes, and reported antibiotic-use behaviours rather than directly measuring antimicrobial resistance. Inappropriate practices included self-medication, non-prescription antibiotic use, poor treatment adherence, inappropriate dispensing, and empirical prescribing. These behaviours represent potential drivers of unnecessary antibiotic exposure and may contribute to selection pressure and the emergence and spread of AMR.

Study Characteristics and Quality Assessment

This SLR encompassed a total of 10 studies conducted in different parts of Pakistan. The studies included various populations such as community members, students, pharmacy consumers, pharmacists, doctors and other healthcare related populations. The study employed various research methods in this review, including quantitative, qualitative and mixed methods. The detailed JBI quality-assessment results are shown in Table 2. The quality of the methods used in the studies was mostly satisfactory. As far as JBI Critical Appraisal Checklist assessment is concerned, it can be stated that most studies clearly defined their inclusion criteria, described the population and sample well, used valid outcome measures, and conducted proper statistics. However, in some studies, confounding factors were not identified or controlled for. Overall, most studies had high methodology quality, but two studies had moderate quality.

Table 2: Methodological Quality Assessment of Included Studies Using the JBI Critical Appraisal Tool for Analytical Cross-Sectional Studies (n=10).

JBI Checklist	Khan et al. 2021	Nabeel et al. 2024	Shahid et al. 2025	Waseem et al. 2019	Saif et al. 2024	Faizullah et al. 2017	Ashraf et al. 2022	Gillani et al. 2021	Shah et al. 2022	Khan et al. 2020
Were the criteria for inclusion in the sample clearly defined?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the study subjects and the setting described in detail?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was the exposure measured in a valid and reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were objective, standard criteria used for measurement of the condition?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Confounding factors identified?	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial
Were strategies to deal with confounding factors stated?	No	No	No	No	No	No	No	No	No	No

Were the outcomes measured in a valid and reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall Quality Status	High	High	High	Moderate	High	High	High	High	High	Moderate

Note: (Yes = criterion met; Partial = partly met; No = criterion not met).

The MMAT tool was also used to assess methodological quality and risk of bias according to study design. The assessment supported the overall methodological reliability of the evidence included in the review. The MMAT assessment results are presented in Table 3.

Characteristics of the Included Studies

The ten studies showed considerable variation in KAP regarding AMR and antibiotic use in Pakistan. Khan et al. findings (2021) revealed considerable pharmacist knowledge but lack of distinction among antibiotic classes.⁵⁴ Nabeel et al (2024) stated that pharmacists showed knowledge and good attitude but poor dispensing.⁵⁵ Findings of Shahid et al (2025) revealed that the HCPs had poor knowledge and negative practices in dispensing medicine.⁵⁶ Waseem et al. (2019) reported low knowledge regarding AMR among pharmacists.⁵⁷ Saif et al (2024) stated that the public commonly self-medicate and adheres poorly.⁵⁸ Faizullah et al (2017) found out that physicians possess good knowledge, but practices are inappropriate.⁵⁹ Ashraf et al (2022) identified knowledge gaps among practitioners.⁶⁰ Gillani et al (2021), Shah et al (2022) and Khan et al (2020) reported that there exist widespread beliefs, irrational use of medicines, self-medication and poor adherence among the public, students and consumers.^{61,62,63}

Descriptive Findings on Knowledge, Attitudes and Practices

The descriptive synthesis in Table 5 and studies outcome in Table 6 indicated differences amongst the three main KAP areas. The overall average knowledge score stood at 59.88% (SD = 20.49%), suggesting moderate knowledge levels with large differences between studies. The overall average attitude score was 68.52% (SD = 22.48%), showing mostly positive attitudes about correct antibiotic use and AMR avoidance. Contrarily, the practice score was lower, at 59.62% (SD = 17.52%). The distribution of KAP outcomes across studies is shown in Table 6. The findings indicate a gap between KAP while the participants in various studies demonstrated knowledge of AMR and appropriate use of antibiotics, inappropriate practices were prevalent.

