International Journal of Research in Medical Sciences
*Sane I et al. Int J Res Med Sci. 2026 Nov;14(11):5110-5118*
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20263689

**Original Research Article**

# Assessment of awareness and practice gaps related to antimicrobial resistance among medical practitioners

**Ishan Sane*, Jessica Gupte, Yogita Karandikar**

Department of Pharmacology, Smt. Kashibai Navale Medical College and General Hospital, Pune, Maharashtra, India

**Received:** 15 September 2026
**Revised:** 29 September 2026
**Accepted:** 30 September 2026

***Correspondence:**
Dr. Ishan Sane,
E-mail: ishansane.2001@gmail.com

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** Antimicrobial resistance (AMR) is a major global health threat driven largely by irrational antibiotic use and inadequate antimicrobial stewardship (AMS). Clinicians play a pivotal role in combating AMR. This study assessed the knowledge, attitudes, and practices (KAP) regarding AMR among doctors in a tertiary care setting in India.
**Methods:** A cross-sectional study was conducted among 305 medical practitioners from government and private healthcare facilities. Data were collected using a validated, self-administered questionnaire evaluating knowledge, attitudes, and practices related to antibiotic use and AMR. Descriptive statistical analysis was performed.
**Results:** Overall knowledge and attitudes were satisfactory. Most participants recognized hand hygiene as essential in preventing AMR (95.1%), and 79.3% were aware of hospital AMS programs. However, knowledge gaps existed regarding antibiotic escalation-de-escalation (36.1%) and the WHO AWaRe classification (30.8%). A majority opposed prescribing antibiotics based on patient demand (91.5%) and supported mandatory AMS training (91.8%). While 84.3% reported never prescribing antibiotics due to patient pressure, 66.5% discontinued empiric therapy after negative culture reports.
**Conclusions:** Despite good knowledge and positive attitudes, gaps persist in stewardship implementation. Strengthening training, diagnostics, and guideline adherence is essential to bridge the knowledge practice gap and address AMR effectively.

**Keywords:** Antimicrobial resistance, Antimicrobial stewardship, Prescribing practices, AMR awareness

## INTRODUCTION

Today, antibiotics are most commonly prescribed medications. But once known as magic bullets, these antibiotics are now under the threat of antimicrobial resistance (AMR).[1]

The discovery of antibiotics in the early 20th century, along with their effectiveness in treating infections and saving lives, led to widespread reliance on these drugs during the 1960s and 1970s. Over the past six decades, these drugs have played an important role in lowering the global burden of infectious diseases.[2] The excessive and inappropriate use of antibiotics has led to the development of AMR, reduced treatment effectiveness, and increased healthcare costs.[3]

Multiple microbes, originally susceptible to commonly used antimicrobials, are now showing resistance patterns that render them unresponsive to standard treatment modalities. Such resistance then results in prolonged duration of illness, higher expenditure, increased risk of complications, or even death.[4]

The CDC estimates that, in the United States alone, over two million individuals are affected by antibiotic-resistant infections each year, resulting in at least 23,000 deaths annually.[5]

According to the Annual report released by National Centre for Disease Control (NCDC) in India, the number of reported AMR cases rose sharply from 25,833 in 2017 to 119,686 in 2022.[6]

Physicians play a crucial role against AMR through the rational use of antibiotics and by educating the public about appropriate antibiotic use and consequences of developing AMR.[7]

It is apparent that many of the drivers of irrational or inappropriate antimicrobial use and consequent AMR relate to deficiencies in prescribers' KAP in relation to antibiotics. Studies have been conducted around the world looking into physicians' KAP on antibiotic use and resistance, commonly used information sources for prescribing and recommendations to improve antibiotic prescribing.[8]

However, there is a lack of comprehensive data and studies in India regarding AMR. Only a limited number of studies have assessed the KAP of clinicians concerning AMR. This study aims to address this gap by evaluating the awareness and attitudes of clinicians toward AMR, thereby contributing valuable insights to guide future interventions and stewardship efforts.

## METHODS

### *Study design*

A cross-sectional study was conducted in multiple tertiary health care hospitals like Smt Kashibai Navale Medical College, Pune; Bharati Hospital, Pune; D. Y. Patil Medical College, Pune; Deenanath Mangeshkar Hospital, Pune, etc and private clinics from April 2025 to July 2025.

### *Inclusion and exclusion criteria*

Medical practitioners, including interns, residents, general practitioners, and specialists, working in tertiary, secondary, and primary healthcare settings, and actively involved in patient care and antibiotic prescribing, were included in the study. Informed consent was obtained from all practitioners prior to their inclusion in the study. Practitioners who did not give the consent were excluded.

