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Research

Optimizing Antibiotic Use: How Pharmacists Can Address Knowledge, Attitudes, and Practices to Combat Antimicrobial Resistance

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Abstract

Objective: This study aimed to assess the knowledge, attitude, and practices of community pharmacists towards antimicrobial resistance (AMR) management in Khetri Tehsil, Jhunjhunu District, Rajasthan, and identify strategies to enhance their understanding and awareness of the issue.
Methods: Community pharmacists were selected as the study population. Registered pharmacists working at retail pharmacies were invited to complete a paper-based questionnaire comprising 10 multiple-choice questions each (MCQs) related to knowledge, attitude, and practice concerning AMR management.
Results: A total of 99 participants provided their responses. Knowledge, Practice and attitudes regarding antimicrobial resistance were evaluated by the percentage of the population given correct answer based on questions asked.
Conclusion: The findings revealed a lack of knowledge and poor practices among community pharmacists regarding antimicrobial resistance, although a positive attitude was observed. These results highlight the need for increased awareness and education to enhance reporting and combat antimicrobial resistance effectively.

Keywords: Antimicrobial resistance (AMR), Community Pharmacist, questionnaire, awareness.

INTRODUCTION

Antibiotic Resistance: A Global Threat to Public Health

Antibiotic resistance has emerged as a formidable challenge, posing a significant threat to global health, food security, and development. This phenomenon occurs when bacteria evolve mechanisms to evade the effectiveness of antibiotics, rendering them powerless against infections they were once designed to combat [1-

4]. The gravity of the situation lies in the alarming rise of infections resistant to traditional antibiotic treatments. Common ailments like pneumonia, tuberculosis, and even gonorrhea are becoming increasingly difficult, and sometimes impossible, to treat. This translates to longer hospital stays, increased healthcare costs, and most concerning, a rise in mortality rates. The misuse and overuse of antibiotics in both humans and animals are the primary drivers of this accelerating crisis. The global burden of drug-resistant infections is staggering, with estimates suggesting nearly 1.3 million deaths attributable to these infections in 2019 alone. This figure surpasses fatalities associated with HIV and malaria, highlighting the urgency of addressing this issue. Combating this threat requires a multi-pronged approach. Raising awareness among healthcare professionals, policymakers, and the general public about the responsible use of antibiotics is crucial. Additionally, stricter regulations on antibiotic use in agriculture and stricter adherence to treatment guidelines are essential to prevent the emergence and spread of resistant strains. Investing in research and development of new antibiotics is also paramount to replenish our dwindling arsenal of effective treatments. In conclusion, antibiotic resistance is a global health crisis demanding immediate and comprehensive action. Through collaborative efforts, increased awareness, and responsible use of antibiotics, we can mitigate the devastating consequences of drug-resistant infections and safeguard public health for generations to come [5-8].

The United Nations Secretary-General has established IACG to improve coordination between international organizations and to ensure effective global action against this threat to health security. The IACG is co-chaired by the UN Deputy Secretary-General and the Director General of WHO and comprises high level representatives of relevant UN agencies, other international organizations, and individual experts across different sectors [9].

The Need to Address Antibiotic Resistance in Community Pharmacists

Antimicrobial resistance (AMR) poses a significant public health threat, impacting millions globally. It hinders the treatment of infectious diseases, leading to increased illness and death rates, while driving up healthcare costs [10]. Pharmacists, as key stakeholders in antibiotic management, play a crucial role in combating AMR. However, research suggests a gap in pharmacists' knowledge, attitudes, and practices concerning AMR, potentially contributing to the issue. This study aims to address this gap by exploring the knowledge, attitudes, and practices of community pharmacists regarding AMR. By identifying areas for improvement, we can develop effective strategies to enhance their understanding and awareness. Improved knowledge and awareness among pharmacists will lead to better management of antibiotic use, potentially improving patient outcomes and reducing healthcare costs. Additionally, this study can provide valuable insights to policymakers and stakeholders for designing interventions to combat AMR more effectively. Research on pharmacists' knowledge and practices in this area remains limited, highlighting the need for this investigation.

