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A survey on knowledge, attitude, and practice of the general population on antibiotic use and resistance

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ABSTRACT

Background: Antibiotics are prescription drugs that are used to treat and prevent bacterial infections. Over time, the irrational and inappropriate use of antibiotics has led to the development of antimicrobial resistance (AMR), which poses a serious danger to global public health and has significant economic, social, and political ramifications on a global scale. **Aims and Objectives:** The study aims to evaluate the general population's knowledge, attitudes, and practices regarding antibiotic usage and resistance, as well as identify the factors influencing these behaviors. **Materials and Methods:** A cross-sectional quantitative survey was conducted among 353 community members in Kerala's Thrissur district using a pre-validated questionnaire developed by Nepal et al. Data were collected by giving an online questionnaire (Google Forms) after obtaining informed consent. The form was distributed through messaging services such as WhatsApp to the general public. The Statistical Package for the Social Sciences version 25 was used to code, enter, and analyze the data in Microsoft Excel. Qualitative data are expressed as frequency and proportion, and quantitative data as mean and standard deviation. Both univariate and multivariate regression analysis were used to examine the association between the various factors. **Results:** The respondents were mainly young adults, and more than half were female. The respondents showed good aptitude in "identification of antibiotics" and "antibiotic resistance," whereas showing comparatively less aptitude in "knowledge in role of antibiotics." The key factors leading to high aptitude were health education background and educational status. The attitude of respondents was high in all domains except for "antibiotic safety and resistance." Using Pearson's correlation, it was seen that individuals having high knowledge show poor attitude and practice, and vice versa. **Conclusion:** The study examines antibiotic use knowledge, attitudes, and practices in Thrissur district, aiming to reduce misconceptions and increase awareness. It suggests educational campaigns, reforms, interactive platforms, multimedia, and policies such as AMR Intervention for Total Health to address antibiotic resistance.

Key words: Antibiotics; Resistance; Knowledge; Attitude; Practice

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INTRODUCTION

Antibiotics are prescription drugs that are used to treat and prevent bacterial infections. Over time, the irrational and inappropriate use of antibiotics has led to the development of antimicrobial resistance (AMR), which poses a serious danger to global public health and has significant economic, social, and political ramifications on a global scale.[1]

Antibiotic resistance occurs naturally, but misuse of antibiotics in humans and animals is accelerating the process.[2,3]

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Antimicrobial drugs can cause bacteria to develop resistance, either innately or by acquisition. The two main causes of acquired resistance are (i) chromosomal changes in cell genes that result in cross-resistance and (ii) gene transfer from one microorganism to another by conjugation, transformation, or transduction.[4]

AMR affects both Gram-positive and Gram-negative bacteria (GNB).[5] Reports from various studies from hospitals in India suggest that the prevalence of extended spectrum beta-lactamase producing GNB ranges between 19% and 60%, and that of carbapenem-resistant GNB between 5.3% and 59%. In Mumbai, west India, the prevalence of drug-resistant Enterobacteriaceae was about 18.5%.[6]

Warnings of increased resistance are not new. Some were issued prominently well before antimicrobials became widely available. Alexander Fleming's Nobel Prize acceptance speech is often cited for his admonition that "it is not difficult to make microbes resistant to penicillin in the laboratory by exposing them to concentrations not sufficient to kill them. There is the danger that the ignorant man may easily underdose himself and, by exposing his microbes to non-lethal quantities of the drug, make them resistant."[7,8] Unchecked and uninformed antimicrobial use, including lack of knowledge about course, side effects, dosage limits, and overdose consequences, can lead to inappropriate treatment or misdiagnosis.[7]

The public plays a key role in the emergence and spread of bacterial resistance to antibiotics.[3] In 2000, the WHO Report Overcoming AMR identified three key issues for public involvement: improving access to medical services, reducing unnecessary use of antimicrobial drugs, and not sharing medication with other people or keeping part of the course for another occasion.[9]

