

# A KAP Study of Healthcare Professionals on Antimicrobial Stewardship in a Tertiary Care Hospital

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## Abstract

**Introduction:** The prevalence of communicable diseases remains a significant burden for developing countries like India, with antimicrobial agents playing a crucial role in treatment. However, irrational and excessive use of these agents has led to a rise in antimicrobial resistance (AMR), prompting the need for effective interventions. The study aimed to assess the Knowledge, Attitudes, and Practices (KAP) of healthcare professionals concerning Antimicrobial Stewardship (AMS) principles and implementation.

**Methods:** A cross-sectional study was conducted over six months in a premier medical college and its affiliated tertiary care hospital in Maharashtra, India. A validated questionnaire was distributed via e-mail and WhatsApp to participants including medical officers, residents, nursing staff, and faculty members. The sample size of 395 was determined based on previous research. Data analysis was performed using SPSS; and the Pearson Chi-square test was employed for categorical data.

**Results:** Study revealed responses from 395 participants across various specialties, with medical officers, residents, nursing staff, and faculty members represented. Only 13% were aware of the WHO's open course on antibiotic stewardship. While a majority understood AMS principles, some knowledge gaps existed, such as the importance of drug administration routes. There was variation in knowledge and attitudes among different groups, with faculty members demonstrating a better understanding of AMS compared to residents. Practice attitudes were assessed regarding prescribing antibiotics for common illnesses like Upper Respiratory Tract Infections (URTI) and acute diarrhoeal illness. While most participants refrained from prescribing antibiotics for these cases, practice attitudes varied. Some respondents were not familiar with terms like pre-authorisation and pre-formulary restriction, indicating a need for increased awareness.

**Conclusion:** The study highlights knowledge-practice gaps among healthcare professionals related to AMS and appropriate antibiotic prescription. The findings emphasize the importance of comprehensive education and training to bridge these gaps and promote responsible antibiotic use. Addressing these issues is essential for combating AMR and improving patient outcomes.

**Keywords:** Antimicrobial stewardship, antimicrobials, antimicrobial resistance, pre-authorisation, pre-formulary restriction.

## Introduction

The prevalence of communicable diseases ranges from 28.05 to 29.57 per 1,000 population, highly burdening for a developing country like India. Antimicrobial agents have a pivotal role, but are being used irrationally and overwhelmingly, causing a rise in resistance. ICMR notified a 66% increase in per capita consumption of antimicrobials in India (2010 as compared to 2000). However, there exist significant knowledge and practice gaps among practicing doctors regarding the principles and implementation of antimicrobial stewardship<sup>1,2</sup>. Studies have highlighted the irrational use of antimicrobial agents, contributing to the development of resistance<sup>2</sup> and thereby, increasing the cost of treatment. Healthcare professionals can significantly reduce antimicrobial resistance by practicing Antimicrobial Stewardship (AMS). The Antimicrobial Stewardship

Programme (ASP) is an efficient and reliable healthcare strategy to encourage suitable use of antimicrobial drugs, through the implementation of evidence-based interventions. It plays a crucial role in combating the rise of antimicrobial resistance and ensuring optimal patient outcomes<sup>3-4</sup>.

Furthermore, research indicates a lack of awareness and adherence to guidelines for appropriate antibiotic prescription among healthcare professionals<sup>3-5</sup>. The burden of communicable diseases in developing countries like India further underscores the need to address these gaps<sup>4,5</sup>. To bridge these knowledge and practice gaps, it is imperative to provide comprehensive education and training on AMS principles and evidence-based interventions<sup>6,7</sup>. By equipping healthcare professionals with the necessary knowledge and tools, we can enhance their understanding and promote

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appropriate use of antimicrobial agents, thereby mitigating the emergence and spread of antimicrobial resistance. AMS is a critical component in the fight against antimicrobial resistance (AMR) and ensuring optimal patient outcomes. Numerous studies have highlighted the knowledge gaps among physicians regarding AMR and appropriate prescribing practices. A study conducted in a tertiary care teaching hospital in Eastern India revealed significant gaps in the knowledge, attitudes, and practices of physicians concerning AMR and prescribing<sup>7,8</sup>. Similarly, a cohort study found that physicians' attitudes and knowledge significantly influenced the quality of antibiotic prescription, emphasizing the need to address these factors to improve prescribing practices<sup>9</sup>. These findings underscore the urgency of enhancing physicians' knowledge and awareness of antimicrobial stewardship to promote AMS use.

A freely available, open WHO online Antimicrobial Stewardship programme can be used as a simple and efficient tool to reduce the existing knowledge gap and ensure optimal prescription of antimicrobial agents. The paper on antibiotic stewardship aims to assess the knowledge, attitudes, and practices (KAP) of healthcare professionals regarding antibiotic use and resistance. It investigates their understanding of the importance of responsible antibiotic prescribing and adherence to guidelines, as well as their perception of the impact of antibiotic resistance on patient outcomes and healthcare costs. The study also explores any variations in KAP between different professional levels.