Knowledge Regarding Antimicrobial Resistance and Antibiotic Use

Knowledge of AMR and antibiotic therapy showed considerable variation across the studies analysed. Several studies highlighted pervasive misconceptions regarding antibiotic therapy for viral disease and other everyday ailments. In a large community-based study involving 2,106 respondents, 35.4% thought that antibiotics were useful for the treatment of viral diseases, and 47.5% believed that antibiotics could help treat the common cold or flu. About 60% of respondents reported using antibiotics without prescription. Pharmacy customers from Swat Valley had low levels of knowledge about AMR. Many respondents were not aware of the AMR term, while others stated that they kept antibiotics at home and did not respect the recommended dosage.

The lack of knowledge was found among the students and healthcare-related subjects as well. Some studies showed that people did not have proper information regarding the antimicrobial stewardship programs, while future healthcare professionals did not undergo sufficient education in this area. Overall, the findings showed that knowledge was uneven across populations. Higher education and professional training were generally associated with better understanding of antibiotics and AMR.

Table 3: Methodological Quality and Risk of Bias Assessment of Included Studies (n=10) using MMAT Tool.

Study Name	Study Design	MMA T Category	S1	S2	Item 1	Item 2	Item 3	Item 4	Item 5	Score	Overall Qty Rating	Methodological Assessment
Khan et al. (2021)	Mixed - Metho	Category 5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100 %	High Quality	Clear rationale for mixed methods; quantitative survey and thematic qualitative interviews are

Nabeel et al. (2024)	Quantitative Cross-Sectional	Category 4	Yes	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	80 %	High Quality	Pretested questionnaire and appropriate logistic regression analysis in SPSS.
Shahid et al. (2025)	Mixed - Method	Category 5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100 %	High Quality	Strong integration of quantitative survey data and qualitative focus group discussions.
Waseem et al. (2019)	Quantitative Cross-Sectional	Category 4	Yes	Yes	Yes	Moderate	Yes	No	Yes	Yes	60 %	Moderate Quality	Good sample size across 3 groups, but low response rates among pharmacists (27.7%) and doctors (27.7%).
Saif et al. (2024)	Quantitative Cross-Sectional	Category 3	Yes	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	80 %	High Quality	Pre- and post-intervention scores compared with paired t-tests using a validated WHO index.
Faizullah et al. (2017)	Quantitative Cross-Sectional	Category 4	Yes	Yes	Yes	Yes	Yes	Yes	Moderate	Yes	80 %	High Quality	Pre-validated self-administered questionnaire; acceptable response rate (61.50%) among 320.
Ashraf et al. (2022)	Multicenter Cross-Sectional	Category 4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100 %	High Quality	Multicenter sampling across 6 public tertiary teaching hospitals in Lahore using a robust 45.
Gillani et al. (2021)	Quantitative Cross-Sectional	Category 4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100 %	High Quality	Large representative population sample (n=2,106) across Punjab, 50 items validated.
Shah et al. (2021)	Quantitative Cross-Sectional	Category 4	Yes	Yes	Yes	Yes	Yes	Yes	Moderate	Yes	80 %	High Quality	Good comparative study (n=525) between medical and non-medical students; ANOVA.
Khan et al. (2020)	Quantitative Cross-Sectional	Category 4	Yes	Yes	Yes	Moderate	Yes	Moderate	Yes	Yes	80 %	High Quality	High Quality: Unique dataset from Swat (n=399); appropriate non-parametric statistical testing (K-W &

Table 4: Characteristics of Studies Investigating KAP regarding AMR.