### *Sample size*

Participants were recruited using convenience sampling from selected healthcare centers. Total 305 participants were taken in the study.

The sample size was calculated by the formula

$n=[DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1) +p*(1-p)]$

Where, n=sample size

DEFF= design effect, taken as 1

N=population size, taken as 737

p=prevalence, taken as 50%

d=margin of error/ precision, taken as 0.05

Z=1.96 (confidence limits)

### *Consent and ethics approval*

Informed written consent was taken from the participants. A self-structured, approved and validated questionnaire was given to the physicians to fill and responses were recorded. The study was approved by the Institutional Ethics Committee, SKNMC& GH with approval number-SKNMC/Ethics/App/2025/327.

### *Statistical analysis*

Data was entered using Microsoft Excel and analysis was done using SPSS and OpenEpi. Descriptive statistics such as frequencies and percentages were calculated.

### *Procedure*

Eligible medical practitioners were approached at healthcare facilities during the study period. After obtaining informed written consent, participants were provided with a validated questionnaire and were requested to complete it independently. The questionnaire comprised of multiple sections assessing demographic characteristics, KAP related to AMR and antibiotic use. The completed questionnaires were collected, reviewed for completeness, and the responses were systematically recorded for further analysis.

## RESULTS

A total of 305 doctors and clinicians participated in this study with a respondent rate of 100%. Table 1 showcases the socioeconomic characteristics of study group.

### *Sociodemographic details*

Of the total 305 participants, 132 (43.3%) were aged 25-35 years, 108 (35.4%) were above 35 years, and 65 (21.3%) were aged 18-25 years. Male respondents accounted for 169 (55.4%), while 136 (44.6%) were female. With respect to educational qualifications, 165 (54.1%) held postgraduate degrees such as MD/MS/DNB/MCh/DM, 110 (36.1%) were MBBS graduates, 22 (7.2%) had BHMS/BAMS degrees, and 8 (2.6%) had other qualifications. Clinical experience varied, with 138 (45.2%) having 10-20 years of practice, 82 (26.9%) having 5-10 years, 58 (19.0%) having more than 20 years, and 27 (8.9%) having less than 5 years of experience. A total of 152 doctors (49.8%) belonged to Medicine and allied specialties, 40 (13.1%) to Surgery and allied, 98 (32.1%) to general practice or other specialties, and 15 (4.9%) to basic sciences. Regarding work setting,

176 doctors (57.7%) were employed in private hospitals or clinics, while 129 (42.3%) worked in government or tertiary-care hospitals. With respect to designation, 162 (53.1%) were consultants, 76 (24.9%) senior faculty, 37 (12.1%) junior faculty, 18 (5.9%) junior residents, and 12 (3.9%) interns.

**Table 1: Sociodemographic details.**

| Variables | N (%) |
|---|---|
| **Age (in years)** | |
| 18-25 | 65 (21.3) |
| 25-35 | 132 (43.3) |
| >35 | 108 (35.4) |
| **Gender** | |
| Male | 169 (55.4) |
| Female | 136 (44.6) |
| Other | 0 |
| **Qualification** | |
| MBBS | 110 (36.1) |
| MD/MS/DNB/Mch/DM | 165 (54.1) |
| BHMS/BAMS | 22 (7.2) |
| Other | 8 (2.6) |
| **Years of practice** | |
| <5 | 27 (8.9) |
| 5-10 | 82 (26.9) |
| 10-20 | 138 (45.2) |
| >20 | 58 (19) |
| **Speciality** | |
| Basic sciences | 15 (4.9) |
| Medicine and allied | 152 (49.8) |
| Surgery and allied | 40 (13.1) |
| Other/ GP | 98 (32.1) |
| **Work setting** | |
| Government hospital/ tertiary centre | 129 (42.3) |
| Private hospital/ clinic/ OPD | 176 (57.7) |
| **Designation** | |
| Intern | 12 (3.9) |
| Junior resident | 18 (5.9) |
| Junior faculty (SR/ Attending) | 37 (12.1) |
| Senior faculty | 76 (24.9) |
| Physician/ consultant/ specialist | 162 (53.1) |

Table 2-4 depicts the knowledge about antibiotics in the study group.