The National Antibiotic Policy was established, a national surveillance database was created, and the National Centre for Disease Control was designated as the AMR focal point.[10] The World Health Assembly Resolution of 1998 urged Member States to encourage appropriate, cost-effective use of antibiotics, prohibit dispensing without prescription, prevent infection spread, and develop sustainable systems for detecting resistant pathogens.[11] The following three strategies were suggested to improve drug use: (i) Educational strategy: Training, printing materials, and media-based approach, to discourage self-medication by the general public. (ii) Managerial strategy: Monitoring and supervision, generic substitution, patient cost sharing (economic incentives), etc. (iii) Regulatory strategy: enforcement, sanction, drug withdrawal, market control.[12] Physicians can help reduce antibiotic resistance by making an accurate diagnosis, determining when and if antimicrobial therapy is required, tailoring the treatment plan to the individual needs of the patient, and using the narrowest spectrum and shortest duration of therapy.[13]

Many efforts have been made to describe the many facets of antibiotic resistance and the interventions needed to meet the challenge. Yet, antibiotic resistance remains a relatively obscure topic among the public, and the data associated with public awareness and perception in India remains relatively scarce. Our study intends to determine the knowledge, attitudes, and practices regarding antibiotic use and antibiotic resistance among the general population in the Thrissur district of Kerala.

Aims and objectives

The study aims to evaluate the general population's knowledge, attitudes, and practices regarding antibiotic usage and resistance, as well as identify the factors influencing these behaviors.

MATERIALS AND METHODS

A cross-sectional quantitative survey of community members was conducted in the Thrissur district of Kerala. Participants residing in Thrissur district who were above the age of 18 and had given consent to participate in the study were selected. The study was conducted after obtaining consent from the institutional ethics committee. The purposive sampling technique was adopted in order to ensure all participants who took part in the study fell within the age of ≥18 years. Data collection was conducted during the months of January to March 2023. Convenient, purposive sampling was employed as a sampling technique for this study. The sample size was estimated based on a study by Nepal et al.,[14] using a prevalence of 0.33%. At 95% confidence level and 5% precision level, we estimated the minimum sample size as 350.

The primary study tool was a pre-validated questionnaire developed by Nepal et al.,[14] of Nepal. Data were collected by giving an online questionnaire (Google Forms) after obtaining informed consent. The form was distributed through messaging services such as WhatsApp to the general public. Respondents without smartphones or Internet access were contacted directly. Both the English and Malayalam versions of the questionnaire were used in the process. The English version of the questionnaire was translated into Malayalam and back-translated into English to ensure the accuracy of the translated text.

The questionnaire was divided into four sections: one on each of knowledge, attitudes, and practices about antibiotics and their use; the other section focused on the sociodemographic characteristics of respondents. Questions about knowledge were divided into four domains, namely "identification of antibiotics" (Q1-Q3), "knowledge on the role of antibiotics" (Q4-Q5), "side-effects of antibiotics" (Q6-Q8), and "antibiotic resistance" (Q9-Q11). The questions on attitudes were divided into three domains: "preference for use of antibiotics" (Q12-Q14), "antibiotic resistance and safety" (Q15-Q17), and "attitudes to doctors' prescribing of antibiotics" (Q18-Q20). The six questions relating to practices (Q21-Q25) were not divided into domains. Responses to the knowledge and attitudes questions were given a score of "1" for a correct response and "0" for an incorrect or uncertain response, and scores were summed for respondents across each of the domains. For the practice questions, responses were given a score based on the five-point Likert scale, ranging from "5" for the most appropriate answer to "1" for the least appropriate answer, and summed.

Data were coded and entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences version 25. Qualitative data are expressed as frequency and proportion, and quantitative data as mean and standard deviation. The association between the various factors was analyzed using univariate and multivariate regression analysis.

RESULTS

A total of 353 respondents from the Thrissur district of Kerala participated in the study after providing informed consent. As shown in Table 1, nearly half (47.2%) of the participants were young adults aged 18–27 years. Women constituted a slightly higher proportion (52.8%) of the sample. A large majority (88.6%) had completed a college education or higher. Most respondents (55.4%) resided in urban areas, and over half (53.7%) reported no prior work experience in the health sector.