Authors & Year	Study Design	Population / Demographics	Sample Size	Study Domain	Key Findings
Khan et al. (2021)	Cross Sectional, Mix	Pharmacists	180	KAP	Good knowledge of AMR but poor in differentiating antibiotic groups; positive attitude; acceptable practice leaning towards
Nabeel et al. (2024)	Cross Sectional	Pharmacists	359	KAP	Adequate knowledge, positive attitude, but poor practices regarding dispensing without prescription.
Shahid et al. (2025)	Cross Sectional Mix	HCPs	326	KAP	Poor knowledge (55.5%), relatively positive attitudes (54.6%), and unfavorable practices (48.3%).
Waseem et al. (2019)	Cross Sectional	Pharmacists	385	K & A	Highlighted Poor AMR knowledge; pharmacist absence and stewardship awareness highlighted significant gaps
Saif et al. (2024)	Cross Sectional	General Population	493	KAP	39.2% practiced self-medication; 42% non-adherent to treatment; significant improvement noted after video-based
Faizullah et al. (2017)	Cross Sectional	Physicians	320	KAP	Generally good knowledge but flawed practices; 94.1% cited failure to complete courses as a cause of resistance.
Ashraf et al. (2022)	Cross Sectional	Clinicians	336	KAP	Knowledge is relatively poor regarding spectrum/choice; clinicians are aware of shortcomings and desire improvement.
Gillani et al. (2021)	Cross sectional	General Population	2106	KAP	High inappropriate use; 47.5% believed antibiotics treat cold/flu; nearly 60% practiced self-medication.
Shah et al. (2022)	Cross Sectional	Students	525	KAP	14% agreed antibiotics treat viral infections; 54% bought antibiotics without prescription.

Khan et al. (2020)	Cross Sectional	Consumers	399	KAP	Poor to moderate knowledge; 66.7% did not follow prescribed dosage regimen; storage of antibiotics at home was common.
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Table 5: Descriptive Statistics of identifies Studies (n=10).

Determinants	Study Regional Distribution	Study Design	Sample Population	Study Sample Size
Number of Studies	10	10	10	10
Mean	2.20	1.20	2.60	523.70
Std. Error of Mean	.327	.133	.427	179.485
Std. Deviation	1.033	.422	1.350	567.581
Range	3	1	3	1926
Minimum	1	1	1	180
Maximum	4	2	4	2106

Table 6: Distribution of KAP Outcomes among included Studies (n=10).

Studies	Knowledge		Attitude		Practice	
	Good Adequate Knowledge (%)	Moderate / Poor Knowledge (%)	Positive Attitude (%)	Negative / Poor Attitude (%)	Good Practice (%)	Poor Practice (%)
Khan et al. (2021)	65.60%	31.10%	90%	10%	52.80%	47.20%
Nabeel et al. (2024)	83.00%	17.00%	81.90%	18.90%	51.00%	49.00%
Shahid et al. (2025)	44.50%	55.50%	54.60%	45.40%	59.90%	40.10%
Waseem et al. (2019)	44.40%	55.60%	38.20%	61.80%	76.60%	23.40%
Saif et al. (2024)	68.40%	31.60%	50.70%	49.30%	54.76%	45.24%
Faizullah et al. (2017)	85.00%	15.00%	91.85%	8.15%	93.70%	6.30%
Ashraf et al. (2022)	34.00%	66.00%	81.34%	18.65%	68.00%	32.00%
Gillani et al. (2021)	52.50%	47.50%	31.60%	68.40%	40.40%	59.60%
Shah et al. (2022)	86.00%	14.00%	85%	15%	65.70%	34.30%
Khan et al. (2020)	35.00%	65.00%	80%	20%	33.30%	66.70%
Mean	59.8800	39.8200	68.5190	31.5600	59.6160	40.3840
Std. Error of Mean	6.47841	6.51673	7.10723	7.09113	5.54138	5.54138
Median	59.2500	39.5500	80.6700	19.4500	57.3300	42.6700
Mode	34.00 ^a	14.00 ^a	31.60 ^a	8.15 ^a	33.30 ^a	6.30 ^a
Std. Deviation	20.48652	20.60770	22.47503	22.42412	17.52339	17.52339

Variance	419.697	424.677	505.127	502.841	307.069	307.069
Range	52.00	52.00	60.25	60.25	60.40	60.40

Attitudes Towards Antibiotic Use and Antimicrobial Stewardship

The studies reviewed showed that respondents held generally positive attitudes towards the responsible use of antibiotics; however, having a positive attitude did not always mean that the practices were proper. Indeed, some participants recognised AMR as a serious public health issue and supported the responsible antibiotic usage. Likewise, medical specialists and pharmacy staff expressed their concerns about inappropriate antibiotic use. Unfortunately, such factors as patients' expectations, customer pressure, finances, and working conditions influenced the decision process. So, the attitude-behaviour gap was very significant in this case, as the participants agreed that they should use antibiotics properly, but this knowledge was often not applied in practice because of various social and medical factors.