***Knowledge about AMR***

Knowledge related to AMR was generally strong. A total of 290 (95.1%) respondents recognized hand hygiene as an important measure to prevent AMR, while 177 doctors (58.1%) agreed that culture and sensitivity testing should be performed when feasible. Awareness of hospital antibiotic policies or AMS programs was reported by 242 (79.3%). Of the 305 doctors surveyed, 250 (82%) correctly believed that AMR is not limited to individuals who frequently use antibiotics. 257 (84.3%) doctors knew that Hospital antibiograms are important tools in AMR surveillance. Additionally, 228 doctors (74.8%) felt that limited diagnostic facilities contribute to irrational antibiotic use. Knowledge gaps were seen in awareness of escalation and de-escalation practices, which were only understood by 110 doctors (36.1%), and WHO AWaRe classification, was only known to 94 (30.8%) doctors. This data is presented in Table 2.

***Questions regarding antibiotics***

Table 3 which showcased the MCQ-based knowledge assessment, 271 doctors (88.9%) correctly identified Amikacin as having strong activity against Gram-negative bacilli, and 260 participants (85.2%) marked Ceftriaxone as the correct answer.

***AMR and its causes***

Regarding perceived causes of AMR which is depicted in Table 4, overuse of antibiotics was the most commonly identified factor by 134 doctors (43.9%), followed by preference for broad-spectrum agents (22%). Beyond healthcare, 190 participants (62.3%) felt that poor regulation of antibiotic sales and 185 participants (60.7%) considered improper disposal of antibiotics contributed significantly to AMR. System-related barriers leading to overprescription of antibiotics included the absence of local guidelines (63.3%), limited availability of infectious disease specialists or AMS training (58.4%), delayed culture reports (55.1%), fear of infection progression (50.8%), difficulty interpreting antibiograms (37.4%), and patient loss to follow-up (36.1%).

***Attitude about AMR***

Table 5 describes the attitudes of clinicians towards antibiotics prescription and AMS. Attitudes toward AMS were notably positive. Antibiotic use being monitored by pharmacologists or infection-control physicians was supported by 218 (71.5%) respondents, and willingness to educate patients about AMR was expressed by 225 (73.8%). A total of 240 (78.7%) strongly agreed or agreed that antibiotic guidelines help improve clinical care, and 238 (78.0%) agreed that there is rampant use of antibiotics in hospital settings.

Only 26 (8.5%) agreed with prescribing antibiotics on patient demand indicating that the vast majority had an appropriate attitude against such inappropriate prescribing. Mandatory AMS training for all healthcare practitioners was supported by 280 (91.8%). Confidence in withholding antibiotics when bacterial infection was unlikely was reported by 214 (70.2%). A total of 273 doctors (89.5%) disagreed that over-prescribing antibiotics is better than avoiding unnecessary prescriptions.

***Practices about AMR***

As per Table 6, practices related to antibiotic use showed moderate adherence to stewardship principles. A total of 233 doctors (76.4%) reported encountering AMR cases in their clinical practice.

**Table 2: Knowledge about AMR.**

| Questions | Yes | No |
|---|---|---|
| **Do you think hand hygiene and infection control measures can help reduce AMR?** | 290 (95.1%) | 15 (4.9%) |
| **Do you have to do culture and sensitivity for all bacterial infections?** | 177 (58.1%) | 128 (41.9%) |
| **Every hospital has its own antibiotic-policy/AMS programme. Are you aware of that?** | 242 (79.3%) | 63 (20.7%) |
| **Antibiotic resistance is only an issue for people who take them frequently.** | 55 (18.0%) | 250 (82%) |
| **Hospital antibiograms serve as important tools in guiding empiric antibiotic therapy and tracking resistance patterns.** | 257 (84.3%) | 48 (15.7%) |
| **Do you know about antibiotic escalation and de-escalation?** | 110 (36.1%) | 195 (63.9%) |
| **Lack of rapid diagnostic tests is one of the reasons for irrational antibiotic use** | 228 (74.8%) | 77 (25.2%) |
| **Are you familiar with the WHO AWaRe classification of antibiotics?** | 94 (30.8%) | 211 (69.2%) |

**Table 3: Questions regarding antibiotics.**

| Questions | | | | |
|---|---|---|---|---|
| **Which antibiotic has strong activity against Gram-negative bacilli but limited activity against Gram-positive organisms?** | Metronidazole-2 (0.7%) | Amikacin-271 (88.9%) | Vancomycin 10 (3.3%) | Amoxicillin-22 (7.2%) |
| **Which of following has broad-spectrum activity, covering both Gram-positive and negative bacteria** | Metronidazole-5 (1.6%) | Amikacin-12 (3.9%) | Vancomycin 28 (9.2%) | Ceftriaxone-260 (85.2%) |