## Methodology

This was a hospital-based observational cross-sectional study conducted at a premier medical college in western Maharashtra and its affiliated tertiary care hospital in Pune. The study included faculty, residents from clinical subjects, medical officers, and nursing officers. The study spanned six months, during which a validated questionnaire and consent forms were sent to the participants via e-mail and WhatsApp. Ethical clearance was taken from the institutional ethical committee prior to beginning the study.

The sample size of 395 participants was determined based on the KAP prevalence observed in a previous study by Chatterjee *et al*<sup>2</sup>. All available healthcare workers who prescribed and administered antimicrobials were included in the study. The participant selection was done using a universal sampling method, including all available doctors during the six months. However, doctors from the departments of radiology, anaesthesia, and psychiatry were excluded due to the infrequent use of antimicrobials.

The questionnaire was developed by comparing studies and adapting questions from the freely available online WHO

course on Antimicrobial Stewardship: A competency-based approach. The questionnaire consisted of 27 questions with subsections, evaluated on a 5-point Likert scale.

The primary outcome aimed to quantify the existing knowledge gap among different specialty doctors regarding AMS, identify their attitudes, and assess common errors in prescribing antimicrobial agents. The questionnaire incorporated clinical-based scenarios for evaluation.

Data analysis was performed using the Statistical Package for Social Sciences (SPSS® 24.0, USA), and the proportions of each group were defined. The Pearson Chi-square test was used for categorical data, with a significance level set at  $p < 0.05$ . The findings were reported following the STROBE guidelines.

## Results

The questionnaire was shared among healthcare workers at various levels out of which we received responses from 395 participants ranging from various specialties. We received responses from 4 groups, i.e., Medical Officers (51), Residents (196), Nursing staff (114), and faculty (35).

Only 13% of them had ever visited or participated in the WHO open course on AMS as shown in Fig. 1. Most of the residents and the faculty thought that making a correct diagnosis and using the correct dose are important principles of AMS. This has been depicted in Fig. 2. One Hundred and twenty seven (strongly disagree = 11.39%, disagree = 20.76%) respondents did not consider the route of drug administration as an important factor and 104

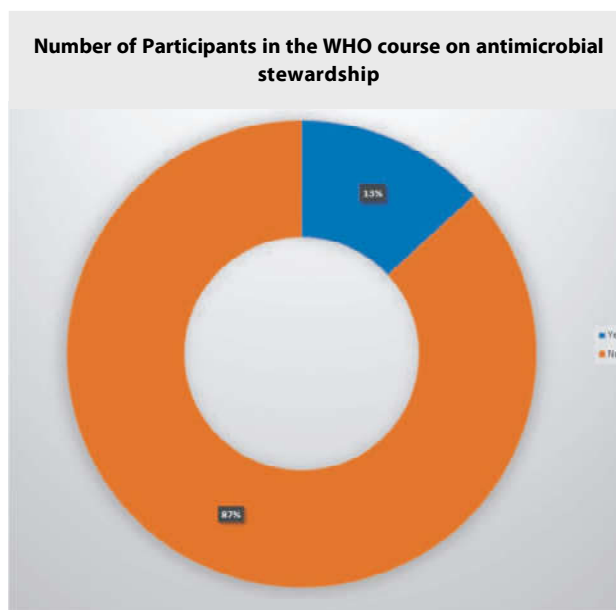


Fig. 1: 51 Respondents who had taken the online WHO course on antimicrobial stewardship.

(26.33%) of them had no opinion on the statement. One hundred and fifty two (SD = 16.2%, D = 22.29%) did not prefer using antibiotics for a longer duration. Two hundred and forty nine (strongly agree = 28.60%, agree = 34.43%) agreed that microbiology guides the therapy whereas 257 (SA = 34.94%, A = 30.12%) felt that antimicrobial use should be evidence based. Most of the residents and faculty were aware that the likely source, site, likely pathogen, and patient characteristics were important in choosing the correct antibiotic. However, Medical Officers and Nursing Officers considered other factors less important. A large number of participants (53.41%) felt that the emergence of AMR is inevitable.

When asked about the mechanism of AMR, 212 (SA = 25.31%, A = 28.35%) felt that it is caused due to alteration in the target molecule. Only 92 (SA = 8.60%, A = 14.68%) respondents felt that large infrequent dosing is required for concentration-dependent killing whereas 99 (SD = 9.62%, D = 15.44%) felt that optimizing the duration of exposure above MIC would not be useful concentration-dependent killing. On asking about the intervention types of antimicrobial stewardship, 180 (45.56%) were not aware of pre-authorization and 168 (42.53%) did not know about pre-formulary restriction.