Practices Related to Antibiotic Use and Dispensing

Inappropriate antibiotic practices were frequent in the studies included. The common practices were self-medication, buying antibiotics without prescription, wrong dispensing, poor adherence to treatment, and empirical prescribing. The self-medication was observed in 60% of some communities. In one study, 67% of the antimicrobials were requested without prescription. It appears that the main reason why people do not get treatment from the professionals is money and the cost of consultation. Buying without prescription was another issue. Pharmacy workers said they were pressured by customers and were influenced by commercial/financial pressures. Non-adherence to treatment was another big issue. Six out of ten pharmacy patients neglect taking antibiotics correctly. There is evidence that people also keep antibiotics for future use. The results clearly showed that knowledge doesn't always lead to good practices.

Social and Structural Determinants of KAP

Thematic synthesis (Table 7) outlines four categories of social and structural factors that affect KAP related to AMR and antibiotic use. These are: education and health literacy, socioeconomic status, access to healthcare, and institutional and professional factors. Education and training generally help build knowledge and responsibility, although they may also help do some, although not all, inappropriate practices. Poverty and financial constraints affect the means of seeking healthcare and often result in visits to a pharmacy for self-medication without prescriptions. Insufficient and unaffordable healthcare also results in inappropriate use of antibiotics. Prescribing and dispensing of antibiotics is also affected by institutional and professional factors, such as patient expectations, and the lack of knowledge, uncertainty in diagnosis, and commercial interests in the practice of medicine and weak implementation of regulations.

Table 7: Thematic Synthesis of Findings on KAP and Determinants Regarding Antimicrobial Resistance (n = 10).

Main Theme	Sub-theme	Summary of Findings	Supporting Studies	Frequency (n=10)
Knowledge regarding AMR	Awareness of AMR	Most studies reported moderate to high knowledge of AMR and appropriate antibiotic use; however, important knowledge gaps remained among community members and some healthcare professionals.	Khan et al. (2021); Nabeel et al. (2024); Shahid et al. (2025); Waseem et al. (2019); Saif et al. (2024); Faizullah et al. (2017); Ashraf et al. (2022); Gillani et al. (2021); Shah et al. (2022); Khan et al. (2020)	10
	Misconceptions about antibiotics	Several studies identified misconceptions regarding the effectiveness of antibiotics against viral infections, inappropriate indications, and the development of antimicrobial resistance.	Gillani et al. (2021); Khan et al. (2020); Saif et al. (2024); Shahid et al. (2025)	4
Attitudes toward antibiotic use and AMR	Recognition of AMR as a public health issue	Healthcare professionals and pharmacists generally demonstrated positive attitudes towards AMR prevention and acknowledged the importance of rational	Khan et al. (2021); Nabeel et al. (2024); Faizullah et al. (2017); Ashraf et al. (2022); Shah et al. (2022)	5

