# Evaluating the Impact of the Kerala Antibiotic Resistance Strategic Action Plan: A Questionnaire-Based Study Among Community Pharmacists in Wayanad

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## Abstract

***Background:*** Antimicrobial resistance is a highly serious healthcare-related issue of this era. Considering the burden of the global crisis of antimicrobial resistance, various strategies have been adopted worldwide. The Kerala Antibiotic Resistance Strategic Action Plan (KARSAP) is an action plan adopted in Kerala. It is the first of its kind, initiated by a state in India to tackle this global issue. Our objective is to evaluate the impact of the implementation of KARSAP, focusing on pharmacists' knowledge and awareness of antibiotics and antibiotic resistance.

***Methods:*** A questionnaire-based study was conducted among community pharmacies in a locality in Kerala, with a sample size of 50. The questionnaire was distributed by visiting each pharmacy and also involved a personal interview with the drug dispensers. The questionnaire was validated prior to the study. The results were statistically analysed to reach a conclusion.

***Results:*** We observed a 100% response rate in our study. The majority of the respondents were registered pharmacists, and 26% of unqualified persons were also involved. Despite the rising crisis of antimicrobial resistance, many respondents are still unaware of antimicrobial resistance, and only 60% are aware of it. Although over-the-counter sales of antibiotics have reduced, people still request them. As a measure to reduce the burden of this crisis, the government of Kerala has initiated a policy named KARSAP. However, 68% of our study population was unaware of the key policy itself.

***Conclusion:*** While some pharmacists possess a solid understanding of antimicrobial resistance, the broader pharmacist community remains largely uninformed about this issue. The study also identifies the areas of improvement necessary to make KARSAP a complete success.

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**Keywords:** Antibiotic Resistance; Antibiotics; Dispensing; KARSAP; Over-The-Counter; Pharmacist; Prescription

## Introduction

The confidence that antibiotics provided in the treatment of serious and fatal diseases was immense (1). Unfortunately, this led to the overconsumption of antibiotics and the emergence of the dreadful phenomenon of antibiotic resistance. Misuse and overuse of antibiotics, overprescribing, patients not completing the course of therapy, taking antibiotics for diseases that cannot be cured with them, use of antibiotics in veterinary medicine for treating infections and as growth promoters, poor sanitation practices, and inadequate infection control in hospitals and clinics are all contributors to antibiotic resistance (2).

Implementation of recommended steps, such as adopting

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antibiotic stewardship programs; improving diagnosis, tracking, and prescribing practices; optimizing therapeutic regimens; and preventing infection transmission, is expected to be effective in managing this crisis. Increasing collaboration among stakeholders to establish policies, initiatives, and investments in new agents to battle antibiotic resistance is also promising. Therefore, various policies and strategies have been introduced globally, as well as at the national and state levels.

Strategies to tackle antimicrobial resistance are largely based on Antimicrobial Stewardship, which involves promoting and monitoring the use of antimicrobials to preserve their effectiveness (3). The National Action Plan in India outlines the priorities and implementation strategies for curbing antimicrobial resistance. In light of this, the Government of Kerala launched a state action plan known as the Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) in 2017 (4). This plan outlines six strategic priorities to be implemented to tackle the severity of antimicrobial resistance in the state.

The extent to which these strategic priorities have been implemented must be assessed to evaluate the impact of the action plan. Thus, we focus on pharmacists' awareness of antibiotic resistance and stewardship programs, as well as the actions taken by regulatory authorities to curb this crisis. We also aim to understand antibiotic prescribing and dispensing trends to determine whether overuse and inappropriate prescribing continue, and how these may correlate with antibiotic resistance.

## Methods

### *Study design*

A cross-sectional study was conducted by distributing a questionnaire and conducting personal interviews among pharmacy practitioners of various community pharmacies in Mananthavady, Kerala, India. The background and purpose of the questionnaire were explained before its administration. The study was performed without interrupting the proper functioning of the drug stores and in compliance with laws and institutional guidelines.

### *Study population*

The study population included drug dispensers in community pharmacies in Mananthavady. Data were collected through convenience sampling. The sample size was 50, and we received a 100% response rate.

