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Knowledge, Attitudes, and Practices Regarding Antibiotic Use and Antimicrobial Resistance among Community Members in Central Travancore, Kerala: A Cross-Sectional Survey from a Tertiary Care Centre

Dr. Neetha Mary Kurian[1], Dr. Vinay Hajare[2], Dr Vikram Gowda N R[3]

[1]Associate Professor, Department of Community Medicine, Pushpagiri Institute of Medical Sciences & Research Centre, Thiruvalla, Kerala
[2]Professor, Department of Microbiology, Navodaya Medical College, Raichur, Karnataka
[3]Professor, Department of Physiology, Pushpagiri Institute of Medical Sciences & Research Centre, Thiruvalla, Kerala

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Corresponding Author:

Dr Vikram Gowda N R
Professor, Department of Physiology, Pushpagiri Institute of Medical Sciences & Research Centre, Thiruvalla, Kerala

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ABSTRACT

Background: Antimicrobial resistance (AMR) is a growing global health threat, and inappropriate antibiotic use is a major driver. While awareness among healthcare professionals in Kerala has been studied, community-level knowledge, attitudes, and practices (KAP) regarding antibiotic use in the Central Travancore region remain unexplored. This study aimed to assess community KAP regarding antibiotic use and AMR in a tertiary care setting in Kerala, South India.

Methods: This cross-sectional survey was conducted at Pushpagiri Medical College Hospital, Thiruvalla, Kerala, between June and December 2024. A total of 420 community members (≥18 years) attending the hospital's outpatient departments were recruited using convenience sampling. A structured, pre-validated questionnaire adapted from the WHO multi-country survey and prior Indian studies was administered through face-to-face interviews. Data were analyzed using descriptive statistics and chi-square tests.

Results: Among 420 respondents (52.1% female; mean age 42.3±14.6 years), 94.8% had heard of antibiotics, but only 31.2% had heard of "antibiotic resistance." While 82.6% correctly identified that antibiotics do not treat colds and flu, 44.3% believed antibiotics help faster recovery from fever. Notably, 38.6% reported obtaining antibiotics without a prescription at least sometimes, and 27.4% reported not completing the full prescribed course. Only 18.3% correctly understood that antibiotic resistance occurs in bacteria, not the human body. Higher education was significantly associated with better knowledge ($p<0.001$) and appropriate practices ($p=0.003$). Pharmacists were the most common source of non-prescription antibiotics (62.1%).

Conclusions: Substantial knowledge gaps and risky practices regarding antibiotic use exist in the Central Travancore community. Targeted educational interventions, stricter enforcement of prescription regulations, and pharmacist engagement are urgently needed to curb non-prescription antibiotic use in this region.

Keywords*:* antibiotic resistance; antimicrobial resistance; knowledge; attitudes; community survey.

INTRODUCTION

Antimicrobial resistance (AMR) has emerged as one of the most critical public health threats of the 21st century, undermining the effective treatment of infectious diseases and threatening the gains of modern medicine. Inappropriate and excessive use of antibiotics is a leading driver of resistance, and community-level practices including self-medication, non-completion of prescribed courses, and demand for antibiotics for viral illnesses play a significant role in this phenomenon.[1,2,3]

India bears a disproportionate burden of AMR, with high rates of antibiotic consumption and widespread over-the-counter (OTC) availability despite regulatory restrictions. The Drugs and Cosmetics Act of 1940 and subsequent Schedule H1 amendments (2014) classify most antibiotics as prescription-only medications. However, enforcement remains weak, and studies from various Indian states have consistently documented high rates of non-prescription antibiotic sales. In South India specifically, a study from Andhra Pradesh found that 78% of pharmacies dispensed antibiotics without a prescription even after an educational intervention for pharmacists. In Kerala, while awareness among healthcare professionals has been shown to be moderate to high, community-level knowledge and practices remain poorly characterized.[1, 4, 5, 6]

Kerala presents a unique epidemiological context. The state has among the highest literacy rates and health indices in India, yet it also faces a rising burden of non-communicable diseases and an aging population, both of which increase vulnerability to infections and antibiotic use. The Central Travancore region comprising Kottayam, Pathanamthitta, and Alappuzha districts is a predominantly semi-urban and rural area where healthcare access is mediated through a mix of public and private facilities, including tertiary care centres like Pushpagiri Medical College Hospital.