		antibiotic use.		
	Support for antimicrobial stewardship	Most professional groups supported educational initiatives, antibiotic stewardship programs, and policies promoting rational antibiotic prescribing.	Khan et al. (2021); Nabeel et al. (2024); Waseem et al. (2019); Ashraf et al. (2022); Faizullah et al. (2017)	5
Practices related to antibiotic use	Appropriate antibiotic use	Appropriate practices such as completing prescribed antibiotic courses and following medical advice varied considerably across studies, with reported good practice ranging from approximately 33% to 94%.	All included studies	10
	Self-medication with antibiotics	Self-medication, purchasing antibiotics without prescriptions, and discontinuing treatment early remained common among community participants and consumers.	Gillani et al. (2021); Khan et al. (2020); Saif et al. (2024); Waseem et al. (2019)	4
	Patient counselling and dispensing practice	Pharmacists emphasized counselling patients regarding antibiotic adherence and rational use, although implementation varied between studies.	Khan et al. (2021); Nabeel et al. (2024)	2
Factors influencing KAP	Educational status	Higher educational attainment was consistently associated with better knowledge, more positive attitudes, and improved antibiotic-use practices.	Saif et al. (2024); Shah et al. (2022); Gillani et al. (2021); Waseem et al. (2019)	4
	Professional training and experience	Healthcare professionals with greater clinical experience or formal AMR training demonstrated superior knowledge and prescribing practices.	Faizullah et al. (2017); Ashraf et al. (2022); Khan et al. (2021); Nabeel et al. (2024)	4
Recommendations for improving AMR control	Public awareness programs	Most studies recommended nationwide public education campaigns to improve awareness regarding appropriate antibiotic use and antimicrobial resistance.	Khan et al. (2021); Waseem et al. (2019); Saif et al. (2024); Gillani et al. (2021); Khan et al. (2020)	5
	Continuing professional education	Several studies recommended regular AMR training, updated prescribing guidelines, and continuing education for physicians and pharmacists.	Faizullah et al. (2017); Ashraf et al. (2022); Khan et al. (2021); Nabeel et al. (2024)	4

The outcome showed there is a similar gap between knowledge and practice in various population groups. Although knowledge of and attitudes towards AMR were generally rated positively or at least not too poorly, improper practices were widespread. Figure 2 illustrates the main themes identified across the included studies. Thus, the findings indicate that antibiotic-related behaviour is a result of more factors than just individual knowledge. Social and structural conditions, such as education, poverty, access to healthcare, professional pressure, institutional shortcomings and regulations are also important in shaping antibiotic use and behaviour related to AMR.

DISCUSSION

This systematic review identified a large gap in Pakistan between knowledge, attitudes, and actual practices pertaining to antibiotics. Overall, ten studies showed that knowledge and attitudes were better than the actual practice. The mean score for adequate knowledge was 59.88%, the mean score for positive attitudes was 68.52%, and 40.38% of the practices were considered inappropriate. These numbers must be treated with caution because included studies varied regarding the population, setting, sample size, measurement instruments, and the definition of KAP. Most of the included studies focused on knowledge, attitudes, and practices regarding the use of antibiotics, whereas the direct measurement of microbiological AMR was lacking. Therefore, inappropriate use of antibiotics must not be confused with AMR. Behaviors such as self-medication, use of antibiotics without a prescription, inappropriate dispensing, poor compliance, and unnecessary prescribing may lead to increased selection pressure of antibiotics, and consequently, increased AMR.

These results show the gap between knowledge and practice of AMR persists in both community and professional environments. In health care practice, Khan et al. noted good AMR knowledge among pharmacists, and Nabeel et al. found good attitudes and even worse antibiotic dispensing practices.^{54,55} Similarly, Faizullah et al. noted good knowledge among physicians of antibiotic use, yet inappropriate behavior, and Ashraf et al. noted gaps in knowledge of antibiotic spectrum and choice.^{59,60} Resource limitations and the clinic culture interact with the balance of the professional factors and the need to address patient expectations and clinical demands to influence practice. In the community, poor adherence to treatment, self-medication, poor storage of antibiotics, non-prescription access to antibiotics and misunderstanding of viral illness, were all cited. It is clear from these studies that the poor use of antibiotics is a systemic problem that exists in both the professional and community settings.