This study aims to comprehensively evaluate community pharmacists' knowledge, attitudes, and practices concerning antimicrobial resistance (AMR) and identify strategies to improve their understanding and awareness. To achieve this, the following objectives will be pursued:

MATERIALS AND METHODS

Assess Knowledge: Employ a validated questionnaire to evaluate community pharmacists' knowledge base regarding AMR.
Evaluate Practices: Assess current practices employed by community pharmacists in managing antibiotic use and preventing the spread of resistant infections.
Identify Challenges: Explore the barriers and challenges faced by community pharmacists in implementing effective antibiotic stewardship programs.
Develop Improvement Strategies: Identify and explore strategies that can be implemented to enhance community pharmacists' understanding and awareness of AMR.
Survey Development: Develop a validated questionnaire or survey tool to assess the knowledge, attitudes, and practices of community pharmacists regarding AMR.
Sample Selection: Identify a diverse and representative sample of community pharmacists to participate in the study.
Data Collection: Administer the questionnaire or survey tool to the selected sample of community pharmacists, preferably in person.
Data Analysis: Employ appropriate statistical methods to analyze the collected data.
Synthesis and Recommendations: Synthesize the findings from the knowledge assessment, practice evaluation, and exploration of challenges. Based on the synthesis, develop practical and actionable recommendations for strategies that can enhance community pharmacists' knowledge, attitudes, and practices concerning AMR.

METHOD

Analytical study was conducted in pharmacies around Khetri tehsil, Jhunjhunu District, Rajasthan, India, among the community pharmacist, during January 2023 – May 2023. A questionnaire was prepared to investigate knowledge, attitude and practices of community pharmacists regarding antimicrobial resistance [11]. The initial version of the questionnaire was developed in the English language and the final version was translated into Hindi language. The translation was validated using the standard forward-backward method [12]. This study includes both males and females of Registered Pharmacist. The survey questionnaire was prepared according to the need of the present study. A total of 30Multiple Choice Questions were framed and classified into three groups which include 10 questions each related to knowledge, attitude and practices towards antimicrobial resistance (AMR). The questionnaire was validated by three professors of clinical pharmacy. This questionnaire was tested and made error-free prior to using [13-16].

Table1: Gender of the Respondent

Gender	No. of Participants	Percentage (%)	Cumulative Percentage (%)
Males	80	83.33	83.33
Females	16	16.66	99.99
Total	**96**	**99.99**	

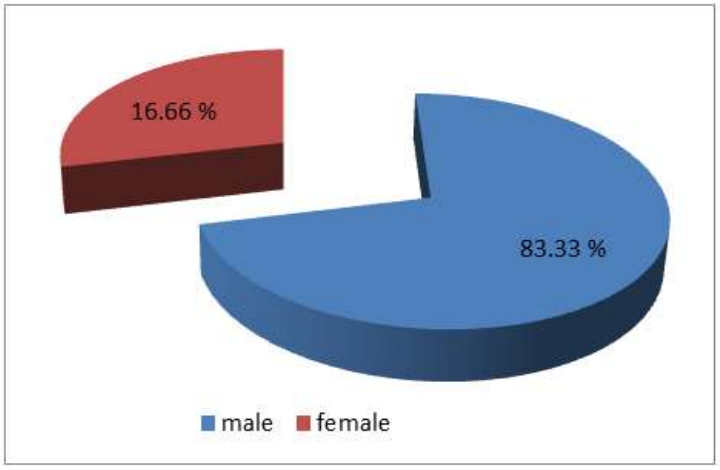


Fig 1: Illustrates the demographic characteristics of respondents

Table 2: Knowledge of the participants (Community Pharmacist) regarding the AMR Management

S.No	Question	Answer	Number	Percentage %
1	**What is the definition of antimicrobial resistance (AMR)?** A. The ability of a microorganism to stop an antimicrobial from working against it B. The allergic reaction to an antimicrobial agent C. The ability of a microorganism to produce more antimicrobial agents D. The use of antimicrobial agents in animals and humans	Correct	**73**	**73.7**
		Incorrect	**26**	**26.2**
2	**Which of the following is not a consequence of antimicrobial resistance?** A. Increased morbidity and mortality B. Longer hospital stays C. Lower healthcare costs	Correct	**04**	**4.04**
		Incorrect	**92**	**92.9**