Previous studies in India have examined KAP regarding antibiotics among specific populations, including healthcare professionals, pharmacists, and urban communities. However, to our knowledge, no study has specifically assessed community KAP in the Central Travancore region of Kerala, despite the region's distinct socio-cultural and healthcare-seeking characteristics. Understanding local knowledge gaps and behavioral patterns is essential for designing effective, context-appropriate interventions.[7, 8, 9]

This study aimed to assess the knowledge, attitudes, and practices regarding antibiotic use and AMR among community members attending a tertiary care hospital in Central Travancore, Kerala, to inform future awareness campaigns and stewardship initiative.

MATERIALS AND METHODS

This cross-sectional survey was conducted at Pushpagiri Medical College Hospital, a tertiary care teaching hospital located in Thiruvalla, Pathanamthitta district, Kerala, between June 1 and December 31, 2024. The hospital serves as a major referral centre for the Central Travancore region, drawing patients from Kottayam, Pathanamthitta, Alappuzha, and adjoining areas.

Community members aged ≥18 years attending the hospital's outpatient departments (general medicine, surgery, and community medicine) for non-emergency consultations were eligible. Individuals who were healthcare professionals, had received antibiotics within the preceding 4 weeks, or were unable to provide informed consent were excluded.

A sample size of 384 was calculated using the formula for cross-sectional studies ($n = Z^2pq/d^2$), assuming a 50% prevalence of adequate knowledge (for maximum sample size), 95% confidence level, and 5% absolute precision. Accounting for a 10% non-response rate, the target was 422. A total of 420 completed questionnaires were analyzed.

Convenience sampling was employed, with trained research assistants approaching eligible individuals in waiting areas. Participation was voluntary and anonymous, and written informed consent was obtained.

Questionnaire Development

The questionnaire was adapted from the World Health Organization's "Antibiotic Resistance: Multi-Country Public Awareness Survey" and prior Indian KAP studies. It was translated into Malayalam (the local language), back-translated into English, and pilot-tested with 30 respondents to ensure clarity and cultural appropriateness.

The final questionnaire comprised four sections:
Section A: Sociodemographic characteristics (age, sex, education, residence, occupation)
Section B: Knowledge about antibiotics and antibiotic resistance (12 items)
Section C: Attitudes toward antibiotic use and prescribing (8 items, 5-point Likert scale)
Section D: Practices related to antibiotic acquisition and use (6 items)

Data Collection

Face-to-face interviews were conducted by two trained research assistants (one male, one female) fluent in Malayalam. Each interview lasted approximately 15-20 minutes. The questionnaire was administered orally to ensure accessibility for participants with varying literacy levels. Responses were recorded on paper forms and subsequently entered into a secure database.

The study protocol was approved by the Institutional Ethics Committee of Pushpagiri Medical College Hospital (IEC No. PMCH/2024/156). Written informed consent was obtained from all participants. No identifying information was collected, and data were stored securely.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize sociodemographic characteristics and responses to KAP items. Knowledge scores were calculated by assigning 1 point for each correct response and 0 for incorrect/don't know responses (total possible: 12). Scores above the median were classified as "good knowledge." Chi-square tests were used to examine associations between sociodemographic variables and knowledge/practice categories. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 420 community members participated (response rate: 99.5%). As shown in **Table 1**, the majority were female (52.1%), aged 30-49 years (48.3%), and resided in semi-urban (42.4%) or rural (38.6%) areas. Most had completed secondary education (38.1%) or higher secondary/diploma (28.6%), and 22.4% were graduates or postgraduates. Agriculture and daily wage work were the most common occupations (31.2% and 24.5%, respectively).