Knowledge and Health Literacy

The review found moderate knowledge of AMR and antibiotic use, with better understanding among health professionals and students, although misconceptions persisted. According to the study, there is a moderate level of awareness on AMR and the use of antibiotics, with comparatively higher knowledge among health professionals and students. Nevertheless, they still have some misconceptions. According to Gillani et al., 47.5% of the people surveyed felt that antibiotics can treat colds or flu.⁶¹ Other studies (Kosiyaporn et al and Hawkins et al.) have dealt with the same issue and concluded that people in different countries have different levels of knowledge, meaning that providing people with information does not always lead to making the right decisions regarding the use of antibiotics.^{18,19} Recent evidence indicates that health-literacy interventions can improve antibiotic-related knowledge and decision-making, particularly among younger populations.²⁵

Attitudes and the Knowledge–Practice Gap

A major finding of this review was gap among attitude and antibiotic use. The mean positive attitude score (68.52%) was higher than the proportion of participants appropriate practices, meaning that there is no guarantee that positive attitudes towards antibiotic use will result in responsible use of antibiotics. This finding agrees with Hawkins et al. and their response of knowledge, attitudes, beliefs and behaviors related to antibiotics may not be completely harmonized.¹⁹ Beliefs are not the only factor that affect the knowledge-practice gap. Among professionals in LMICs, there are barriers to antimicrobial stewardship that are related to insufficient staff, poor resources, and poor organization.^{28,29} Therefore, the attitudes and knowledge gaps need not be the only target of interventions, but also the context where healthcare professionals make decisions about antibiotic prescribing.

Self-Medication and Non-Prescription Access

Self-medication and non-prescription access to antibiotics were major contributors to inappropriate antibiotic use in Pakistan. Statistics by Saif et al., 39.2% of the surveyed people employed self-medication, whereas Gillani et al. used a far larger figure of 60%.^{58,61} Meanwhile, Shah et al. obtained a result of 54% of the surveyed students receiving antibiotics without prescription.⁶² This issue indicates the serious and ongoing problems regarding human behaviour and government regulations. According to research conducted globally, Gashaw et al. discovered that the pooled prevalence of self-medication with antibiotics was equal to 43% according to 71 studies.¹⁵ Stricter regulation, improved pharmacy practices, affordable healthcare, and better access to qualified professionals are therefore essential.¹⁶

Social and Socioeconomic Determinants

Antibiotic-related behaviors are also influenced by socioeconomic factors. Some may self-medicate because of financial constraints which limit the ability to afford to see a health care professional, have tests done, or complete treatment. Collignon et al. show how socioeconomic and anthropological factors have an effect globally on AMR.²² Hussain et al. in their study on Pakistan, linked multidimensional poverty with the phenomenon of antibiotic resistance and also linked socioeconomic factors with the phenomenon of antibiotic resistance.²³ Due to the impacts of structural inequities, knowledge-focused interventions are likely to have minimal impact.

Healthcare Systems, Stewardship, and Regulation

In addition to healthcare-system factors, professional factors also need to be considered. Several of the studies have identified insufficient knowledge among health care professionals regarding antibiotic selection and stewardship.^{57,60} Therefore, antimicrobial stewardship must be integrated into routine practice. Diagnostic uncertainty is yet another important factor, and antibiotic prescribing is likely to become more frequent with limited access to reliable and rapid diagnostics.²⁶ Building strong diagnostics within primary care is likely to

decrease the exposure of patients to antibiotics.³³ Addressing all the components of stewardship, including organizational support, is also critical.^{28,29} Stewardship directly engages pharmacists, as pharmacies are important sites of access.⁶⁹ Pakistan requires stronger implementation of prescription requirements, monitoring of antibiotic dispensing, and coordination between regulatory authorities, healthcare institutions, and pharmacy professionals. Bajwa et al. highlighted the role of drug inspectors in implementing the national AMR strategy, supporting the need for stronger regulatory oversight.³⁵

Integrated Interpretation

Pakistan's inappropriate antibiotic use cannot be fully attributed to lack of education. Knowledge and attitudes are important, but social and economic factors, healthcare access, professional practices, diagnosis, pharmacy behaviour, and regulations also affect antibiotic use. Self-medication, medicines without prescriptions, over-prescribing, and poor compliance all increase the exposure to antibiotics, and increases the selection pressure as a result, thereby increasing the risk of AMR. Therefore, the existing knowledge–practice gap is the result of numerous individual and structural factors. A comprehensive, integrated approach towards AMR control combines health-literacy, antimicrobial stewardship, responsible pharmacy practice, accessible diagnostics, professional education, and affordable healthcare, along with effective regulatory measures.

