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Original Research Article

Knowledge, attitude, and practice about antimicrobial stewardship concepts among practitioners

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ABSTRACT

Background: Antimicrobial agents have been crucial in human medicine for over five decades. However, antimicrobial resistance (AMR) has become a significant global threat, with the world health organization (WHO) identifying it as a top ten health threat in 2019. Over 50% of antimicrobials are improperly used, leading to increased morbidity, mortality, and healthcare costs. This study assesses the knowledge, attitudes, and practices (KAP) of physicians regarding AMR to enhance antimicrobial stewardship (AMS).

Methods: A cross-sectional, descriptive study was conducted among physicians in Maharashtra, India, from December 2023 to March 2024. A self-administered survey, developed through literature review and pilot testing, was distributed electronically. The questionnaire included 27 questions across three sections: knowledge, attitude, and practice. Responses were collected anonymously.

Results: Out of 580 responses, 72% of participants were aware of AMS, with an average knowledge score of 7.3 out of 11. High awareness was noted, with 96% correctly identifying the primary goal of AMS. However, only 31.6% consistently documented the rationale for prescriptions, and 80.3% de-escalated from broad-spectrum to narrow-spectrum antimicrobials based on culture results.

Conclusions: While foundational knowledge and positive attitudes towards AMS were strong, variability in practices highlighted the need for ongoing education and system improvements. Gaps in specific knowledge areas and mixed attitudes towards newer antimicrobials and long-duration antimicrobial use indicate the need for consistent guidelines and education. Improving documentation practices, updating resistance patterns, and enhancing trust in laboratory results are crucial for optimizing AMS. Further research should address the influence of physicians' specialties, hospital types, and years of experience on prescribing behaviors.

Keywords: WHO, Health threat, Narrow spectrum, Education, Rationale

INTRODUCTION

For over five decades, antimicrobial agents have been extensively utilized within the realm of human medicine, serving either as preventive measures or as treatment modalities. This enduring application has yielded profound advantages for human health.¹ AMR stands prominently among the ten threats listed by the WHO in 2019, owing to its profound implications for contemporary

healthcare systems and the efficacy of interventions aimed at combating an expanding spectrum of infectious diseases.² As described in reports published by the WHO, an excess of 50% of antimicrobials is administered, distributed, or prescribed erroneously.¹ The proliferation of drug-resistant bacterial infections has led to heightened levels of morbidity and mortality, alongside prolonged durations of hospitalization and escalated healthcare expenditures.

A recent investigation reveals a notable surge of 65% in the global utilization of antimicrobials within the timeframe of 2000 to 2015, primarily fueled by escalated usage in low-and middle-income nations (LMICs).³ In LMICs, inappropriate antimicrobial prescribing and dispensing across healthcare sectors, alongside widespread use in animal agriculture and poor disposal, are fueling the rise of AMR. As a responsible physician it's necessary to recognize the urgency of implementing effective AMS programs to combat this global threat.⁴

WHO recommends adoption and integration of updated model list of essential medicines, which categorizes antimicrobials into distinct categories denoted as access, watch, and reserve (AWaRe).⁵ This classification is intended to be used as a tool for countries to better support antimicrobial monitoring and stewardship activities. This classification system classifies antimicrobials based on their criticality and recommended usage scenarios. Access category encompasses essential antimicrobials deemed necessary for consistent availability.⁵ Conversely, Watch category includes antimicrobials of critical importance, recommended solely for specific, delimited indications.⁵ Finally, the reserve category comprises antimicrobials to be utilized as a last resort when conventional options prove ineffective.⁵ AwaRe classification framework aims to enhance accessibility to vital antimicrobial medications while mitigating risk of AMR stemming from over utilization of select priority antimicrobials.⁵

Assessing the comprehension, beliefs, and behaviors of medical practitioners, and recognizing AMR as a key educational concern, is crucial in combating AMR. Effective AMS programs require raising awareness among healthcare professionals, particularly doctors, and addressing any knowledge gaps.⁶ Identifying these gaps helps optimize AMS implementation, enhancing its effectiveness against AMR. We conducted comprehensive KAP survey among physicians across diverse regions and academic affiliations to understand the educational landscape of AMR and promote AMS initiatives.

METHODS

Study designs

This was a cross-sectional and descriptive study.

Study population and setting

This study was conducted in Maharashtra, India during December 2023, and March 2024 among physicians and the sample size was estimated to be 200. The study was representative of physicians and surgeons across all specialties, super specialties and general practitioners.

Data collection tool

A self-administered survey was distributed to physicians who were engaged in the prescription of antimicrobials.