### *Data collection*

The study was conducted in January 2024 in Mananthavady, Kerala. Responses were collected and then converted into spreadsheets for descriptive analysis. Our survey questionnaire comprised demographics, including educational qualifications, knowledge about antibiotic therapy, trends of antibiotic usage among the population, knowledge about antibiotic resistance, training in antibiotic resistance and stewardship, and inspections and notices by governing authorities on antibiotic dispensing. The questionnaire was prepared by the researchers themselves, referring to similar studies (5).

### *Validation of the questionnaire*

The questionnaire was modified several times before the study to meet the required standards. Validation was performed by experts with experience in pharmacy practice and regulation, as well as subject experts and a biostatistician, who reviewed the structure and content validity. The experts involved in the validation process came from both academic and practical backgrounds in the field of pharmacy. Cronbach's alpha value was calculated using the Statistical Package for Social Sciences (SPSS), and a value greater than 0.7 was obtained.

### *Inclusion criteria*

One drug dispenser in each community pharmacy, including registered pharmacists and other unqualified persons involved in drug dispensing, regardless of age, gender, or educational qualification, was included.

### *Exclusion criteria*

Clinical pharmacists, pharmacists employed in hospital pharmacies, and pharmacists working in other areas of practice, such as industry and academia, were excluded.

### *Data analysis*

Data were represented as frequencies and percentages using a frequency distribution table and a pie chart. Statistical analysis was conducted through descriptive analysis using SPSS.

### *Ethical considerations*

This study was conducted strictly adhering to the ethical guidelines. Prior to the commencement of the study, all participants were informed of the objectives and significance of the study. Informed consent was obtained from each participant prior to data collection, and the confidentiality of all participating members was ensured. The study received ethical approval from the Institutional Innovation and Research Committee (Approval No: 73// IIRC/DMCP/2023) of Dr. Moopen's College of Pharmacy, Wayanad. Confidentiality of all participants was ensured.

### *Method adopted*

Questionnaire-based study: The questionnaire comprised 15 multiple-choice questions about antibiotics, antibiotic resistance, rules and regulations regarding antibiotics, and

trends in antibiotic consumption. Responses were collected through personal interviews with drug dispensers employed at drug stores without disrupting their regular functioning. These data were then entered into spreadsheets for further analysis, and the percentage of each response was calculated. The percentage responses were then studied in correlation with other available studies and articles, and conclusions were drawn.

## Results

### *Demographics of the dispensers*

Out of the 50 responses gathered, the majority were female, with the largest age group falling within the 25–35 years range. The qualifications of the respondents varied, with most holding a diploma in pharmacy, while some individuals were not qualified as pharmacists, which is a matter of concern. The demographic attributes of the respondents are provided in Table 1.

**Table 1. Demographics of the dispenser**

| Characteristics | | N (%) |
|---|---|---|
| **Sex** | Females | 30 (60%) |
| | Males | 20 (40%) |
| **Age** | <25 | 4 (8%) |
| | 25-35 | 20 (40%) |
| | 36-45 | 7 (14%) |
| | >45 | 19 (38%) |
| **Qualification** | D.Pharm | 22 (44%) |
| | B.Pharm | 14 (28%) |
| | M.Pharm | 1 (2%) |
| | Unqualified | 13 (26%) |
| **Professional** | Pharmacist | 37 (24%) |
| | Apprentice (non-pharmacist) | 13 (26%) |

### *Knowledge about antibiotic resistance and the regulations regarding antibiotic sales*

Among the 50 respondents, only 30 (60%) were aware of antibiotic resistance, which is low considering its serious impact on healthcare. To improve antibiotic use and awareness of antimicrobial resistance (AMR), Kerala introduced KARSAP, but only 16 (32%) knew about it, showing limited reach.

Respondents noted that strict rules prohibit dispensing antibiotics without a prescription, with inspections conducted to enforce compliance. Some mentioned a proposed system of stamping prescriptions with "drug issued" to prevent repeated use, but this was not implemented.