**Table 4: AMR and its causes.**

| Questions | N | Percentage (%) |
|---|---|---|
| **What are main causes of AMR** | | |
| Overuse of antibiotics | 134 | 43.9 |
| Prescribing multiple antibiotics per prescription | 12 | 3.9 |
| Preference for broad-spectrum antibiotics | 67 | 22 |
| Inadequate infection control practices | 5 | 1.6 |
| Low or suboptimal antibiotic dosages | 37 | 12 |
| Prolonged duration of antibiotic use | 2 | 0.7 |
| Poor hand hygiene among healthcare professionals | 40 | 13 |
| Genetic mutations in microbes leading to resistance | 8 | 2.6 |
| Influence of pharmaceutical advertising on prescribing patterns | 0 | 0 |
| Other | 0 | 0 |
| **Beyond healthcare, what may be the other causes of developing AMR** | | |
| Misuse of antibiotics in agriculture and poultry farming | 160 | 52.5 |
| Use of antibiotics in livestock farming for both infection treatment and growth promotion | 144 | 47.2 |
| Inadequate wastewater treatment from pharmaceutical and agricultural sources | 163 | 53.4 |
| Overuse of antibiotics in aquaculture and fisheries | 110 | 36.1 |
| Poor regulation of antibiotic sales and distribution | 190 | 62.3 |
| Disposal of unused or expired antibiotics in the environment | 185 | 60.7 |
| Contaminated soil due to excessive antibiotic use in crop farming | 48 | 15.7 |
| **What are the reasons for overprescribing of antibiotics-** | | |
| Limited availability or difficulty in interpreting antibiograms | 114 | 37.4 |
| Absence of well-defined local guidelines | 193 | 63.3 |
| Inadequate infectious disease specialists and antibiotic stewardship training | 178 | 58.4 |
| Concern about patient loss to follow-up | 110 | 36.1 |
| Fear of potential infection development | 155 | 50.8 |
| Delayed results from culture tests | 168 | 55.1 |
| High cost of rapid diagnostic tests | 97 | 31.8 |

**Table 5: Attitude about AMR.**

| Questions | Yes | No |
|---|---|---|
| **Do you feel that antibiotic usage should be monitored by clinical pharmacologists or infection-control physicians?** | 218 (71.5%) | 87 (28.5%) |
| **Are you interested in educating patients regarding antibiotic use and resistance?** | 225 (73.8%) | 80 (26.2%) |
| **Do you think Antibiotic guidelines and antibiotic stewardship are of help in clinical care?** | 240 (78.7%) | 65 (21.3%) |
| **There is a rampant use of antibiotics in the hospital I work in-** | 238 (78.0%) | 67 (22%) |
| **Do you think patients should be prescribed antibiotics on their personal demands?** | 26 (8.5%) | 279 (91.5%) |
| **Would you support mandatory AMS training for all medical practitioners?** | 280 (91.8%) | 25 (8.2%) |
| **Would you feel comfortable withholding antibiotics when bacterial infection is unlikely?** | 214 (70.2%) | 91 (29.8%) |
| **It is always better to over-prescribe antibiotics than under prescribe which can cause relapse:** | 32 (10.5%) | 273 (89.5%) |

**Table 6: Practices about AMR.**

| Question | | | | |
|---|---|---|---|---|
| | **Yes, N (%)** | | **No, N (%)** | |
| **Have you encountered AMR cases in your practice?** | 233 (76.4%) | | 72 (23.6%) | |
| | **Always (4/4)** | **Often (3/4)** | **Sometimes (2/4)** | **Never/ rarely (1/4)** |
| **Do you prescribe antibiotics on the demand of patients?** | 0 | 10 (3.3) | 38 (12.5) | 257 (84.3) |
| **Do you take the help of a clinical pharmacologist/microbiologist to assist you in choosing the drug?** | 21 (6.9) | 83 (27.2) | 37 (12.1) | 164 (53.8) |
| **Did you attend any training in hospital stewardship practices?** | 42 (13.8) | 163 (53.4) | 60 (19.7) | 40 (13.1) |
| **Do you consider culture and sensitivity results before prescribing antibiotics when feasible?** | 108 (35.4) | 106 (34.8) | 70 (23.0) | 21 (6.9) |
| **Do you educate junior doctors, colleagues or interns about rational antibiotic use?** | 182 (59.7) | 45 (14.8) | 70 (23.0) | 8 (2.6) |
| **Do you follow clinical guidelines when prescribing antibiotics?** | 78 (25.6) | 122 (40) | 68 (22.3) | 37 (12.1) |
| **Have you prescribed broad spectrum antibiotics due to pressure from your colleagues/ seniors?** | 10 (3.3) | 33 (10.8) | 58 (19.0) | 204 (66.9) |
| **How frequently does a senior colleague recommend an antibiotic that is different from your choice?** | 43 (14.1) | 32 (10.5) | 182 (59.7) | 48 (15.7) |
| **How often do you discontinue empiric antibiotic after negative culture report?** | 65 (21.3) | 138 (45.2) | 80 (26.2) | 22 (7.2) |
| **How often do you prescribe prophylactic antibiotics without evidence of infection?** | 0 | 40 (13.1) | 80 (26.2) | 185 (60.7) |
| **How often do you prescribe antibiotics for viral infections?** | 4 (1.3) | 15 (4.9) | 170 (55.7) | 116 (38.0) |