The development process of the questionnaire involved an exhaustive review of pertinent literature. Subsequently, an initial iteration of the questionnaire was formulated and underwent revisions by the research team. Following this, the questionnaire underwent pilot testing among a cohort of participants to evaluate its linguistic clarity, ease of use, and overall feasibility. Feedback received from the pilot study participants was carefully considered, leading to necessary modifications and enhancements to the questionnaire. It's noteworthy that data collected during the pilot phase were excluded from the final analysis. The electronic version of the questionnaire was developed using Microsoft forms.

This standardized questionnaire was divided in three sections consisting of twenty-seven questions. First section the knowledge section consisted of thirteen questions which included consent for the study, awareness of AMS and knowledge of the antimicrobial usage. The knowledge questions were combined and simulated with clinical scenarios to get a deep insight of judgement and not a mere knowledge evaluation. The questions were graded as 1 point for correctly answered multiple choice question, for 11 knowledge questions, which accounted a total score of 11 points. Second section the attitude section consisted of seven questions to gauge the attitude towards of AMS and prescription of antimicrobials. Third section, the practice section consisted of six points to discover the practices of prescribers and feedback about the form. The responses from attitude and practice section were recorded on the 5-point Likert scale as follows: attitude: strongly agree, agree, neutral, disagree, and strongly disagree; practices: always, very often, sometimes, rarely and never.

Data collection process

The electronic version of the survey instrument was disseminated through various online platforms, including WhatsApp, Instagram, and LinkedIn. The questionnaire prominently featured the study's title, objectives, and aims. Informed consent was obtained at the outset of the study, with clearly explaining that the data collection is for academic research purpose. All data collection procedures were conducted anonymously.⁷

Data analysis

The data was analyzed using Microsoft office 365 excel.

RESULTS

Participants

A total of 580 responses were collected. All the participants consented for the study.

Knowledge

The 72% (420) of the participants were aware of the term AMS. The 11-point quiz in the knowledge section resulted

an average score of 7.3. The results of the survey on antimicrobial knowledge indicate a strong understanding among respondents regarding AMS goals and best practices. Across various questions, an average of 67% of respondents provided correct answers. Notably, nearly 96% respondents correctly identified the primary goal of AMS programs as minimizing the development of AMR. Additionally, 60% correctly identified infectious disease specialists as the healthcare professionals typically responsible for leading AMS efforts. Majority participants correctly identifying cefazolin for preventing postoperative endophthalmitis (67%), prioritizing narrow-spectrum antimicrobials based on local guidelines for

bacterial infections (66%), and recognizing amoxicillin as the first-line therapy for acute bacterial sinusitis (57%). 90% participants correctly identified the spectrum of penicillin. Moreover, respondents accurately identified nafcillin for penicillinase-producing *Staphylococcus aureus* infections (45%) and cilastatin role in preserving imipenem efficacy (72%)⁸. Additionally, 52% correctly understood that penicillin inactivates gentamicin in IV mixtures, explaining treatment failure. Notably, 71% correctly identified the primary reason for initiating combination therapy in HIV patients as preventing resistance to monotherapy.