	D. Limited treatment options for infections			
3	**What is the role of community pharmacists in the fight against antimicrobial resistance?** A. Prescribe antibiotics B. Promote vaccination campaigns C. Educate patients on the proper use of antibiotics D. B and C	Correct	**60**	**60.6**
		Incorrect	**39**	**39.3**
4	**What is the most appropriate approach to manage a patient with a viral infection?** A. Prescribe antibiotics to prevent secondary bacterial infections B. Prescribe antiviral medications C. Recommend symptomatic treatment and rest D. Prescribe a high-dose antibiotic for a short duration	Correct	**12**	**12.1**
		Incorrect	**87**	**87.8**
5	**Which of the following practices can help prevent the spread of antimicrobial resistance?** A. Washing hands frequently and properly B. Storing antibiotics at room temperature C. Sharing antibiotics with friends or family D. Taking antibiotics for viral infections	Correct	**76**	**76.7**
		Incorrect	**23**	**23.2**
6	**Which of the following statements about the use of antibiotics is TRUE?** A. Antibiotics should be used to treat all types of infections B. Antibiotics are effective against bacteria, viruses, and fungi C. Taking antibiotics exactly as prescribed is important for combating antimicrobial resistance D. It is acceptable to stop taking antibiotics once you start feeling better	Correct	**64**	**64.6**
		Incorrect	**35**	**35.3**
7	**What is the term used to describe bacteria that are resistant to multiple antibiotics?** A. Multidrug-resistant (MDR) bacteria B. Unicellular organisms C. Superbugs D. A and C	Correct	**16**	**16.1**
		Incorrect	**83**	**83.8**

8	**What is the main difference between narrow-spectrum and broad-spectrum antibiotics?** A. Narrow-spectrum antibiotics target only specific types of bacteria, while broad-spectrum antibiotics target a wider range of bacteria B. Narrow-spectrum antibiotics are more effective than broad-spectrum antibiotics C. Broad-spectrum antibiotics have fewer side effects than narrow-spectrum antibiotics D. Narrow-spectrum antibiotics are more commonly used in clinical practice	Correct	**04**	**4.04**
		Incorrect	**92**	**92.9**
9	**How can community pharmacists help reduce the unnecessary use of antibiotics?** A. Educating patients on the proper use and disposal of antibiotics B. Providing information on non-antibiotic treatment options for minor illnesses C. Monitoring antibiotic prescribing patterns and providing feedback to healthcare providers D. All of the above	Correct	**40**	**40.4**
		Incorrect	**56**	**56.5**
10	**Which of the following is an example of a superbug?** A. Multidrug-resistant tuberculosis (MDR-TB) B. Influenza C. Athlete's foot D. None of the above	Correct	**48**	**48.4**
		Incorrect	**51**	**51.5**

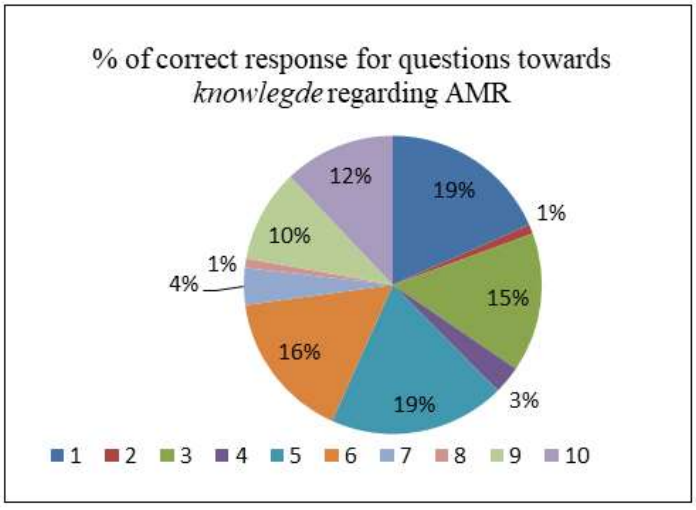


Fig 2: Depicts pie chart of correct response from participant pharmacists towards the *knowledge* of AMR management

Table 3: *Practice* of the participants (Community Pharmacist) regarding the AMR Management