Most respondents (44, 88%) were aware of a recent circular warning that both pharmacist and store licenses would be revoked for dispensing antibiotics without a prescription. Still, awareness gaps remain: two (4%) were unsure about the regulations, and six (12%) were unaware of any circulars. Training sessions on antibiotic resistance are conducted by the state pharmacy council, but only 32 (64%) knew about them, and just 24 (48%) had attended. This highlights limited awareness and participation despite the growing crisis. These responses are detailed in Table 2.

**Table 2. Knowledge about Antibiotic resistance and the regulations regarding the sale of antibiotics**

| Knowledge about Antibiotic resistance and the regulations regarding antibiotic sales | N (%) |
|---|---|
| Awareness of the antibiotic resistance crisis | 30 (60%) |
| The existence of any rule for regulating the OTC sale of antibiotics | 48 (96%) |
| Issue of circulars or notifications regarding the OTC sale of antibiotics | 44 (88%) |
| Conduct of inspections for monitoring the OTC sale of antibiotics | 41 (82%) |
| Conduction of training and awareness classes about antibiotic resistance by the authorities | 32 (64%) |
| Attended the training classes that were conducted | 24 (48%) |
| Awareness of KARSAP | 16 (32%) |
| Provide patient counseling | 16 (32%) |

### *Antibiotic dispensing trend*

We sought to understand the trend in antibiotic procurement. Despite the regulations prohibiting the dispensing of antibiotics without a prescription, a significant portion of the public remains uninformed about this rule. Forty-four (88%) respondents reported that people frequently request antibiotics without a prescription; however, none dispensed them without one. This reflects commendable adherence to regulations by pharmacists but also underscores the public's insufficient awareness regarding the proper use of antibiotics, emphasizing the necessity of public education on this matter. Among the establishments included in our study, 26 (60%) also provided veterinary medicines. Furthermore, only two (4%) reported instances of individuals seeking to obtain veterinary antibiotics over the counter. This indicates that the demand for antibiotics is predominantly for human rather than veterinary use. These findings are summarised in Table 3.

**Table 3. Antibiotic dispensing trend**

| Antibiotic dispensing | N (%) |
|---|---|
| People procure antibiotics as OTC | 44 (88%) |
| Stores dispense veterinary medicines | 26 (60%) |
| People request veterinary antibiotics as OTC | 2 (4%) |

OTC: Over the Counter

Figure 1 illustrates the distribution of antibiotics as over-the-counter (OTC) based on the average number of units dispensed per day across surveyed pharmacies. The data highlight the prevalence of different dispensing ranges, reflecting accessibility and potential misuse of antibiotics in the community.

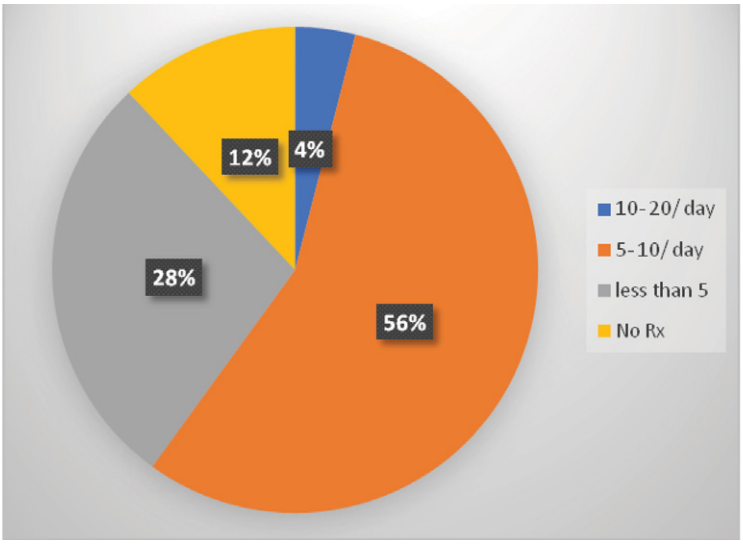


**Figure 1. Distribution of Antibiotics Over-the-Counter (OTC) in a daily range in Community Pharmacies**

### *An enquiry into the largely demanded antibiotics*

The study found that the most commonly purchased OTC antibiotics were azithromycin (23, 46%) and beta-lactams (14, 28%). Eight (16%) participants reported that people often request antibiotics by naming an illness rather than a drug. Most visits for OTC antibiotics were for cough, flu, cold, sore throat, or respiratory infections, explaining the demand for azithromycin and beta-lactams. Respondents noted that many people choose these based on past prescriptions for similar symptoms.