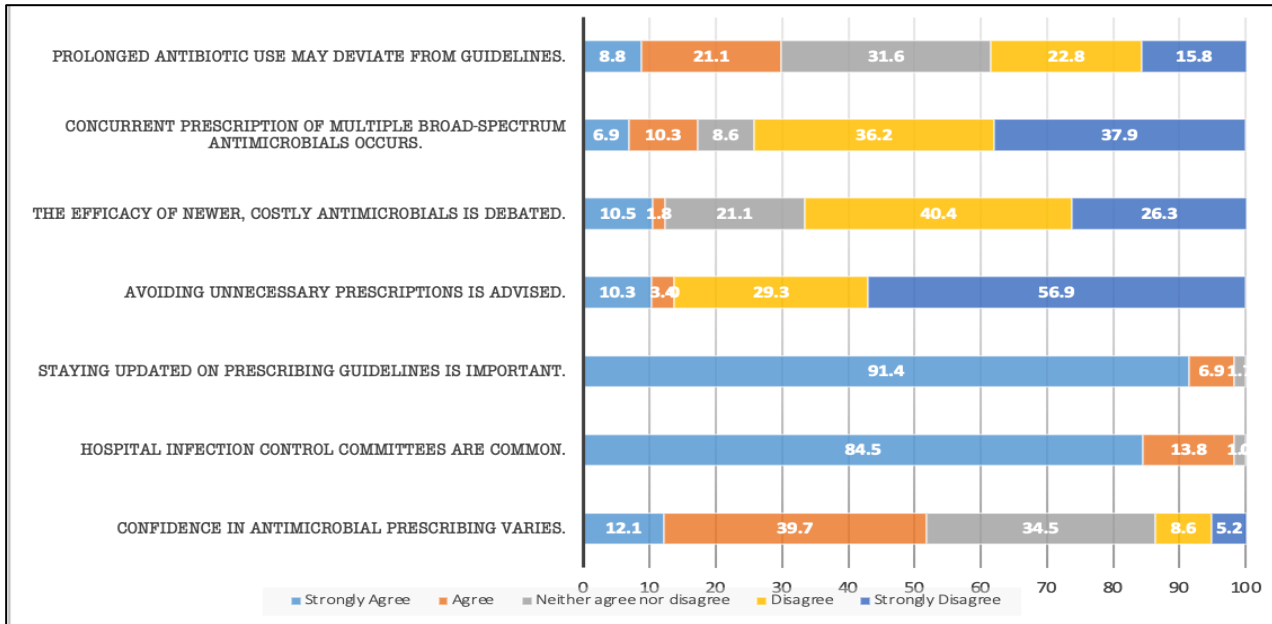


Figure 1: Attitude.

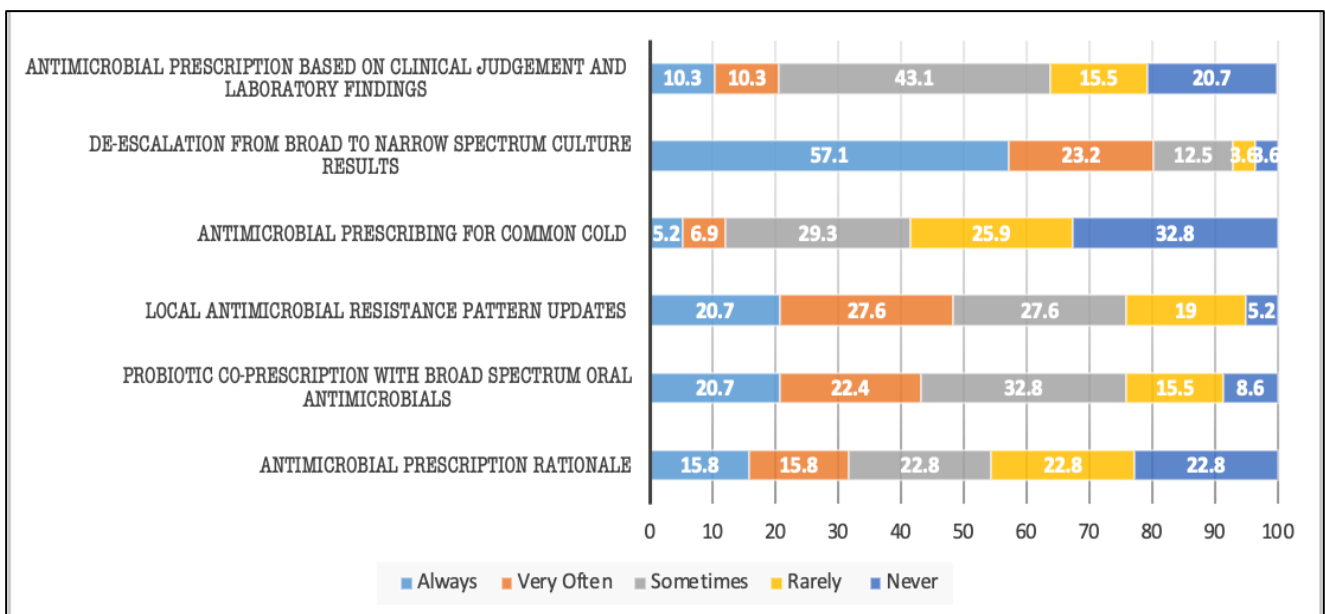


Figure 2: Practice.