Table 1: Sociodemographic distribution of participants

Sociodemographic	Frequency	Percentage
Age-wise distribution		
18–27	166	47.2
28–37	38	10.8
38–47	36	10.2
48–57	93	26.4
>57	19	5.4
Gender wise distribution		
Male	166	47.2
Female	186	52.8
Education		
University and above	312	88.6
Secondary school	27	7.7
Other	13	3.7
Area of distribution		
Rural	157	44.6
Urban	195	55.4
Health profession background		
Yes	149	42.3
Don't Know	14	4.0
No	189	53.7
Any regular medication taken?		
Yes	86	24.4
No	266	75.6
Any antibiotics taken in the last 12 months?		
Yes	218	61.9
No	122	34.7
Do not remember	12	3.4

Knowledge, attitude, and practice related to antibiotic use

Questions about knowledge were divided into four domains (Figure 1), namely "identification of antibiotics" (Q1-Q3), "knowledge on the role of antibiotics" (Q4-Q5), "side-effects of antibiotics" (Q6-Q8), and "antibiotic resistance" (Q9-Q11).

Common misconceptions seen in the participants of the survey are "Diarrhea gets better with antibiotics" and "antibiotics are often needed for cold and flu illnesses with the question that most participants got wrong being the latter (36.4%)." Most of the respondents showed higher aptitude and better understanding to the questions that came under the "identification of antibiotics" domain and "antibiotic resistance" domain with <1 in 10 people (8.6%) getting the wrong answer or not knowing the answer for the question "Misuse of antibiotics can lead to antibiotic resistance."

The questions to which the most respondents were unsure of or selected the option "Don't Know" were for "Diarrhea gets better with antibiotics" (23.6%), and "Antibiotics can cause secondary infections after killing good bacteria present in our bodies."

Among the factors affecting the aptitude of the respondents, health profession background and level of education have been significantly associated with better knowledge level, with those who have attended universities or have a health professional background scoring significantly higher scores in the knowledge section. With respect to the age-wise distribution, the young adults (18–27) and older age (48 and above) groups scored better in the knowledge section when compared to the adult age group (28–47).

The questions on attitudes were divided into three domains (Figure 2): "preference for use of antibiotics" (Q12-Q14),