**Table 7: Source of information while prescribing antibiotics.**

| Source of information while selecting antibiotics | N | Percentage (%) |
|---|---|---|
| **Internet based sources** | 205 | 67.2 |
| **National/ international antimicrobial guidelines** | 215 | 70.5 |
| **Journals/ textbooks** | 185 | 60.7 |
| **ID specialists or microbiologists** | 176 | 57.7 |
| **Local hospital guidelines** | 160 | 52.5 |

Prescribing antibiotics on patient demand was uncommon, with 257 participants (84.3%) reporting that they never did so. Seeking assistance from a clinical pharmacologist or microbiologist was reported always or often by only 104 participants (34.1%), while 164 doctors (53.8%) never sought such help.

Attendance at hospital AMS training was reported always or often by 205 participants (67.2%) reflecting favourable practices. Consideration of culture and sensitivity results before prescribing antibiotics when feasible was reported always or often by 214 participants (70.2%). Educational practices were relatively strong, with 227 participants (74.4%) reporting that they always or often educate junior doctors or colleagues about rational antibiotic use. Adherence to clinical guidelines was reported always or often by 200 participants (65.6%).

Prescribing broad-spectrum antibiotics due to peer pressure was avoided by 204 participants (66.9%). Discontinuation of empiric antibiotics after a negative culture report was practiced always or often by 203 doctors (66.5%). Prophylactic antibiotic use without evidence of infection was avoided by 185 doctors (60.7%), and antibiotics for viral infections were sometimes or never prescribed by 286 participants (93.7%).

***Source of information while prescribing antibiotics***

Table 7 states that when selecting antibiotics, 215 (70.5%) doctors commonly relied on national or international guidelines, while internet-based resources were used by 205 doctors (67.2%), journals or textbooks by 185 (60.7%), ID specialists or microbiologists by 176 (57.7%), and local hospital guidelines by 160 (52.5%).

## DISCUSSION

This is a KAP study to assess the awareness regarding AMR among clinicians and physicians.

In the present study, we analysed that physicians possessed strong knowledge regarding AMR. This is in contrast to the study performed by Pulcini et al in which the study population had poor knowledge regarding AMR.[9] Total 290 respondents (95.1%) recognized hand hygiene as an important measure for preventing AMR. This is consistent with the observations of Sano et al who reported that improved hygiene and infection-control practices reduce infection rates and consequently lower antibiotic use, thereby decreasing the selective pressure that drives AMR.[10] 58.1% doctors agreed that culture and sensitivity testing should be performed when feasible, which is comparable to the findings of Gangurde et al where 51% of respondents supported culture and sensitivity testing for all bacterial infections.[11] In the study, awareness of the presence of a hospital AMS programme was reported by 79.3% of participants, which is similar to findings by Bodke et al who observed awareness levels of 72% in the study population.[12] In our study, 82% of doctors correctly disagreed with the point that AMR is limited only to patients who frequently consume antibiotics, a finding comparable to a study done by Nishat et al where 75% of participants expressed a similar understanding.[13] The 84.3% believed Hospital antibiograms serve as important tools in guiding empiric antibiotic therapy and tracking resistance patterns, which is well emphasized in the CLSI M39 A4 guidelines which states hospital antibiograms are necessary for guiding therapy.[14] However, knowledge gaps were evident, as only 36.1% of participants had an understanding of antibiotic escalation and de-escalation strategies. This is in contrast to the study done by Gangurde et al in which 60% doctors were aware of the strategies.[11] Additionally, 75% of respondents identified lack of rapid diagnostic tests as a contributor to irrational antibiotic use, supporting observations by Machowska et al that such limitations promoted empirical prescribing and antibiotic overuse.[4] Awareness of the WHO AWaRe classification was limited to 30.8% of participants, similar to low awareness reported by Akpan et al (21%).[15]