Attitude

Firstly, a significant proportion of respondents (51.8%) express confidence in their knowledge regarding antimicrobial prescribing. However, a substantial minority (34.5%) neither agree nor disagree. The overwhelming consensus (98.3% either strongly agreeing or agreeing) on the necessity of having an infection control committee at every healthcare facility. Additionally, the data shows a strong commitment (98.3% either strongly agreeing or agreeing) to staying updated with the latest antimicrobial information. There is a clear rejection (86.2% either disagreeing or strongly disagreeing) of the notion that prescribing should be influenced by patient demands. The responses regarding the efficacy of newer antimicrobials are more mixed. While 12.3% agree or strongly agree that newer antimicrobials are more effective, a significant proportion (40.4%) disagree, and 26.3% strongly disagree. When considering the use of broad-spectrum antimicrobials, a majority (74.1%) disagree or strongly disagree that many should be prescribed, emphasizing a preference for targeted therapy to minimize resistance development. Lastly, opinions on the justification for long-duration antimicrobial usage are divided. While 30.9% either agree or strongly agree with long-duration use in certain scenarios, a significant portion (38.6%) disagree or strongly disagree (Figure 1).

Practices

Only 31.6% of respondents always or very often write the rationale, while a combined 45.6% rarely or never do so. The 43.1% of respondents always (20.7%) or very often (22.4%) prescribe probiotics while prescribing broad-spectrum oral antimicrobials. A smaller proportion, 24.1%, rarely (15.5%) or never (8.6%) include probiotics in their prescribing regimen. 48.3% of healthcare professionals always (20.7%) or very often (27.6%) update themselves with local AMR patterns. However, 24.2% do this rarely (19%) or never (5.2%). Only 5.2% always and 6.9% very often prescribe antimicrobials for common cold. However, 29.3% sometimes and 25.9% rarely prescribe for viral illness, with 32.8% never doing so. A significant majority, 80.3%, always (57.1%) or very often (23.2%) de-escalate from broad-spectrum to narrow-spectrum antimicrobials as soon as culture results are available. Prescribing antimicrobials based on clinical discretion due to a lack of trust in laboratory results is practiced always by 10.3% and very often by 10.3% of respondents. A notable 43.1% sometimes rely on clinical discretion, while 15.5% rarely and 20.7% never do so, (Figure 2).

DISCUSSION

The findings of this study will contribute valuable data to inform public health interventions aimed at improving AMS.²

Knowledge

AMS initiatives have proven effective in mitigating the rise of AMR and preventing healthcare-associated infections.⁹ In a 2022 study by Vernoooy et al., respondents exhibited an overestimation of their understanding of knowledge regarding antimicrobial prescribing and their capacity to correctly answer the knowledge questions. This finding contrasts with the Dunning-Kruger effect, commonly observed in learners, where confidence can outstrip objective competence.¹⁰ On the contrary our data suggests respondents possessed a realistic perception of their ability, demonstrating alignment between self-reported confidence and performance on knowledge-based assessments.⁸ The 72% of the participants were aware of the term AMS but 96% of the participants were able to correctly identify the goal of antimicrobial stewardship, this imparts that there was an existing awareness among the participants towards increasing AMR which is in alignment with a similar study conducted by Shendy et al.¹¹ Respondents (60%) correctly identified infectious disease specialists as leading AMS efforts, aligning with prior research (Rhabri et al).¹² The average score of the questionnaire obtained was 7.3 out of 11 which imparts that the population holds a decent knowledge about the antimicrobials and its usage in clinical scenarios. It was observed that there were few knowledge gaps which can be overcome by education about anti-microbial stewardship. The basic knowledge of the participants turned out to be good for the coverage of penicillin antimicrobials towards gram positive bacteria. Further on funneling the knowledge to specific condition like endophthalmitis only 67% answered cefazolin correctly. Only 66% of doctors chose to rely on local guidelines and start treatment with narrow spectrum antimicrobials reflecting aggressiveness towards treating the infections despite the appropriate knowledge about the spectrum of antimicrobials. Also, a lack of recent updates and newer approaches was reflected while selecting amoxicillin for acute bacterial sinusitis. A concerning response to rationale of using nafcillin against *S. aureus* where only 45% answered the question correctly by choosing nafcillin is resistant to penicillinase. The examination of participants' comprehension pertaining to pharmacokinetics, pharmacodynamics, and drug-drug interactions illuminated a conspicuous gap in their application when questioned on combination therapy, rationale for failure of drug therapy and its prevention and extended understanding of mechanism of action.⁶ It surfaced that despite their paramount significance, these factors are often undervalued in shaping treatment outcomes. In the foreseeable future, the pivotal elements for crafting an efficacious response to AMR are anticipated to be education, communication, and training.^{13,14}

Attitude

A significant proportion of respondents (51.8%) expressed confidence in their knowledge of antimicrobial prescribing, while 34.5% were uncertain, indicating a need

for further education and support. An overwhelming 98.3% agreed on the necessity of infection control committees, highlighting the importance of organizational support for proper antimicrobial use.