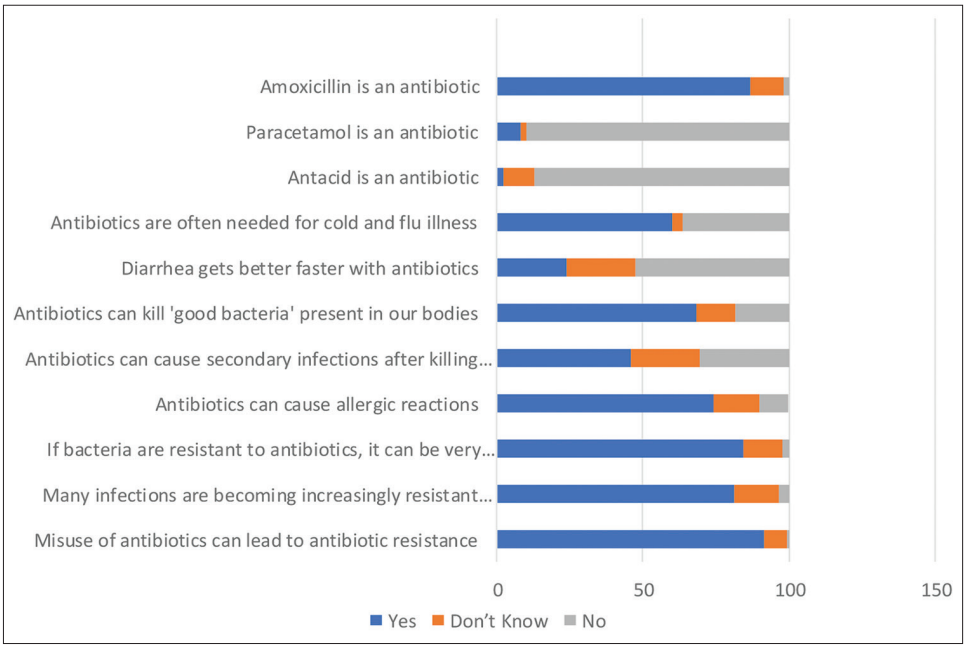

Figure 1: Percentage distribution of responses to the knowledge section

"antibiotic resistance and safety" (Q15-Q17), and "attitudes to doctors' prescribing of antibiotics" (Q18-Q19).

In the domain of "preference for use of antibiotics," most respondents were well aware that there is no need to take antibiotics for cold (81.5%) and preferred not to take an antibiotic when not necessary (81.3%) but a little over half the respondents were convinced that antibiotics will help them get better quickly from fever.

Around more than half (55.7%) of the respondents were aware that antibiotic usage can lead to antibiotic resistance, and more than 6 in 10 people were aware that skipping doses can contribute to antibiotic resistance (61.9%).

Attitude toward doctors' prescription of antibiotics was very positive, as most respondents do not show dissatisfaction when not prescribed an antibiotic (84.9%) and would not go to other doctors if they did not get an antibiotic when they think it is required (89.2%).

In the questions pertaining to the practice (Figure 3), majority of patients (62.2%) always consult a doctor before using antibiotics, checked the expiry date of antibiotics an (69.9%) and completes the entire course of even if they get better from the initial doses (61.9%) and never use antibiotics as a prophylaxis (58.8%) and never opts to obtain antibiotics from pharmacy when they can from a doctor (49.7%). However, the majority of the study group sometimes (30.7%) or never (29.3%) preferred to use antibiotics when they had a cough or cold.

Relationship between knowledge, attitude, and practices

Correlation between the fields of knowledge, attitude, and practice was done using Pearson's correlation, where correlation was considered significant at the 0.01 level (2-tailed). According to which the knowledge-attitude correlation (−0.344) is negative, suggesting individuals with higher knowledge scores may have a negative attitude due to their increased criticalness or awareness of complexities.

Likewise, the study also discovered a small negative association between knowledge and practice, with a correlation of −0.190 showing a slight decline in knowledge as practice increased. (Negative correlation is weaker when compared to knowledge-attitude). On the contrary, the practice-attitude correlation: 0.415, indicative of a positive correlation from which it can be concluded that Individuals' attitudes on the topic tend to get better when they participate in the relevant practice more frequently.

DISCUSSION

Antibiotic resistance is a global health crisis, causing over 700,000 deaths annually due to infections by resistant organisms. The European One Health Action Plan against AMR emphasizes the urgent need for improving public awareness and antibiotic stewardship.[15,16] To improve and counteract current practices, the public's knowledge, attitude, and practices have an important influence on the standard of antibiotic usage.[16]