For outpatients, beta-lactams were the most frequently prescribed, followed by azithromycin. In veterinary use, however, ceftriaxone and enrofloxacin were most common, with cephalexin also frequently prescribed. These details are provided in Tables 4.

**Table 4. Characteristics of the antibiotics**

| **Highly requested antibiotic as OTC** | **N (%)** |
|---|---|
| Beta-lactam antibiotics | 14 (28%) |
| Azithromycin | 23 (46%) |
| Asking about the disease | 8 (16%) |
| **Mostly prescribed antibiotics** | **N (%)** |
| Beta-lactam antibiotics | 34 (68%) |
| Azithromycin | 14 (28%) |
| Others (cefixime) | 2 (4%) |
| **Commonly prescribed antibiotics for veterinary use** | |
| Cephalexin | 5 (19.2%) |
| Ceftriaxone | 8 (30.7%) |
| Enrofloxacin | 8 (30.7%) |
| Ciprofloxacin | 2 (7.6%) |
| Others | 3 (11.5%) |

### *Efficiency in patient counselling*

Patient counselling is an important responsibility for pharmacists, especially when dispensing antibiotics. However, most respondents reported not providing counselling. Only 16 (32%) said they did so, and this was limited to dosage and duration, without covering side effects or precautions. This was largely due to a lack of knowledge among pharmacy staff. This gap contributes to misuse, including patients not completing prescribed antibiotic courses.

### *Knowledge regarding the contributing factors of antibiotic resistance*

Only 30 (60%) of the respondents were aware of the phenomenon of antibiotic resistance, but most could not define it. When asked about the contributing factors, seven (38%) identified patients not completing the course of antibiotic therapy, and two (4%) each pointed to overuse and overprescribing of antibiotics. Only 19 (14%) responded correctly that all the factors mentioned contribute to resistance. Meanwhile, 20 (40%) remained unaware of the extent of resistance prevailing. These results are presented in Table 5.

**Table 5. Knowledge regarding the contributing factors of antibiotic resistance**

| **Reasons for antibiotic resistance** | **N (%)** |
|---|---|
| Incomplete course of antibiotics | 7 (38%) |
| Overuse of antibiotics | 2 (4%) |
| Overprescribing of antibiotics | 2 (4%) |
| All of the above | 19 (14%) |

## Discussion

This study was conducted to assess pharmacists' awareness of antibiotic resistance and to evaluate how far the objectives

of KARSAP have been implemented in Kerala. The study examined the qualifications of dispensers employed in retail drug stores, pharmacists' knowledge regarding antibiotics and antibiotic resistance, existing regulations on the sale of antibiotics, and trends in antibiotic consumption and sales. This study is the first of its kind, unlike other studies that focus solely on pharmacists' knowledge of antibiotics and OTC drug use.

The study found that most pharmacists in retail drug stores hold a Diploma in Pharmacy, indicating lower qualifications compared to pharmacy graduates. A similar study conducted by Barker AK et al. observed the same trend, wherein diploma holders constituted a major proportion in community pharmacies (6). Graduates and postgraduates often avoid retail roles due to low wages and a lack of respect in the field, instead pursuing advanced degrees and higher-level positions. To attract more qualified pharmacists to retail settings, wages and public perception must be improved (7). It is alarming that 26% of those dispensing drugs are unqualified, despite regulations in India allowing only licensed pharmacists to do so (6,8). Studies in other countries have shown similar findings, with unqualified and untrained dispensers running pharmacies (9,10). This not only reduces job opportunities for qualified professionals but also poses serious risks to patient safety, as unqualified staff often lack knowledge of drug interactions, adverse effects, and proper dispensing practices (11). To address this, stricter inspections, enforcement of regulations, and better wages for pharmacists are essential to reduce reliance on unqualified personnel (12).