In the present study, overuse of antibiotics was identified as a major cause of AMR by 42% of respondents, consistent with observations by Chatterjee et al. where 72% participants also identified the same cause for AMR.[8] In this study, poor regulation of antibiotic sales and distribution emerged as the most commonly identified cause of AMR apart from healthcare related causes. This finding is consistent with India's National Action Plan on AMR (NAP-AMR), which highlights weak regulatory enforcement and over-the-counter availability of antibiotics as major contributors to the development and spread of AMR.[16] Furthermore, many clinicians perceived the absence of well-defined local guidelines as a driver of overprescribing, a finding supported by a study done by Yevutsey et al who demonstrated that weak regulatory frameworks and poor guideline adherence contribute significantly to inappropriate antibiotic use.[17]

In our study, participants had a positive attitude regarding AMR. The 71.5% doctors wanted the antibiotic usage to be monitored by clinical pharmacologists or infection-control physicians and 73.8% were interested in educating patients regarding antibiotic use and AMR. These findings are similar to the study done by Praveen et al in which the respective percentages were 98.3% and 93.3%.[5] In the present study, 78.7% believed that antibiotic guidelines and antibiotic stewardship help in clinical care practice. This is in line with the study done by Chaterjee et al in which more than 80% doctors had the same belief.[8]

The 78% participants in our had experienced rampant use of antibiotics in their hospital, similar to the findings showcased in the study by Sami et al in which 44% agreed and 23.1% strongly agreed that there was inappropriate antimicrobial use in their hospitals as well.[18]

Of the total participants, 91.5% were of the believe that one should not prescribe antibiotics on patient's demands indicating correct attitude. In contrast, a survey done by

Garg et al among Indian healthcare providers reported that 92.4% overprescribed antibiotics, largely due to patient pressure.[19] In this study, 91.8% supported the idea of having a mandatory AMS training programme. Similar results were found in the research done by Chandan et al in which 63.7% agreed and 31.2% strongly agreed for having a course on AMS.[3] In the present study, 214 participants (70.2%) reported being comfortable withholding antibiotics when bacterial infection was unlikely. This attitude aligns with national treatment guidelines, which recommend against antibiotic use for non-bacterial and viral infections such as acute bronchitis, viral upper respiratory tract infections, etc. as highlighted in a study done by Fleming-Dutra et al.[20] The 89.5% participants disagreed with the point of over-prescribing antibiotics, reflecting a correct attitude toward rational antibiotic use; this aligns with the study done by Ventola indicating that excessive antibiotic use is a key driver of rapidly emerging AMR and undermines the benefits of antimicrobial therapy.[21]

In our study, participants possessed good knowledge and had a favourable attitude regarding AMR, however, showed moderate adherence towards their practices.

In the present study, 76.4% doctors encountered cases of AMR in their practice. This is in line with the data presented in the study done by Chaterjee et al in which 86.56% participants encountered this issue.[8]

A total of 84.3% doctors never prescribed antibiotics on the demand of patients, which is similar to the study done by Miller et al in which 80% physicians did not allow patients demands to influence their decision.[22]

In this study, the training about AMS was always attended by 13.8% doctors and often attended by 53.4% doctors. A practice of considering the culture and sensitivity results before prescribing antibiotics was always done by 35.4% doctors and often by 34.8%. This is in contrast to the data presented in the study by Shrestha et al in which only 39.4% had the habit of doing culture and sensitivity and more than 67% doctors did not attend training programs.[23] However, 53.4% doctors never took help of a clinical pharmacologist while choosing a drug. Similar results were found in Praveen et al study in which 55% never took the help.

On the other hand, 59.7% doctors always educated junior doctors and colleagues about rational use of antibiotics, while 14.8% often did the same. In the study by Praveen et al 91.7% participants taught rational practices to colleagues.[5] A total of 66.9% clinicians never prescribed broad spectrum antibiotics due to pressure from their colleagues or seniors. This is in contrast to the study done by Sami et al in which 59.9% participants prescribed BSA due to overlying pressure.[18]

The 25.6% doctors always while 40% often followed guidelines while prescribing antibiotics. These findings are in line with the study done by Nishat et al in which 35.5% frequently followed guidelines while 43.6% followed them moderately.[24]

In this study, 59.7% doctors sometimes observed that a senior had recommended a different antibiotic from their choice. This finding is supported by a needs-assessment survey by Gharbi et al which demonstrated that junior doctors often report low confidence in antibiotic prescribing and frequently seek advice from senior clinicians, with senior input commonly influencing or confirming prescribing decisions.[25]