Table 1. Sociodemographic Characteristics of Study Participants (n=420)

Characteristic	Category	n (%)
Sex	Male	201 (47.9)
	Female	219 (52.1)
Age group (years)	18-29	78 (18.6)
	30-49	203 (48.3)
	50-64	98 (23.3)
	≥65	41 (9.8)
Residence	Urban (municipal)	80 (19.0)
	Semi-urban	178 (42.4)
	Rural	162 (38.6)
Education	Primary or below	46 (10.9)
	Secondary (up to Class 10)	160 (38.1)
	Higher secondary/diploma	120 (28.6)
	Graduate/postgraduate	94 (22.4)
Occupation	Agriculture	131 (31.2)
	Daily wage labour	103 (24.5)
	Salaried employment	82 (19.5)
	Homemaker	68 (16.2)
	Other (retired, student, unemployed)	36 (8.6)

Knowledge about Antibiotics and Antibiotic Resistance

Knowledge regarding antibiotics and AMR is summarized in Table 2. While 94.8% had heard of "antibiotics," only 31.2% had heard of "antibiotic resistance" or "antimicrobial resistance." When asked whether antibiotics are effective against colds and flu, 82.6% correctly answered "no," but 44.3% believed antibiotics help faster recovery from fever. Only 18.3% correctly understood that resistance occurs in bacteria, not the human body; 51.7% incorrectly believed that the human body becomes resistant to antibiotics.

Table 2. Knowledge about Antibiotics and Antibiotic Resistance (n=420)

Statement/Question	Correct Response	n (%) Correct
Have you heard of "antibiotics"?	Yes	398 (94.8)
Have you heard of "antibiotic resistance"?	Yes	131 (31.2)
Antibiotics are effective against colds and flu.	No	347 (82.6)
Antibiotics help you recover faster from fever.	No	234 (55.7)
Antibiotic resistance occurs when the body becomes resistant to antibiotics.	No	77 (18.3)
Skipping doses of antibiotics can contribute to resistance.	Yes	268 (63.8)
Resistant bacteria can spread from person to person.	Yes	302 (71.9)
Antibiotics can kill "good" bacteria in the body.	Yes	287 (68.3)
It is acceptable to use antibiotics left over from a previous illness.	No	352 (83.8)
It is acceptable to share antibiotics with family members.	No	379 (90.2)

Overall, 47.6% (n=200) achieved knowledge scores above the median and were classified as having "good knowledge." Higher education was significantly associated with good knowledge: 68.1% of graduates/postgraduates vs. 18.2% of those with primary education or below ($p<0.001$). Urban residence was also associated with better knowledge compared to rural residence (62.5% vs. 39.5%, $p=0.008$).

Attitudes toward Antibiotic Use

Attitudes toward antibiotics are presented in Table 3. While 78.6% agreed that antibiotics should only be taken when prescribed by a doctor, a substantial proportion held misconceptions. Notably, 42.1% agreed that "if I have a fever, I should take an antibiotic to get better faster," and 38.3% agreed that "taking antibiotics when I don't need them is harmless." Trust in doctors was generally high (85.5% agreed that doctors prescribe antibiotics only when necessary), but 31.4% indicated they would be dissatisfied if a doctor did not prescribe an antibiotic when they expected one.