From our study, only 60% of respondents were aware of antibiotic resistance, and few had a clear understanding of it. This limited awareness may be due to a lack of qualifications or insufficient training, as 40% remained unaware of the issue — a serious gap that cannot be overlooked. A study by Peiffer et al. found that educated and experienced pharmacists were more receptive to antimicrobial stewardship interventions, highlighting the association between educational qualifications and awareness of antibiotic resistance, which can confirm our findings (13). Unqualified personnel may inadvertently contribute to antibiotic resistance by failing to provide adequate patient counselling when dispensing antibiotics due to insufficient knowledge. This lack of counselling can lead to patients misusing antibiotics, such as skipping doses or not completing prescribed courses, thereby contributing to antimicrobial resistance. A study by Asghar et al. found that non-pharmacists contributed to inappropriate antibiotic dispensing, which aligns with our findings (9). Incomplete knowledge can cause pharmacists to dispense antibiotics irrationally, further exacerbating AMR (14).

Our study also indicated that training classes are conducted by state pharmacy councils during license renewal and awareness weeks, yet many pharmacists are unaware of them. Only 48% of those informed actually attended, often citing time constraints. Authorities must ensure these sessions are accessible to all, provide alternatives for those unable to attend, and make participation mandatory, with consequences for non-compliance. For example, in the United Kingdom, pharmacy technicians must undergo training to be registered (15). A detailed register of pharmacy technicians is maintained in the UK, and every technician authorized to work in community pharmacies is required to renew their registration annually with the General Pharmaceutical Council (16). Such strict measures can bring about better compliance.

Improper use, incomplete therapy, and overuse are key contributors to antimicrobial resistance (17). While most respondents identified some causes in our study, only a few answered accurately, indicating partial knowledge but a lack of clarity. This gap can be addressed through targeted training, awareness sessions, informational leaflets, and social media campaigns (18). The lack of continuous professional development opportunities, as well as the absence of revisions or updates in the pharmacy curriculum, may contribute to this lack of awareness. Therefore, it is necessary to consider modifying the curriculum to align with practice requirements and provide a more practical approach. A study by Ansari indicated that a major limitation among pharmacists was keeping their knowledge updated (19). These findings highlight the need for ongoing professional development and on-the-job training for community pharmacists to address these issues.

KARSAP was launched by the Government of Kerala in 2018 to combat antibiotic resistance. It mirrors the National Action Plan and the Global Action Plan launched to curb the same issue. KARSAP is composed of six strategic priorities, including conducting awareness and training on antibiotic resistance, improving understanding, strengthening knowledge through surveillance, infection prevention and control, optimizing antibiotic use, and promoting research, innovations, and collaborations (20). However, our study revealed a lack of awareness of KARSAP among most pharmacists. This also indicates how uninformed and outdated the community of retail pharmacies remains. Therefore, KARSAP must be included in the pharmacy curriculum for budding pharmacists.

Launching policies alone is not enough to curb this crisis; proper implementation and active follow-up are essential. The rigorous enforcement of regulations concerning OTC sales of antibiotics has proven effective in decreasing non-prescription use in Brazil, Chile, South Korea, and Mexico

(21-23). This aligns with a systematic review by Jacob TG et al., which evaluated the effect of law enforcement on reducing OTC antibiotic sales in low- and middle-income countries. The study concluded that regulations requiring prescriptions are effective but insufficiently enforced (24). This highlights the necessity of multifaceted interventions targeting stakeholders, along with policy evaluations using rigorous study designs.

As part of the Antibiotic Stewardship Program, the National Action Plan, and KARSAP, legislation and circulars were issued mandating that antibiotics must not be dispensed without a prescription (25). Our study confirms the existence of stringent rules in Kerala that antibiotics must be dispensed only on a prescription and that many pharmacists adhere to them. However, OTC sales of antibiotics persist due to factors such as limited knowledge about antibiotics and AMR, fear of losing customers, pressure from patients, requests from regular customers or friends, busy working hours, and concerns about sales (12). Similar findings have been reported in other studies (6,26). A systematic review covering 162 studies across 52 countries found that the overall prevalence of non-prescription antibiotic dispensing in community pharmacies was 63.4%, consistent with our findings (27). In 2024, 342 stores in Kerala faced action for dispensing antibiotics without a prescription (28). The Drugs Control Department of Kerala suspended pharmacy licenses under "Operation AMRITH," an initiative to curb antibiotic overuse (28). More than 400 store licenses were suspended, and 15 stores were issued notices (28). Operation AMRITH (Antimicrobial Resistance Intervention for Total Health) aims to curb OTC antibiotic sales in Kerala by mandating proper record-keeping by pharmacies and allowing the public to report violations (29). These suggest that active inspections are currently taking place. However, our study found that some individuals are unaware of ongoing inspections, reflecting negligence within the field.