On comparing the knowledge, a significant knowledge gap was observed between the different groups of Medical Officers, Residents, Nursing staff, and Faculty members. Faculty were more rational about AMS knowledge compared to the Residents.

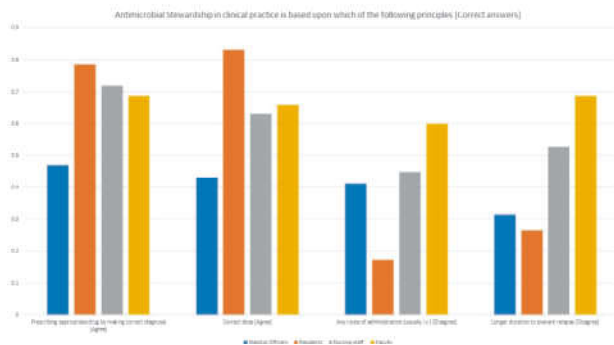


Fig. 2: Response to the questionnaire on knowledge of respondents.

A majority 254 (SA = 35%, A = 29%) of respondents believed that ASP is necessary in our hospitals and 245 (SA = 32%, A = 30%) agreed that ASP would reduce the adverse effects of inappropriate antimicrobial prescription. One hundred and twenty one (SD = 14.5%, D = 28.39%) stated that they would not prefer to take their senior's advice and rather take the online WHO competency-based course. All these responses have been summarised in Fig. 3.

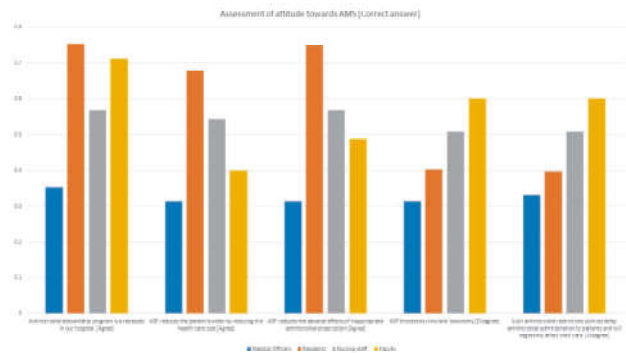


Fig. 3: Response to the questionnaire on attitude of respondents.

In the practice part of the questionnaire 194 (SA = 14.18%, A = 34.93%) reported that microbiologists guide the therapy and only 108 (SA = 7.34%, A = 20%) mentioned pharmacologists as the guide for therapy as illustrated by Fig. 4. One hundred and eighteen (SA = 11.14%, A = 18.73%) of the total respondents answered that they would not prescribe antibiotics for Acute bronchitis (URTI) and 134 (SA = 16.45%, A = 17.49%) said they would not give empirical antimicrobials for acute diarrhoeal illness.

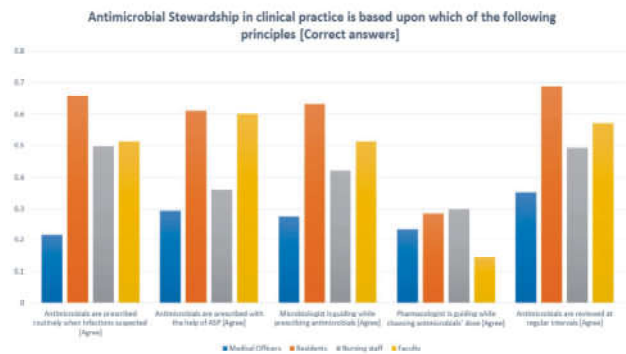


Fig. 4: Response to the questionnaire on practice of respondents.

A detailed Table mentioning all the questions and responses has been included in Appendix A.

## Discussion

Rampant and irrational use of antibiotics has resulted in the development of AMR. Good knowledge and training of healthcare workers may help in the reduction of AMR<sup>7</sup>. WHO has launched a free online course called "Antimicrobial Stewardship: a competency-based Approach" to further this cause. We, therefore, decided to conduct a study on the KAP of healthcare workers based on this study. It was found that a very limited number of participants (13%) had heard about this course which is quite similar to the findings of Kaur *et al* (11%)<sup>1</sup>.