Discontinuation of antibiotics after a negative culture report was followed always by 21.3% and often by 45.2% doctors, indicating a good practice. This practice is supported by evidence from Saha et al who demonstrated that implementation of a structured follow-up protocol increased antibiotic discontinuation after negative culture results from 4% to 84%, without an increase in recurrence or return visits.[26]

In our study, 60.7% never prescribed prophylactic antibiotics without evidence of infection, while 13.1% sometimes followed this practice. This is in line with the study done by Paul et al in which only 16% doctors inappropriately prescribed antibiotics in cases of asthma without infection.[27] Only 1.3% doctors always prescribed antibiotics in cases of viral infection, while 55.7% sometimes did this practice. This is in contrast to the study done by Praveen et al in which a large proportion of 95% followed this incorrect practice.[5] In the present study, 70.5% used National/ International guidelines, while 67.2% used internet sources for prescribing antibiotics. This is similar to the study done by Garcia et al in which 69% participants used antimicrobial guidelines, while 62% used the internet.[28]

### *Limitations*

This was a cross-sectional study with a limited sample size conducted in selected healthcare centers. The study relied on self-reported responses and did not assess changes in prescribing practices in the physicians over time following the study.

## CONCLUSION

This study highlights that clinicians exhibit good knowledge and positive attitudes toward AMR and AMS. However, there are some important gaps in the practical implementation, awareness about antibiotic escalation and de-escalation, and consultation with microbiologists, pharmacologists and infection control specialists. Given the rapidly increasing burden of AMR and its impact on patient outcomes and healthcare systems, addressing these gaps through targeted training programmes, improved diagnostic support, and stronger institutional stewardship policies is essential. Improving adherence to treatment guidelines and providing regular training for clinicians can

help reduce inappropriate antibiotic use and address the growing problem of AMR.

## ACKNOWLEDGEMENTS

Authors would like to thank to the Department of Pharmacology at Smt Kashibai Navale Medical College and General Hospital, Pune for their support and guidance throughout this study. Authors also appreciate the contributions of our colleagues and hospital staff in facilitating data collection.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee SKNMC&GH with approval number-SKNMC/Ethics/App/2025/327*