In India, antibiotics are classified under Schedule H of the Drugs and Cosmetics Act of 1940 and Rules of 1945. Schedule H drugs cannot be purchased over the counter without a prescription from a registered medical practitioner. Since OTC procurement of antibiotics is one factor contributing to overuse and resistance (30), strict orders are issued by authorities to prevent it. Yet people continue to demand and purchase antibiotics OTC. This can be correlated with a study conducted in Greater London, where people requested antibiotics OTC mainly for cold, flu, and sore throat (31). In our study, 88% of the respondents agreed that people often request antibiotics without a prescription, but none dispensed them without one, even when demanded, which aligns with the study by Kotwani et al. (32). This is a positive indication that pharmacists are adhering to regulations. However, it also reflects how lightly the public regards antibiotics. Therefore, there is a need to raise public awareness that antibiotics must not be procured without a prescription and about the consequences of misuse.

Researchers from the Public Health Foundation of India, in a 2019 study, revealed that a high proportion of antibiotics in the private sector were prescribed for upper respiratory tract infections, such as acute upper respiratory infections (20.4%), cough (4.7%), acute nasopharyngitis (4.6%), and acute pharyngitis (3.9%) (33). This matches our study. Reports also suggest that ceftriaxone, one of India's most prescribed antibiotics, has become increasingly resistant to pathogens (34). A group of researchers in Kerala had earlier flagged the rising resistance to third-generation cephalosporins and demanded immediate action (35).

Patient counselling is an important role of pharmacists, as it provides patients with adequate information regarding dosage, duration of therapy, intervals between doses, possible side effects, and precautions (36). This is especially critical with antibiotics. One of the major causes of antibiotic resistance is patients not completing the course of therapy or not taking antibiotics at the correct intervals. Skipping even one dose reduces the effectiveness of antibiotics and promotes resistance. These errors can be prevented through proper patient counselling. Only 32% of the respondents in our study reported providing adequate counselling when dispensing antibiotics. The main reasons cited were high prescription volumes and patients' impatience to listen. Patient counselling must therefore be strengthened to ensure proper use of antibiotics and reduce misuse.

Strengths and limitations of the study

The primary strength of this study is that it provides insight into the impact of a newer antimicrobial resistance policy, KARSAP, in a locality in Kerala. This study identifies gaps and critical areas for improvement in antimicrobial resistance monitoring and surveillance, which are part of KARSAP. However, it also has certain limitations. Our sample size was 50, and sampling was done through convenience sampling. Many areas were left unrepresented because of this method, restricting the generalizability of our findings. Secondly, the study was conducted only within community pharmacies. Although this was intentional—since community pharmacies are often the first point of contact for medicines rather than hospital pharmacies—the exclusion of clinical and hospital pharmacists may have influenced the generalizability of trends in antibiotic prescribing and dispensing.

## Conclusion

We can conclude that even though some pharmacists have good knowledge and understanding of antimicrobial resistance, a significant level of unawareness still exists

within the pharmacist community. The presence of unqualified personnel in the system is one of the main reasons for this negative impact. Conducting training and awareness programs on antibiotic resistance, along with strict and regular inspections, are necessary to bring about change. Launching action plans alone is not sufficient to curb the crisis; proper implementation is the only way to achieve meaningful impact. Based on our evaluation of the implementation of KARSAP, we conclude that the policy has not been completely successful in this locality, although some improvements have resulted from its adoption. The involvement of unqualified personnel, the lack of knowledge and awareness about the crisis, and the absence of strict regulations and monitoring are the major reasons for the policy's implementation not being 100% successful.

**Conflict of Interest**

There are no conflicts of interest.

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