Additionally, 98.3% showed a strong commitment to staying updated with the latest antimicrobial information, reflecting a proactive attitude towards continuous learning. There was also strong rejection (86.2%) of prescribing based on patient demands, demonstrating an understanding of risks of inappropriate antimicrobial use.

Opinions on newer antimicrobials were mixed, with only 12.3% believing they are more effective, while 40.4% disagreed and 26.3% strongly disagreed. This suggests differing views on their clinical advantages.

A majority (74.1%) disagreed with the frequent use of broad-spectrum antimicrobials, favouring targeted therapy to minimize resistance. Opinions on long-duration antimicrobial use were divided, with 30.9% in favour and 38.6% against, reflecting ongoing debates about optimal therapy duration.

Practices

The practice of documenting the rationale for prescribed antimicrobials is insufficiently adopted, with only 31.6% always or very often doing so, and 45.6% rarely or never documenting. This highlights the need for improved documentation practices to ensure accountability and effective antimicrobial stewardship.

The use of probiotics with broad-spectrum antimicrobials is moderately common, with 43.1% always or very often prescribe them. This practice reflects a growing awareness of the importance of maintaining gut bacteria and preventing adverse effects such as diarrhoea.¹⁵ These factors can impact adherence to antimicrobial treatment, but the 15.5% who rarely and 8.6% who never prescribe probiotics highlight the need for more consistent guidelines and education on their benefits.

Updating local AMR patterns is crucial for stewardship. While 48.3% of respondents frequently do this, 19% rarely and 5.2% never do, indicating the need for better access to resistance data and its integration into practice. High number staying informed shows commitment to addressing AMR. This emphasis on training the next generation signifies need for forward-thinking planning.^{11,13}

Prescribing antimicrobials for the common cold, a typically viral illness, is problematic. Despite this, 12.1% of respondents frequently and 29.3% sometimes do so. This inappropriate prescribing contributes to AMR and the dangers of unnecessary antimicrobial use.

De-escalation from broad-spectrum to narrow-spectrum antimicrobials based on culture results is widely practiced,

with 80.3% always or very often doing so, reflecting strong adherence to antimicrobial stewardship. However, the 7.2% who rarely or never de-escalate.

Finally, it was observed that despite the de-escalation based on laboratory results but on encountering a discrepancy in clinical judgement and laboratory results the reliance was more on clinical judgement. The distrust in laboratory results leading to prescribing based on clinical discretion is a notable concern. While 20.6% of respondents always or very often prescribe based on clinical discretion due to mistrust in lab results, 43.1% sometimes do so. The significant reliance on clinical judgment over laboratory data suggests issues with delays in microbiology report availability, doctors' mistrust in laboratory findings, burden on public sector hospital laboratories, limited availability of antimicrobials in hospitals, and the financial constraints faced by patients, compelling doctors to prescribe broad-spectrum antimicrobials.³

High knowledge levels were associated with positive attitudes towards stewardship practices and adherence to best practices. The high awareness of the primary goal of AMS (96%) and the importance of infection control committees (98.3%) translated into positive attitudes and practices such as the preference for targeted therapy over broad-spectrum antimicrobials (74.1% disagreement with frequent broad-spectrum prescriptions).

However, knowledge gaps and mixed attitudes in specific areas influenced practice variability. Overall, while there is a solid foundation of antimicrobial knowledge and generally positive attitudes towards stewardship, the variability in practices underscores the need for ongoing education and system improvements. Emphasizing the importance of documenting prescribing rationale, standardizing updates on resistance patterns, and enhancing trust in laboratory results are crucial steps towards optimizing antimicrobial stewardship.

Limitations

The specialty of physicians, type of hospital and years of experience influences their prescribing behaviours. However, this survey did not allow for an analysis of the type of hospital and years of experience, characteristics and underlying differences among all participating specialties. Further detailed studies are needed to address this gap.

CONCLUSION

The analysis shows a positive attitude of participants towards the significance, awareness and implementation of the AMS. Though the practices still need to be updated and improved this survey of doctors highlights their awareness and concern about AMR, emphasizing the critical need for robust infection control committee and AMS programs. These programs should incorporate local

guidelines, comprehensive training on antimicrobial prescription, and account for factors such as hospital type, intensive care unit (ICU) settings, and years of experience. The study highlights that effective infection treatment extends beyond antimicrobial prescription to encompass pharmacological understanding, patient education on proper antimicrobial use, and patient adherence to treatment regimens. Addressing AMR requires a holistic approach beyond antimicrobials, with further research needed to explore conceptual gaps and practical barriers at the grassroots level.

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