## Appendix A:

### Knowledge

S.No. Questions	Correct Answer	Medical Officer (n = 51)	Resident (n = 196)	Nursing Staff (n = 114)	Faculty (n = 35)	p-value
1. Antimicrobial Stewardship in clinical practice is based upon which of the following principles?						
Prescribing appropriate drug by making correct diagnosis	Strongly Agree	12 (23.53%)	92 (46.94%)	40 (35.09%)	14 (40.00%)	0.029
Correct dose	Strongly Agree	12 (23.53%)	84 (42.86%)	38 (33.33%)	12 (34.29%)	0.000
Any route of Administration (usually i.v.)	Strongly Disagree	7 (13.73%)	13 (6.63%)	17 (14.91%)	8 (22.86%)	0.000
Longer duration to prevent relapse	Strongly Disagree	7 (13.73%)	25 (12.76%)	18 (15.79%)	14 (40%)	0.000
2. Which of the following do you think are the important components of antimicrobial stewardship?						
Microbiology guides the therapy whenever possible	Strongly Agree	6 (11.76%)	64 (32.65%)	31 (27.19%)	13 (37.14%)	0.003
Indications should be evidence based	Strongly Agree	11 (21.57%)	77 (39.2%)	43 (37.72%)	8 (22.86%)	0.000
Use broadest spectrum of antimicrobials	Strongly Disagree	6 (11.76%)	18 (9.18%)	21 (18.42%)	10 (28.57%)	0.032
Appropriate dosage to site and type of infection	Strongly Agree	7 (13.73%)	67 (34.18%)	38 (33.33%)	13 (37.14%)	0.000
Minimize the duration of therapy	Strongly Agree	3 (5.88%)	36 (18.37%)	28 (24.56%)	8 (22.86%)	0.011
Give polytherapy in most cases	Strongly Disagree	6 (11.76%)	29 (14.80%)	16 (14.04%)	10 (28.57%)	0.013
3. To determine the spectrum of antimicrobial therapy, which of the following patient and epidemiological factors you think are important for antimicrobial prescribing practices ?						
Irrespective of severity of infection, always start treatment with broad spectrum antibiotics	Strongly disagree	10 (19.61%)	37 (18.88%)	35 (30.70%)	12 (34.29%)	0.000
Likely source of pathogen	Strongly Agree	1 (1.96%)	50 (25.51%)	16 (14.04%)	8 (22.86%)	0.000
How likely is the infection due to a drug resistant organism?	Strongly Agree	3 (5.88%)	42 (21.43%)	21 (18.42%)	10 (28.57%)	0.000
Patient characteristics like drug allergies, hepatic and renal function	Strongly Agree	6 (11.76%)	52 (26.5%)	36 (31.5%)	9 (25.71%)	0.000
Laboratory Reports	Strongly Agree	7 (13.73%)	47 (23.9 %)	39 (34.21%)	8 (22.86%)	0.000
4. Emergence of antimicrobial resistance is inevitable	Strongly Agree	5 (9.8%)	49 (25%)	12 (10.53%)	6 (17.14%)	0.006
5. Which of the following are major mechanisms by which microorganisms acquire resistance ?						
Alteration with antimicrobial target molecule	Strongly Agree	7 (13.73%)	65 (33.16%)	18 (15.79%)	10 (28.57%)	0.000
Increased import of drug into the bacterial cell or increased influx	Strongly Disagree	10 (19.61%)	16 (8.16%)	16 (14.04%)	10 (28.57%)	0.000
Inactivation of antimicrobial	Strongly Agree	5 (9.8%)	55 (28.06%)	15 (13.16%)	8 (22.86%)	0.000
6. For antimicrobial with concentration-dependent killing, the appropriate dosing regimen is						
Large infrequent dosing	Strongly Agree	0 (0%)	10 (5.10%)	8 (7.02%)	17 (48.57%)	0.000
Optimizing the duration of exposure with concentration in excess of MIC	Strongly Disagree	7 (13.73%)	11 (5.61%)	13 (11.40%)	7 (20.00%)	0.000
7. Which of the following factors do you consider while switching from IV to oral regimen ?						
Your patient is hemodynamically stable	Strongly Agree	1 (1.96%)	54 (27.55%)	29 (25.44%)	10 (48.57%)	0.000
Irrespective of patient ability to tolerate enteral feeding give i.v. antibiotic till patient is hospitalised	Strongly Disagree	7 (13.73%)	32 (16.33%)	35 (30.70%)	7 (20.00%)	0.000
Your patient is able to adequately absorb orally administered medications	Strongly Agree	4 (7.84%)	43 (21.94%)	30 (26.32%)	8 (22.86%)	0.000
There is an orally bioavailable antibiotic to treat your patient's condition	Strongly Agree	1 (1.96%)	39 (19.90%)	32 (28.07%)	5 (14.29%)	0.000
8. Which of the following steps would you consider for the daily assessment of antimicrobial therapy to ensure continued appropriateness ?						
Review of microbiologic data is not of much importance	Strongly Disagree	12 (23.53%)	43 (21.94%)	33 (28.95%)	17 (47.57%)	0.000
Verify the appropriate spectrum of therapy	Strongly Agree	5 (9.80%)	44 (22.45%)	12 (10.53%)	13 (37.14%)	0.000
Check for adverse effects	Strongly Agree	6 (11.76%)	56 (28.57%)	11 (9.65%)	14 (40%)	0.000
Evaluate route and duration of therapies	Strongly Agree	9 (17.65%)	51 (26.02%)	33 (28.95%)	9 (25.71%)	0.000
10. In formulary restriction type of intervention there is restriction of antibiotics by the trained staff before the therapy is initiated.						
	Strongly Agree	3 (5.88%)	26 (13.27%)	13 (11.40%)	5 (14.29%)	0.169