S.No	Question	Answer	Number	Percentage %
1	**Do you dispense antibiotics without a prescription from a physician?** A. Yes B. No C. Sometimes	Correct	**06**	**06.0**
		Incorrect	**93**	**93.9**
2	**Do you recommend over-the-counter (OTC) antibiotics to patients?** A. Yes B. No C. Sometimes	Correct	**68**	**68.6**
		Incorrect	**31**	**31.3**
3	**Do you recommend probiotics to patients who are taking antibiotics?** A. Yes B. No C. Sometimes	Correct	**16**	**16.1**
		Incorrect	**83**	**83.8**
4	**Do you advise patients to return leftover antibiotics to the pharmacy for proper disposal?** A. Yes B. No C. Sometimes	Correct	**68**	**68.6**
		Incorrect	**31**	**31.3**
5	**Do you work with physicians and other healthcare providers to promote appropriate antibiotic use?** A. Yes B. No C. Sometimes	Correct	**62**	**62.6**
		Incorrect	**37**	**37.3**
6	**Do you provide educational resources or materials to patients regarding the proper use of antibiotics?** A. Yes B. No C. Sometimes	Correct	**24**	**24.2**
		Incorrect	**75**	**75.7**
7	**Do you keep up-to-date with current guidelines and recommendations for antibiotic use?** A. Yes B. No C. Sometimes	Correct	**16**	**16.1**
		Incorrect	**83**	**83.8**
8	**Do you ask patients about their previous antibiotic use before dispensing antibiotics?** A. Yes B. No C. Sometimes	Correct	**60**	**60.6**
		Incorrect	**39**	**39.3**

9	**Do you have a system in place to monitor and track antibiotic use in your pharmacy?** A. Yes B. No C. Somewhat	Correct	**72**	**72.7**
		Incorrect	**27**	**27.2**
10	**Do you feel that you have a responsibility to promote appropriate antibiotic use and prevent the development of antibiotic-resistant infections?** A. Yes B. No C. Somewhat	Correct	**72**	**72.7**
		Incorrect	**27**	**27.2**

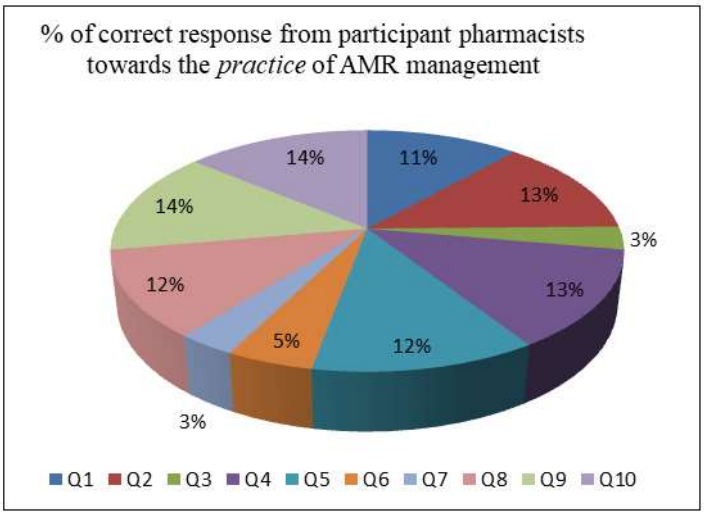


Fig 3: Pie chart of correct response from participant pharmacists towards the *practice* of AMR management

Table 4: *Attitude* of the participants (Community Pharmacist) regarding the AMR Management

S.No	Question	Answer	Number	Percentage %
1	**Do you believe that community pharmacists have a responsibility to promote appropriate antibiotic use and prevent the development of antibiotic-resistant infections?** A. Yes B. No C. Unsure	Correct	**92**	**92.9**
		Incorrect	**05**	**5.05**
2	**Do you believe that the use of antibiotics in livestock and agriculture contributes to the development of antibiotic resistance in humans?** A. Yes B. No C. Unsure	Correct	**12**	**12.1**
		Incorrect	**75**	**75.7**