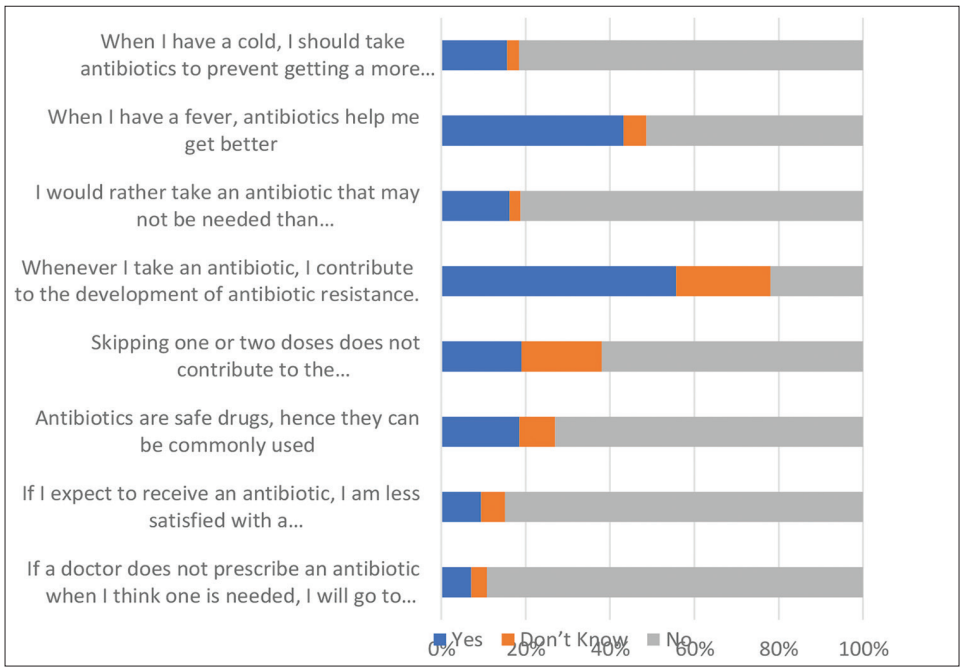

Figure 2: Percentage distribution of responses to the attitude section

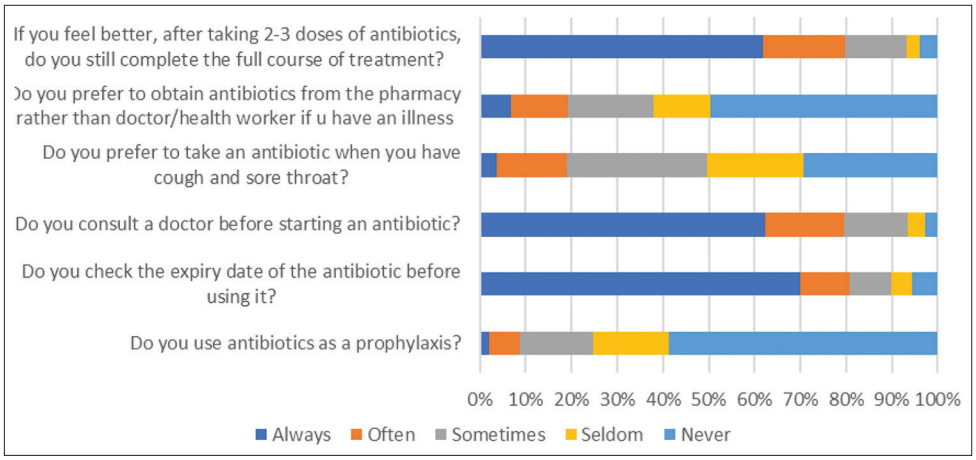

Figure 3: Percentage distribution of responses to practice section

In our study, participants aged 18–27 years comprised the largest group (47.2%), with a majority being female (52.8%) and college-educated (88.6%). Educational qualification was a strong determinant of knowledge on antibiotic resistance, with university-educated individuals exhibiting higher aptitude. This finding aligns with international studies from the UK and Korea,[9,17] but more importantly, it resonates with Indian research as well. For instance, a study in Puducherry by Jayabalan et al. confirmed that while medical students possessed sound theoretical understanding, their attitudes and behaviors toward antibiotic use remained suboptimal.[18]

Urban residency also emerged as a significant factor influencing better knowledge in our study, consistent with findings from a Chinese survey.[19] This may be attributed to better access to information and healthcare services in urban areas. In contrast, an urban cross-sectional survey on 504 respondents in Maharashtra by Banerjee and Raghunathan found that 47% of respondents could not differentiate antibiotics from over-the-counter (OTC) medicines, 25% did not recognize dose-skipping's role in AMR, and 10% admitted to self-medication.[20]

Among the main causes of AMR are self-medication and non-compliance with treatment.[21] Respondents in our study showed higher aptitude in this area than those in a study carried out in central India, where participants' ability to identify antibiotics was subpar.[22] Most respondents