## Attitude

S.No. Questions		Appropriate	Attitude	Medical Officer (n = 51)	Resident (n = 196)	Nursing staff (n = 114)	Faculty (n = 35)	p-value
1.	The following set of statements seeks to assess your attitude towards Antimicrobial Stewardship programmes (ASP):							
	Antimicrobial stewardship programme is a necessity in our hospital	Strongly Agree	5 (9.80%)	80 (40.82%)	37 (32.46%)	17 (48.57%)	0.000	
	ASP reduces the patient burden by reducing the healthcare cost.	Strongly Agree	6 (11.76%)	66 (33.67%)	9 (7.89%)	4 (11.43%)	0.000	
	ASP reduces the adverse effects of inappropriate antimicrobial prescription	Strongly Agree	7 (13.73%)	71 (36.22%)	35 (30.70%)	13 (37.14%)	0.000	
	ASP threatens clinicians' autonomy.	Strongly Disagree	4 (7.84%)	33 (16.84%)	26 (22.81%)	9 (25.71%)	0.000	
	Such antimicrobial restriction policies delay antimicrobial administration to patients and will negatively affect their care.	Strongly Disagree	6 (11.76%)	32 (16.33%)	24 (21.05%)	7 (25.71%)	0.000	
2.	The following set of statements seeks to assess your attitude towards the open online course on Antimicrobial Stewardship: a competency-based approach conducted by WHO. (This question is for those who have participated in this online course.)							
	The course is too lengthy.	Strongly Disagree	10 (21.74%)	14 (12.39%)	13 (14.44%)	13 (38.24%)	0.000	
	There is lack of time due to busy hospital schedule.	Strongly Disagree	7 (15.22%)	8 (7.08%)	13 (14.61%)	5 (14.29%)	0.000	
	I prefer to follow some other local guidelines.	Strongly Disagree	6 (13.04%)	8 (7.02%)	12 (13.79%)	9 (26.47%)	0.000	
	I prefer to take my senior's advice rather than wasting time in such courses.	Strongly Disagree	7 (15.22%)	12 (10.62%)	14 (15.56%)	8 (23.53%)	0.000	
	The treatment options discussed by such courses are too ideal to be implemented in daily practice	Strongly Disagree	6 (13.04%)	11 (9.73%)	12 (13.33%)	7 (20.59%)	0.000	
	The course is very helpful and there should be a compulsory participation for all working clinicians.	Strongly Agree	3 (6.52%)	11 (9.82%)	9 (10.23%)	1 (2.94%)	0.000	

## Practices:

S.No. Questions	Correct Answer	Medical Officer (n = 51)	Resident (n = 196)	Nursing Staff (n = 114)	Faculty (n = 35)	p-value	
1.	In your daily clinical practice of antimicrobial uses, give your opinion to the statements that follow:						
	Antimicrobials are reviewed at regular intervals	Strongly Agree	7 (13.72%)	39 (19.89%)	16 (14.03%)	9 (25.71%)	0.000
	Antimicrobials are prescribed routinely when infections are suspected	Strongly Agree	3 (5.88%)	52 (26.53%)	20 (17.54%)	5 (14.28%)	0.000
	Antimicrobials are prescribed with the help of ASP	Strongly Agree	6 (11.76%)	30 (15.30%)	12 (10.52%)	12 (34.28%)	0.000
	Microbiologist is guiding while prescribing antimicrobials	Strongly Agree	5 (9.80%)	39 (19.89%)	11 (9.64%)	6 (17.14%)	0.004
	Pharmacologist is guiding while choosing antimicrobials' dose	Strongly Agree	3 (5.88%)	15 (7.65%)	9 (7.89%)	1 (2.85%)	0.000
2.	Consider the following case scenario and give your opinion to the statements that follow: A 45-year-old female was consulting you (thinking you an MBBS doctor and a relative) and she was having chronic essential hypertension. She showed you a positive urine culture report done 3 weeks ago, showing the growth of 3 different organisms in large quantities. She told that this culture was done because she had dysuria and urine urgency. She completed several days of antibiotics with the resolution of symptoms. Now she is asymptomatic with a normal physical examination. She has asked you whether there is a need to submit another urine sample for testing ?						
	Urine culture should be collected	Strongly Agree	14 (27.45%)	28 (14.28%)	18 (15.78%)	5 (14.28%)	0.453
	Asymptomatic bacteriuria patients must be given treatment only in pregnancy and invasive urological procedures	Strongly Agree	3 (5.88%)	48 (24.48%)	7 (6.14%)	11 (31.42%)	0.000
	Fluoroquinolones should be used for uncomplicated UTI	Strongly Agree	7 (13.72%)	18 (9.18%)	17 (14.91%)	9 (25.71%)	0.000
	Antibiotics should be advised in the above case because of large growth of organisms	Strongly Agree	3 (5.88%)	29 (14.79%)	8 (7.01%)	12 (34.28%)	0.005
3.	Consider the following case scenario and give your opinion to the statements that follow: An 18-year-old female consults you (thinking you an MBBS doctor and a relative) with fever, abdominal cramping, and diarrhoea for 1 day. She has had 3 bouts of watery, non-bloody diarrhoea. She has just returned from a country with a high prevalence of diarrhoeal illness. She has not taken any recent antibiotics while her physical examination is normal.						
	Patient should be given empiric antimicrobial therapy	Strongly Disagree	12 (23.52%)	27 (13.77%)	17 (14.91%)	9 (25.71%)	0.001
	Stool culture is not required in above case scenario	Strongly Agree	3 (5.88%)	12 (6.12%)	9 (7.89%)	5 (14.28%)	0.000
	Rehydration and watchful waiting without empiric antibiotics is sufficient in most cases of watery diarrhoea	Strongly Agree	4 (7.84%)	46 (23.46%)	17 (14.91%)	14 (40%)	0.000
4.	Consider the following case scenario and give your opinion to the statements that follow: A 25-year-old female consults you (thinking you an MBBS doctor and a relative) with a history of one week of cough and rhinorrhoea but denies fever, chills or night sweats. Her cough is intermittently productive with white sputum. She is not tachycardic or tachypnoeic. On auscultation, bilateral rhonchi and scattered wheeze are heard.						