3	**Do you believe that the government should take a more active role in regulating the use of antibiotics in healthcare and agriculture?** A. Yes B. No C. Unsure	Correct	**00**	**00**
		Incorrect	**98**	**99.9**
4	**Do you believe that the development of new antibiotics is the best solution to the problem of antibiotic resistance?** A. Yes B. No C. Unsure	Correct	**24**	**24.2**
		Incorrect	**75**	**75.7**
5	**Do you believe that the use of rapid diagnostic tests can help to reduce the unnecessary use of antibiotics?** A. Yes B. No C. Unsure	Correct	**64**	**64.6**
		Incorrect	**35**	**35.3**
6	**Do you believe that healthcare professionals, including pharmacists, have a responsibility to educate patients about the risks associated with antibiotic overuse and the importance of appropriate antibiotic use?** A. Yes B. No C. Unsure	Correct	**72**	**72.7**
		Incorrect	**27**	**27.2**
7	**Do you believe that community pharmacists should be more involved in efforts to reduce the development of antibiotic resistance?** A. Yes B. No C. Unsure	Correct	**96**	**96.9**
		Incorrect	**03**	**3.03**
8	**Do you believe that the development of antibiotic-resistant infections can lead to significant economic costs?** A. Yes B. No C. Unsure	Correct	**50**	**50.5**
		Incorrect	**49**	**49.4**
9	**Do you believe that the development of antibiotic-resistant infections can lead to increased mortality rates?** A. Yes B. No C. Unsure	Correct	**76**	**76.7**
		Incorrect	**23**	**23.3**
10	**Do you believe that pharmacists should have the authority to prescribe antibiotics in certain situations?**	Correct	**92**	**92.9**

A. Yes B. No C. Unsure	Incorrect	**08**	**8.08**

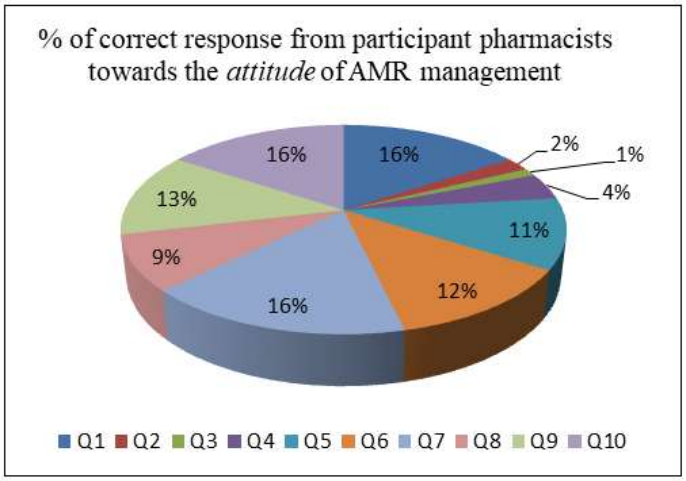


Fig 4: Pie chart of % correct response from participant pharmacists towards the *attitude* of AMR management

DISCUSSION

Study Finds Pharmacists Know Basics of Antibiotic Resistance, But Scope for Improvement

The study sheds light on the knowledge and awareness levels of community pharmacists concerning antimicrobial resistance (AMR) management, offering valuable insights into this critical healthcare issue. A significant majority (73.7%) of pharmacists demonstrated a solid grasp of the definition of antimicrobial resistance, reflecting a strong foundational understanding of the concept within the surveyed group. This finding is promising, indicating that a large proportion of community pharmacists possess the necessary knowledge to comprehend the fundamental nature of AMR. However, only a small percentage (4.04%) of pharmacists accurately identified the consequences of AMR, revealing a potential knowledge gap in understanding the various implications associated with this problem. Addressing this gap through targeted education and training programs is crucial to ensure that pharmacists are well-informed about the risks and implications of AMR.

Regarding the role of community pharmacists in addressing AMR, more than half (60.6%) provided the correct response, indicating a significant awareness of their responsibilities in combating AMR. However, a notable portion of pharmacists may not have a comprehensive understanding of their role, suggesting a need for increased awareness and training efforts to equip all community pharmacists to contribute effectively to AMR mitigation strategies. Similarly, when asked about the appropriate management of viral infections, only a small percentage (12.1%) of pharmacists provided the correct answer, indicating a potential lack of awareness in this area. Enhancing knowledge and providing evidence-based guidelines can optimize patient care and prevent unnecessary antibiotic use.

On a positive note, a significant majority (76.7%) of pharmacists correctly identified practices that help prevent the spread of AMR, demonstrating a strong understanding of the importance of implementing measures to curb AMR transmission. This knowledge is crucial for educating patients and providing guidance on preventing AMR spread. Additionally, more than half (64.6%) of pharmacists demonstrated a solid understanding of appropriate antibiotic use, although continual reinforcement and staying updated with guidelines are essential.