## REFERENCES

1. Saleem H, Jamil S. Antimicrobial resistance-a global threat. J Coll Physicians Surg Pak. 2016;26(4):243-4.
2. Bhatia R, Narain JP. The growing challenge of antimicrobial resistance in the South-East Asia Region-are we losing the battle? Indian J Med Res. 2010;132(5):482-6.
3. Chandan N, Nagabushan H. Assessment of knowledge, attitude and practice of interns towards antibiotic resistance and its prescription in a teaching hospital: a cross-sectional study. Int J Basic Clin Pharmacol. 2016;5(2):442-6.
4. Machowska A, Stålsby Lundborg C. Drivers of irrational use of antibiotics in Europe. Int J Environ Res Public Health. 2018;16(1):27.
5. Kumar PB, Udaykumar P. Cross-sectional study on antibiotic stewardship practices at a tertiary care centre. World J Pharm Pharm Sci. 2015;4(9):924-36.
6. National Centre for Disease Control. Annual report 2022. New Delhi: Ministry of Health and Family Welfare, Government of India. 2022.
7. Khan AKA, Banu G, Reshma KK. Antibiotic resistance and usage-a survey on the knowledge, attitude, perceptions and practices among the medical students of a southern Indian teaching hospital. J Clin Diagn Res. 2013;7(8):1613-6.
8. Chatterjee S, Hazra A, Chakraverty R, Shafiq N, Pathak A, Trivedi N, et al. Knowledge, attitude, and practice survey on antimicrobial use and resistance among Indian clinicians: a multicentric, cross-sectional study. Perspect Clin Res. 2022;13(2):99-105.
9. Pulcini C, Williams F, Molinari N, Davey P, Nathwani D. Junior doctors' knowledge and perceptions of antibiotic resistance and prescribing: a survey in France and Scotland. Clin Microbiol Infect. 2011;17(1):80-7.
10. Sano D, Wester AL, Schmitt H, Amarasiri M, Kirby A, Medlicott K, et al. Updated research agenda for water, sanitation and antimicrobial resistance. J Water Health. 2020;18(6):858-66.
11. Gangurde N, Gaba M, Singh J. Assessment of knowledge, attitude, and practice toward antibiotic use amongst healthcare professionals of an urban city. Int J Med Biomed Stud. 2021;5(1):1.
12. Bodke AV, Mujeeb MMA, Pardeshi ML, Dabhade SS, Tiwari SA, Gawari NC, et al. Knowledge, attitude, and practice about antimicrobial stewardship concepts among practitioners. Int J Basic Clin Pharmacol. 2024;13(5):679-84.
13. Nishat S, Ali MAM, Butul M, Sameen S, Siddiqua SA. Knowledge, attitude and practicing behavior regarding antimicrobial use and awareness of antimicrobial resistance among interns and postgraduates in a tertiary care hospital. Int J Basic Clin Pharmacol. 2023;12(1):77-82.
14. Clinical and Laboratory Standards Institute (CLSI). Analysis and presentation of cumulative antimicrobial susceptibility test data (antibiogram). 4th ed. CLSI guideline M39. Wayne (PA): Clinical and Laboratory Standards Institute. 2014.
15. Akpan MR, Jackson IL, Eshiet UI, Mfon SA, Abasiattai EA. Knowledge of antimicrobial stewardship and the Access, Watch and Reserve (AWaRe) classification of antibiotics among frontline healthcare professionals in Akwa Ibom State, Nigeria: a cross-sectional study. BMC Health Serv Res. 2024;24:1014.
16. National Centre for Disease Control. National action plan on antimicrobial resistance (NAP-AMR) 2017-2021. New Delhi: Ministry of Health and Family Welfare, Government of India. 2017.
17. Yevutsey SK, Buabeng KO, Aikins M, Anto BP, Biritwum RB, Frimodt-Moller N, et al. Situational analysis of antibiotic use and resistance in Ghana: policy and regulation. BMC Public Health. 2017;17(1):896.
18. Sami R, Sadegh R, Fani F, Atashi V, Solgi H. Assessing the knowledge, attitudes and practices of physicians on antibiotic use and antimicrobial resistance in Iran: a cross-sectional survey. J Pharm Policy Pract. 2022;15(1):82.
19. Garg AK, Tewari RK, Agrawal N, Kumar A, Chandra A. Antibiotic prescription pattern among Indian oral healthcare providers: a cross-sectional survey. J Antimicrob Chemother. 2014;69(2):526-8.
20. Fleming-Dutra KE, Hersh AL, Shapiro DJ, Bartoces M, Enns EA, File Jr TM, et al. Prevalence of inappropriate antibiotic prescriptions among US ambulatory care visits, 2010-2011. JAMA. 2016;315(17):1864-73.
21. Ventola CL. The antibiotic resistance crisis: causes and threats. P T. 2015;40(4):277-83.
22. Miller E, MacKeigan LD, Rosser W, Marshman J. Effects of perceived patient demand on prescribing anti-infective drugs. CMAJ. 1999;161(2):139-42.
23. Shrestha L, Pokhrel S, Shrivastava AK, Pokhrel BR, Joshi B, Chhetri P. Knowledge, attitude and practice of health care professionals towards antimicrobial resistance and its stewardship at tertiary care teaching hospital. J Karnali Acad Health Sci. 2020;3(3):1.

24. Nishat S, Jalal J, Butul M, Akhter SN, Siddiqua SA. Knowledge, attitude and practicing behaviour regarding antimicrobial use and awareness of antimicrobial resistance among clinicians. Int J Res Med Sci. 2023;11(1):195-203.
25. Gharbi M, Doerholt K, Vergnano S, Bielicki JA, Paulus S, Menson E, et al. Using a simple point-prevalence survey to define appropriate antibiotic prescribing in hospitalised children across the UK. BMJ Open. 2016;6:e012675.
26. Saha D, Patel J, Buckingham D, Thornton D, Barber T, Watson JR. Urine Culture Follow-up and Antimicrobial Stewardship in a Pediatric Urgent Care Network. Pediatrics. 2017;139(4):e20162103.
27. Paul IM, Maselli JH, Hersh AL, Boushey HA, Nielson DW, Cabana MD. Antibiotic prescribing during pediatric ambulatory care visits for asthma. Pediatrics. 2011;127(6):1014-21.
28. García C, Llamocca LP, García K, Jimenez A, Samalvides F, Gotuzzo G, et al. Knowledge, attitudes and practice survey about antimicrobial resistance and prescribing among physicians in a hospital setting in Lima, Peru. BMC Clin Pharmacol. 2011;11:18.

**Cite this article as:** Sane I, Gupte J, Karandikar Y. Assessment of awareness and practice gaps related to antimicrobial resistance among medical practitioners. Int J Res Med Sci 2026;14:5110-8.