The history of productive cough does not differentiate between URTI, acute bronchitis and community acquired pneumonia	Strongly Agree	2 (3.92%)	28 (14.28%)	13 (11.40%)	8 (22.85%)	0.000
In acute bronchitis, there is no need for a chest X-ray, sputum culture, viral and serological analysis	Strongly Agree	2 (3.92%)	21 (10.71%)	10 (8.77%)	3 (8.57%)	0.000
Antibiotics can help in early cure of patients with acute bronchitis	Strongly Disagree	7 (13.72%)	19 (9.69%)	10 (8.77%)	8 (22.85%)	0.000
In patients with acute bronchitis, patient education is the key	Strongly Agree	4 (7.84%)	36 (18.36%)	14 (12.28%)	8 (22.85%)	0.000
5. Consider the following case scenario and give your opinion to the statements that follow: A 21-year-old male consults you (thinking you an MBBS doctor and a relative) with subcutaneous abscess of 2 cm in diameter on his right leg. He is an athlete at the university and many of his team-mates have similar complaints. He had a similar lesion in the past on his right forearm which drained white pus mixed with blood. He is afebrile and appears non-toxic.						
Source control is the corner stone in the management of the above case	Strongly Agree	2 (3.92%)	51 (26%)	18 (15.78%)	11 (31.42%)	0.000
Antimicrobial therapy must be given in this case	Strongly Disagree	3 (5.88%)	11 (5.61%)	14 (12.28%)	5 (14.28%)	0.000
Thorough cleaning of shared equipment and MRSA decolonisation should be done	Strongly Agree	2 (3.92%)	44 (22.44%)	18 (15.78%)	16 (45.71%)	0.000
Culture sample should be avoided as contamination may lead to use of overly broad-spectrum antibiotics	Strongly Agree	3 (5.88%)	15 (7.65%)	9 (7.89%)	4 (11.42%)	0.033
6. To prevent surgical site infections which of the following factors would you consider? [if you are not a surgeon, please ignore this question]						
Antimicrobial sealants should not be used for surgical sites in preparation for the purpose of reducing SSI	Strongly Agree	1 (1.96%)	25 (12.75%)	11 (9.64%)	2 (5.71%)	0.000
Perioperative surgical antibiotic prophylaxis should be continued during presence of a wound drain for the purpose of preventing SSI	Strongly Disagree	5 (9.80%)	10 (5.10%)	9 (7.89%)	6 (17.14%)	0.000
Prolongation of post-operative antimicrobial prophylaxis decreases the risk of SSI	Strongly Disagree	11 (21.56%)	14 (7.14%)	19 (16.66%)	9 (25.71%)	0.000
Re-dosing of antimicrobials should be considered if blood loss in patient is >1.5 L	Strongly Agree	6 (11.76%)	17 (8.67%)	10 (8.77%)	8 (22.85%)	0.005

Almost all of the participants had good knowledge regarding the principles of AMS except when asked about the route of administration. Only 32.28% of respondents did not feel that it was a principle of AMS which is in line with the results obtained in other studies<sup>1,2,5,8</sup> indicating a high intravenous antimicrobial use in hospitals. Approximately one-fourth of participants gave correct answers regarding the dosing regimen having concentration-dependent killing highlighting a knowledge gap in this topic. The gap found here is higher than that of other KAP studies asking about the same topic<sup>1,9</sup>.