Table 3. Attitudes toward Antibiotic Use (n=420)

Statement	Agree n (%)	Neutral n (%)	Disagree n (%)
Antibiotics should only be taken when prescribed by a doctor.	330 (78.6)	52 (12.4)	38 (9.0)
If I have a fever, I should take an antibiotic to get better faster.	177 (42.1)	68 (16.2)	175 (41.7)
Taking antibiotics when I don't need them is harmless.	161 (38.3)	74 (17.6)	185 (44.0)
Doctors prescribe antibiotics only when necessary.	359 (85.5)	41 (9.8)	20 (4.8)
I would be dissatisfied if my doctor did not prescribe an antibiotic when I expected one.	132 (31.4)	86 (20.5)	202 (48.1)
Antibiotic resistance is a problem that could affect me or my family.	289 (68.8)	78 (18.6)	53 (12.6)
There is not much people like me can do to stop antibiotic resistance.	156 (37.1)	92 (21.9)	172 (41.0)

Practices Related to Antibiotic Acquisition and Use

Practice-related findings are shown in **Table 4**. While 71.4% reported always consulting a doctor before taking antibiotics, 38.6% admitted to obtaining antibiotics without a prescription at least sometimes. Among those who self-medicated (n=162), pharmacists were the most common source (62.1%), followed by leftover antibiotics from previous prescriptions (28.4%) and family/friends (9.5%). Notably, 27.4% reported not completing the full prescribed course, most commonly because they felt better (68.7%).

Table 4. Practices Related to Antibiotic Acquisition and Use (n=420)

Practice	**n (%)**
Consult a doctor before taking antibiotics	
Always	300 (71.4)
Sometimes/Often	84 (20.0)
Never/Seldom	36 (8.6)
Obtain antibiotics without prescription (ever)	
Never	258 (61.4)
Sometimes	118 (28.1)
Often/Always	44 (10.5)
Source of non-prescription antibiotics (n=162)	
Pharmacist	101 (62.1)
Leftover from previous prescription	46 (28.4)

Family/friends	15 (9.5)
Complete the full prescribed course	
Always	305 (72.6)
Sometimes	78 (18.6)
Rarely/Never	37 (8.8)
Reason for not completing course (n=115)	
Felt better	79 (68.7)
Forgot	21 (18.3)
Side effects	10 (8.7)
Cost	5 (4.3)

Higher education was significantly associated with better practices: 84.0% of graduates reported always consulting a doctor, compared to 62.5% of those with primary education or below (p=0.003). Females were more likely to complete the full course than males (77.2% vs. 67.7%, p=0.041).

Summary Table

Knowledge Gap	**Percentage**
Heard of "antibiotic resistance"	31.20%
Correctly understood resistance occurs in bacteria	18.30%
Believed antibiotics help fever	44.3% (incorrect)
Practice Gap	Percentage
Non-prescription antibiotic use	38.6% (ever)
Incomplete course completion	27.40%
Self-medication source:	
Pharmacist	62.10%
Leftover antibiotics	28.40%

DISCUSSION

This cross-sectional survey provides the first community-level assessment of KAP regarding antibiotic use and AMR in the Central Travancore region of Kerala. Our findings reveal a pattern of high basic awareness but substantial misconceptions and risky practices, mirroring observations from other Indian and international studies while highlighting region-specific challenges.

Knowledge Gaps

While nearly all respondents (94.8%) had heard of antibiotics, only 31.2% were familiar with the term "antibiotic resistance" a figure considerably lower than the 72.3% reported in a Cyprus study using similar methodology. This suggests that AMR awareness campaigns have not effectively penetrated this semi-urban/rural South Indian population. More concerning is that only 18.3% correctly understood that resistance occurs in bacteria rather than the human body, a misconception shared by 70.7% of respondents in the Cyprus survey and identified as a common global misunderstanding. The persistence of this misconception underscores the need for educational messages that clearly explain the biological basis of resistance.[8, 9, 10, 11]

The finding that 44.3% believed antibiotics accelerate fever recovery is consistent with studies from Nepal (47.7%) and Puducherry, South India, where similar beliefs were prevalent. This belief likely drives demand for antibiotics in primary care settings, contributing to overprescribing for self-limiting conditions.[9, 12, 13]