Implications for AMR Control in Pakistan

The findings suggest that no single intervention is likely to substantially reduce inappropriate antibiotic use in Pakistan. Public education should continue but should be combined with other initiatives such as health-literacy interventions, regular training of the health professions, antimicrobial stewardship, good pharmaceutical regulation and control, healthcare provision, diagnostics, and effective pharmaceutical services.

Community-based initiatives should focus on the misconceptions surrounding antibiotic use, self-medication, compliance with treatments, and the problems associated with the use of leftover antibiotics. Prescribing of antibiotics should be regulated at pharmacy level, and pharmacists should be required to continue developing their skills in antibiotic stewardship and appropriate dispensing. Improving access to affordable consultations and diagnostics at the healthcare system level should help to reduce the problem of self-treatment and empirical prescribing. Additional robust monitoring and enforcement of existing regulatory frameworks on antibiotic use are required at the policy level.

Most AMR strategies in Pakistan and similar countries should focus on the health system and health services using a holistic 'one-health' approach.^{22,23} The social-economic context most likely influences the use of antibiotics, rather than knowledge, as illustrated by the evidence from Pakistan and most LMICs.

Strengths and Limitations

This review has several strengths. First, it followed a systematic approach as per the PRISMA 2020 recommendations, which included developing predefined eligibility criteria, evaluating the methodological quality of included studies, and employing both quantitative and qualitative synthesis. This review included different population groups, thereby allowing comparison of community members, students, pharmacists, practitioners, and all other healthcare professionals.

This search was restricted to PubMed/MEDLINE and Scopus, so publications indexed by other databases may have been omitted. Second, only articles published in English and peer-reviewed were used, which introduced bias caused by publication and language. Third, most of the studies were cross-sectional studies, therefore, causation is limited. Fourth, many of the studies varied regarding the population, setting, sample size, KAP instruments, definitions of outcomes, as well as the cut-off for good knowledge and adequate practice. Furthermore, most studies evaluated the KAP and antibiotic use rather than microbiologically confirmed AMR. In this regard, the findings are more probabilistic and may overestimate the relative risk of AMR rather than measuring the burden or extent of AMR.

Future Directions

Future studies will be able to fill the gaps of the existing evidence base by encompassing longitudinal studies, intervention studies, and prescription audits. These studies and audits will determine the effectiveness of education campaigns by measuring if knowledge and attitudes have consequently changed the behavior of prescribers when considering the appropriate use of antibiotics. There are more objective measures than self-reported practices such as prescription, pharmacy, and simulated client studies.

Standardized and validated KAP instruments for Pakistan would help facilitate comparability across studies. It is important to understand how varying socioeconomic status, affordability of health care and diagnostics, pharmaceutical marketing, patient and pharmacy expectations, and pharmacy incentives contribute to antibiotic usage. To what extent an integrated educational, regulatory, and health system approach is more impactful than an educational approach on its own should be explored through intervention studies.

It is also imperative that studies shift beyond human KAP to the One Health Framework to understand the interactions of AMR across human health, veterinary, agricultural, and environmental sectors. A more holistic approach to understanding the drivers and pathways of antibiotic resistance and use in Pakistan will require integrating varying antibiotic use and resistance data across these sectors.

CONCLUSION

This systematic review demonstrates a substantial knowledge–practice gap regarding AMR and antibiotic use in Pakistan. Although knowledge and attitudes were generally more favourable than reported practices, self-medication, non-prescription dispensing, inappropriate prescribing, and poor treatment adherence remained common. These behaviours are influenced not only by individual knowledge but also by healthcare access, socioeconomic conditions, patient expectations, commercial pressures, and regulatory weaknesses. Therefore, reducing inappropriate antibiotic use requires an integrated approach combining public education, professional training, effective pharmacy regulation, accessible healthcare and diagnostics, and sustainable antimicrobial stewardship interventions.

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