This study showed poor practice attitude towards common illnesses such as URTI and diarrhoeal illness as compared to previous similar studies<sup>1,8</sup>. Kaur *et al* found that 71.2% of participants refrained from prescribing antimicrobials for uncomplicated upper respiratory tract infections (URTI), whereas Ghosh *et al* documented 46.87% against 29.87% in our study. Regarding acute diarrhoeal illness, Kaur *et al* reported 56.8% non-prescription, and Ghosh *et al* noted 59.38%, while our study indicated a lower rate of 34% for antimicrobial non-prescription.

When asked about terms such as pre-authorisation and pre-formulary restriction, 54% and 57% had not heard of these terms as compared to 64% and 65%, respectively, reported in a similar study. A difference in guidance of therapy was observed against the previous study. 49% of them said microbiologist and 27% reported pharmacologist-guided therapy versus 16% and 88%,

respectively, reported by Kaur *et al*.

There was a significant difference between the answers provided by faculty and residents *versus* the nursing staff and medical officers. This may be because the residents are subjected to better learning opportunities as compared to the other two. But the knowledge and practice gaps extend beyond medical officers to medical students, who play a crucial role as future prescribers in combating antimicrobial resistance. A study conducted among medical students in India revealed significant gaps in their knowledge, attitudes, and practices related to antibiotic resistance<sup>10</sup>. This finding highlights the importance of incorporating comprehensive education and training on antimicrobial stewardship principles, appropriate prescribing practices, and the global burden of antimicrobial resistance into the medical curriculum. By equipping future healthcare professionals with the necessary knowledge and skills, a culture of responsible antimicrobial use can be fostered from the early stages of their careers.

The knowledge-practice gaps observed among healthcare professionals are not limited to specific regions or healthcare settings. A study conducted in a Ghanaian tertiary care hospital demonstrated inadequate knowledge, attitudes, and perceptions concerning antibiotic resistance among physicians, underscoring the need for targeted educational interventions<sup>11</sup>. These gaps have far-reaching implications, as inappropriate prescribing practices

contribute to the development and spread of antimicrobial resistance, leading to increased morbidity, mortality, healthcare costs, and compromised patient safety<sup>12</sup>. Understanding the factors contributing to these gaps is crucial for designing effective interventions and improving the overall quality of antimicrobial use.

The lack of awareness and adherence to guidelines for appropriate antibiotic prescription is a critical issue among healthcare professionals, further contributing to the knowledge-practice gap. Physicians often face challenges in balancing the need to treat patients effectively and the pressure to prescribe antibiotics, even when not clinically warranted<sup>13-16</sup>. Factors such as time constraints, patient demand, diagnostic uncertainty, and limited access to local microbiological data can influence prescribing practices, leading to suboptimal use of antimicrobials. These practices not only contribute to the emergence of antimicrobial resistance but also result in adverse patient outcomes, including increased morbidity, mortality, and healthcare-associated infections<sup>17,18</sup>. Addressing these barriers and promoting adherence to guidelines are essential for improving antimicrobial prescribing practices.

Similar findings have been reported in studies conducted in France, Scotland, and Nepal, where junior doctors demonstrated knowledge gaps and misconceptions related to antibiotic resistance and prescribing practices<sup>20-22</sup>. These studies highlight the global nature of the knowledge-practice gaps and the necessity of implementing multifaceted interventions on a broader scale to address these issues.

The discrepancy between knowledge of faculty and residents in our study may be attributed to the relatively lesser number of faculty respondents.

Developing countries face significant challenges in combating AMR, given the burden of communicable diseases and the emergence of antimicrobial resistance. India, with its large population and high burden of infectious diseases, serves as an example<sup>22-24</sup>. Inadequate prescribing practices and the widespread availability of antibiotics without prescription contribute to the development of antimicrobial resistance<sup>25</sup>.

## Conclusion

A gap in the knowledge regarding antimicrobial stewardship exists in the HCW population. Antimicrobial stewardship is an important component of the fight against emergence of antimicrobial resistance and it should be implemented and followed with due sincerity. Taking courses such as the free open WHO course on antimicrobial stewardship should be encouraged.