Non-Prescription Antibiotic Use

The prevalence of non-prescription antibiotic use (38.6% ever; 10.5% often/always) is alarmingly high and consistent with the broader Indian context. A study in low-income urban Delhi reported 24.6% self-medication with antibiotics, while a study in the Andaman and Nicobar Islands found 64.3% self-medication. In Kerala specifically, a qualitative study involving pharmacists revealed poor awareness of Schedule H1 regulations and a perception of lax enforcement. Our finding that pharmacists were the primary source of non-prescription antibiotics (62.1%) corroborates this and points to a critical intervention point: community pharmacists must be engaged as partners in antimicrobial stewardship, not merely as targets of regulation. [12, 14, 15]

The 2014 Schedule H1 amendment and the Red Line campaign were intended to curb OTC antibiotic sales, but awareness remains low. A Kerala-based study found that only 7% of healthcare professionals and none of the patients surveyed could explain the significance of the Red Line. Our findings suggest that these regulatory and awareness efforts have had limited impact in the Central Travancore community.

Incomplete Course Completion

The 27.4% rate of incomplete course completion is concerning, though lower than the 66.5% reported among the general population in Puducherry. The most common reason feeling better (68.7%) reflects a widespread misunderstanding that symptom resolution equates to cure, a behaviour that selects for resistant organisms. This finding aligns with the broader literature on patient adherence and highlights the need for counselling at the point of dispensing.[8]

Role of Education

Consistent with studies from Nepal, Cyprus, and Puducherry, higher education was strongly associated with better knowledge and practices. This gradient suggests that health literacy interventions should be prioritized for populations with lower educational attainment. However, even among graduates, knowledge gaps persisted (e.g., only 38.2% correctly understood the mechanism of resistance), indicating that education alone is insufficient; targeted AMR-specific messaging is required across all educational levels.[8, 9]

Implications for Practice and Policy

Our findings have several implications for healthcare delivery in Central Travancore:

Community education campaigns should be developed in Malayalam, using local media (community radio, local cable television, and social media) and simplified messaging that explains how resistance develops and why completing the course matters.

Pharmacist engagement is critical. Training programs for community pharmacists on Schedule H1 compliance, counselling on antibiotic use, and referral to physicians when appropriate should be implemented.

Prescriber communication should be strengthened. Our finding that 31.4% of respondents would be dissatisfied without an antibiotic prescription suggests that patient expectations drive prescribing. Training physicians in communication skills and shared decision-making, as recommended by the WHO, could reduce unnecessary prescribing.

Regulatory enforcement must be improved. The perception of lax enforcement undermines the credibility of Schedule H1. Periodic audits and penalties for violators should be considered.

Strengths and Limitations

Strengths: This is the first community KAP study on antibiotic use in the Central Travancore region. The sample size was adequate, the questionnaire was adapted from validated instruments, and face-to-face administration ensured accessibility for participants with varying literacy levels.

Limitations: The use of convenience sampling at a single tertiary care hospital limits generalizability to the broader community, as hospital attendees may differ from the general population in health-seeking behaviour and illness burden. Social desirability bias may have led to underreporting of non-prescription antibiotic use and over reporting of complete course adherence. The cross-sectional design precludes causal inference. Finally, we did not assess actual antibiotic dispensing records, relying instead on self-report.

CONCLUSION

This study reveals significant knowledge gaps and risky practices regarding antibiotic use among community members in Central Travancore, Kerala. While basic awareness of antibiotics is high, understanding of AMR mechanisms is poor, and non-prescription antibiotic use remains common, with pharmacists serving as a major source. Incomplete course completion is also prevalent. These findings highlight the urgent need for targeted, culturally appropriate educational interventions, stricter enforcement of prescription regulations, and active engagement of community pharmacists in antimicrobial stewardship efforts. Future research should evaluate the effectiveness of such interventions in this population.

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