(86.64%) correctly identified amoxicillin as an antibiotic, while questions regarding its role, like "antibiotics are often needed for cold and flu illness," were answered wrong by a majority (60.2%), the later statement being consistent with the findings of another study where around 1 in 2 participants (51.6%) believed that antibiotics can be given for common cold and fever.[1] Although respondents in a study in Nepal[16] showed better aptitude in understanding the role of antibiotics, data across various studies have shown varied results (27%[23] and 40%[9]). Respondents were seemingly aware of the side effects of antibiotics and their consequences when compared to studies conducted in South Korea[17] and the USA.[23] A multicountry survey conducted by WHO also showed similar results in areas of knowledge (64% regarding role and 72% for side effects).[24] The results in our study indicate good compliance and a safe, appropriate approach to antibiotic usage. Our attitude results also aligned with the WHO study, in which 87% agreed that people should use antibiotics only when prescribed by a doctor. In comparison, only 32% of the respondents think they should stop taking antibiotics when they feel better.[24] Our study revealed a concerning trend: nearly half of respondents (50.3%) indicated some inclination to purchase antibiotics from OTC pharmacies, and 37.8% indicated that they are less likely to obtain a prescription from a doctor. A similar concerning trend was observed in an Odisha study where nearly one-seventh of participants preferred to take antimicrobial medications without a prescription, either OTC, or without consulting medical professionals[25] and in a study done in central India, more than 80% of participants have bought antibiotics without a prescription OTC.[22]

In our research, participants demonstrated a higher practical proficiency relative to other studies. In those studies, merely 25% of people sought a physician's guidance for antibiotic prescriptions.[26] While in another study, more than 57% of the respondents used leftover antibiotics or took someone else's advice.[27] Our study also revealed that about 61.9% would complete the entire course of antibiotics despite symptomatic relief with the initial doses, whereas another study revealed that the majority of the participants (87%) of the study would stop once symptomatic relief was obtained.[22] Interestingly, 26% of respondents admitted to not checking expiry dates on antibiotics, a figure comparable to a Delhi-based study where nearly 30% engaged in unsafe antibiotic storage or usage practices.[28]

Our study discovered a substantial relationship between age and knowledge, with younger and older people demonstrating greater accuracy and understanding of antibiotic resistance. While a study from Sweden suggested that younger individuals tend to have greater awareness and knowledge about antibiotic resistance,[29] a separate study from Norway indicated that it is the older age groups who possess more knowledge on the subject.[30] However, contrary to these findings, two additional studies have demonstrated that proficiency regarding antibiotic resistance is lower among the older age groups.[17,31] These discrepancies underscore the importance of localized public health messaging that considers the sociocultural and demographic fabric of the region.

Limitations of the study

Finally, our study is not without limitations. The use of Google Forms may introduce self-selection bias, favoring digitally literate, younger, and more educated individuals. In addition, self-reported responses may be influenced by social desirability bias, especially in questions about unsafe practices.

CONCLUSION

This study highlights the urgent need for improved public awareness and responsible antibiotic use in Kerala. Educational campaigns using interactive and multimedia platforms can help reach broader audiences. The findings offer a useful benchmark for tracking progress in antibiotic stewardship and can inform state-level policies. Initiatives like Operation AMR Intervention for Total Health – which enforces prescription-only antibiotic sales and monitors OTC dispensing – demonstrate how data-driven strategies can help combat AMR. Studies like ours play a key role in supporting such interventions and shaping future AMR policies.

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CBM- Definition of intellectual content, review of literature, data collection, data analysis, preparation of figures/charts statistical analysis and interpretation manuscript, preparation, and submission of article; **ASA-** Prepared first draft of manuscript, concept and design, manuscript preparation, data collection, editing, and manuscript revision; **TE-** Preparation of study protocol, review of literature, data collection and analysis, editing of manuscript, and design of study; **MJ-** Coordination, implementation of study protocol, interpretation of the results, manuscript editing, and manuscript revision

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