## References

1. Simardeep Kaur *et al.* *American Journal of Infectious Diseases* 2022; 18 (1): 9.20.
2. Chatterjee D, Sen S, Begum SA *et al.* A questionnaire-based survey to ascertain the views of clinicians regarding rational use of antibiotics in teaching hospitals of Kolkata. *Indian J Pharmacol* 2015; 47 (1): 105.
3. Khajuria K, Kaur S, Sadiq S. KAP on antibiotic usage and resistance among second professional medical students.
4. Banerjee K, Dwivedi LK. The burden of infectious and cardiovascular diseases in India from 2004 to 2014. *Epidemiol Health* 2016; 38.
5. Byrne MK, Mielle S, McGlinn A *et al.* The drivers of antibiotic use and misuse: The development and investigation of a theory driven community measure. *BMC Public Health* 2019; 19 (1): 1-11.
6. Fernández GF, Detrés J, Torrellas P. Comparison of the appropriate use of antibiotics based on clinical guidelines between physicians in-training versus practicing physicians. *Bol Asoc Med P R* 2013; 105 (3): 21-4.
7. Firouzabadi D, Mahmoudi L. Knowledge, attitude and practice of healthcare workers towards antibiotic resistance and antimicrobial stewardship programmes: A cross-sectional study. *J Eval Clin Pract* 2020; 26 (1): 190-6.
8. Ghosh A, Deb T, Ghosh S. Knowledge, attitudes and practice survey about antimicrobial resistance and prescribing among physicians in a tertiary care teaching hospital in Eastern India. *Int J Basic Clin Pharmacol* 2016; 5 (1): 180-7.
9. Gonzalez-Gonzalez C, López-Vázquez P, Vázquez-Lago JM *et al.* Effect of physicians' attitudes and knowledge on the quality of antibiotic prescription: A cohort study. *PLoS One* 2015; 10 (10): e0141820.
10. Gupta MK, Vohra C, Raghav P. Assessment of knowledge, attitudes and practices about antibiotic resistance among medical students in India. *J Family Med Prim Care* 2019; 8 (9): 2864.
11. Labi AK, Obeng-Nkrumah N, Bjerrum S *et al.* Physicians' knowledge, attitudes and perceptions concerning antibiotic resistance: A survey in a Ghanaian tertiary care hospital. *BMC Health Serv Res* 2018; 18 (1): 1-12.
12. Mauldin PD, Salgado CD, Hansen IS *et al.* Attributable hospital cost and length of stay associated with healthcare-associated infections caused by antibiotic-resistant Gram-negative bacteria. *Antimicrob Agents Chemother* 2010; 54 (1): 109-15.
13. Mincey BA, Parkulo MA. Antibiotic prescribing practices in a teaching clinic: Comparison of resident and staff physicians. *South Med J* 2001; 94 (4): 365-9.
14. Nepal A, Hendrie D, Robinson S. Knowledge, attitudes and practices relating to antibiotic use among community members of the Rupandehi District in Nepal. *BMC Public Health* 2019; 19 (1): 1-12.
15. Pulcini C, Williams F, Molinari N *et al.* Junior doctors' knowledge and perceptions of antibiotic resistance and prescribing: A survey in France and Scotland. *Clin Microbiol Infect* 2011; 17 (1): 80-7.
16. The Global Antimicrobial Resistance Surveillance System (GLASS) Report. *World Health Organisation* 2020.
17. Sango A, McCarter YS, Johnson D *et al.* Stewardship approach for optimizing antimicrobial therapy through use of a rapid microarray assay on blood cultures positive for Enterococcus species. *J Clin Microbiol* 2013; 51 (12): 4008-11.

18. Guidelines for Antimicrobial Use in Common Syndromes.
19. Kunin CM, Liu YC. Excessive use of antibiotics in the community associated with delayed admission and masked diagnosis of infectious diseases. *J Microbiol Immunol Infect* 2002; 35 (3): 141-6.
20. Akande TM, Ologe M, Medubi GF. Antibiotic prescription pattern and cost at University of Ilorin Teaching Hospital, Ilorin, Nigeria. *Int J Trop Med* 2009; 4 (2): 50-4.
21. Remesh A, Gayathri AM, Singh R. The knowledge, attitude and the perception of prescribers on the rational use of antibiotics and the need for an antibiotic policy - a cross-sectional survey in a tertiary care hospital. *J Clin Diagn Res* 2013; 7 (4): 675-9.
22. Fadare JO, Tamuno I. Antibiotic self-medication among university medical undergraduates in Northern Nigeria. *J Public Health Epidemiol* 2011; 3 (5): 217-20.
23. Oberoi L, Singh N, Sharma P. ESBL, MBL and AMPC a Lactamases producing superbugs – HAVOC in the intensive care units of Punjab India. *J Clin Diagn Res* 2013; 7 (1): 70-3.
24. Sahin H, Arsu G, Köseli D. Evaluation of primary health care physicians' knowledge on rational antibiotic use. *Mikrobiyol Bul* 2008; 42 (2): 343-8.
25. Kardas P, Pechère JC, Hughes DA. A global survey of antibiotic leftovers in the outpatient setting. *Int J Antimicrob Agents* 2007; 30 (6): 530-6.

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