However, there were areas needing improvement, such as knowledge of specific terminology like multi-drug resistant bacteria and differentiating between narrow-spectrum and broad-spectrum antibiotics. Efforts to enhance understanding in these areas can improve communication and decision-making. Moreover, while a significant percentage (40.4%) of pharmacists recognized the importance of reducing unnecessary antibiotic use, there is room for improvement in raising awareness and providing support for antimicrobial stewardship efforts.

Pharmacist *Practices* in Antibiotic Use

This study looked at how pharmacists handle antibiotics: Good news that most pharmacists (over 94%) follow the rules and don't dispense antibiotics without a prescription and don't recommend over-the-counter antibiotics. They also advise patients to return leftover antibiotics and work with doctors for proper use. Areas for improvement**:** Many pharmacists (84%) may not tell patients about probiotics, which can help with side effects of antibiotics. Only a quarter (24%) regularly gives patients information on using antibiotics correctly. Less than a fifth (16%) regularly update their knowledge on antibiotic best practices

Pharmacist *Attitudes* on Antibiotic Resistance Management

The study thoroughly investigates the beliefs and opinions of community pharmacists regarding antibiotic resistance management (AMR), revealing several key insights. Firstly, a notable 92% of pharmacists acknowledged their responsibility to advocate for responsible antibiotic use and prevent antibiotic-resistant infections, emphasizing their crucial role as the initial point of contact for patients seeking medication and advice in AMR management. However, there exists a concerning knowledge gap as only 12% of pharmacists correctly identified the link between antibiotic use in livestock and the emergence of resistance in humans, indicating a need for education on the "One Health" approach that emphasizes the interconnectedness of human, animal, and environmental health.

Interestingly, none of the pharmacists believed that the government should play a more active role in regulating antibiotic use, necessitating further investigation to understand this perspective. Moreover, a significant portion (24%) of pharmacists disagreed that developing new antibiotics is the ultimate solution, showcasing their understanding of the necessity for broader strategies such as antimicrobial stewardship and infection prevention. The study also highlighted that over 64% of pharmacists recognized the value of rapid diagnostic tests in guiding appropriate antibiotic use, potentially reducing unnecessary prescriptions and mitigating AMR development.

Regarding patient education, a substantial majority (73%) of pharmacists expressed the belief that healthcare professionals, including themselves, have a responsibility to educate patients about the risks of antibiotic overuse and the importance of appropriate use, aligning with their role as educators and trusted healthcare providers. Furthermore, an overwhelming 97% of pharmacists expressed a desire to be more involved in AMR reduction efforts, indicating their willingness to collaborate with healthcare professionals and policymakers effectively.

Awareness of the economic costs associated with AMR was evident among half of the pharmacists, while over 76% recognized the increased mortality rates linked to antibiotic-resistant infections, underscoring the importance of this awareness in motivating stakeholders to address AMR. Additionally, a significant majority (93%) of pharmacists believed that they should have the authority to prescribe antibiotics in certain situations, signaling a willingness to expand their role and contribute to improved antibiotic stewardship.

CONCLUSION

In conclusion, the findings from the study on pharmacist practices and attitudes towards antibiotic resistance management (AMR) reveal both strengths and areas for improvement within the pharmacy profession. On the positive side, there is a high level of recognition among pharmacists regarding their responsibility in promoting responsible antibiotic use and preventing antibiotic-resistant infections. Their willingness to engage in AMR reduction efforts, collaborate with healthcare professionals, and educate patients underscores their crucial role in combating this global health threat. It is essential to implement an intervention program focusing on pharmacists' practices to improve antibiotic use and minimize resistance. A thorough analysis of pharmacists' roles in combating antibiotic resistance is necessary.

LIMITATION

Regrettably, most community pharmacies surveyed in this study had salespeople rather than qualified pharmacists. While some admitted to their actual roles, many others pretended to be pharmacists. It's worth mentioning that we maintained data integrity by excluding suspected individuals from the survey. However, a limitation of this research is the relatively small number of participants.

Conflicts of interest

All authors declare that have no conflicts of interest.

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