



Original Research Article

Analytical cross-sectional study on knowledge, attitude, and practices about antibiotic use and resistance among medical students tertiary healthcare Center, Vadodara, Gujarat

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Abstract

Background: With increasing overuse of antibiotics leading to difficulty in managing antimicrobial resistance, involvement of medical students who are usually associated with health care settings sufficient knowledge and skills can support the struggling health system. This study was undertaken to investigate the knowledge, attitude, and practices about antibiotic use and resistance among medical students at tertiary healthcare teaching center, Vadodara, Gujarat.”

Materials and Methods: This analytical cross-sectional study was conducted between 15th April 2024 and 15th October 2024 at a tertiary care teaching hospital in Gujarat, India. In this study, Knowledge, attitude, and practices regarding antibiotic use and resistance were assessed through preformed Google forms using a self-designed, pre-validated questionnaire consisting of 30 questions. Detail about descriptive statistical analysis like mean, standard deviation, and median was calculated for different variables to assess the significance of this study

Results: In this study, amongst 100 undergraduate medical and postgraduate medical students who showed an overall knowledge score of 85 % but no significant difference in scores was observed amongst various age, gender, and phase of undergraduate study. This study was done to significantly improve students’ knowledge on antibiotics and aware about emerging antimicrobial drug resistance along with brings their attention for prevention of antibiotic resistance due to inappropriate use of antibiotics.

Conclusion: This study was conducted to assess and improve medical students’ knowledge on antibiotics use and resistance also brings their attitude towards antibiotic use and to help prescribing antibiotic in future with aim to reduce antimicrobial drug resistance .Here, this study also will help future doctor to stop inappropriate use of antibiotics & also to create awareness regarding antibiotic resistance among medical students.

Keywords: Antibiotic, Antimicrobial drug resistance, Antimicrobial stewardship program, Superbugs, Knowledge, Attitude, Behavior, Medical students.

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1. Introduction

Antibiotic resistance has a globally effect public health, that is why basic knowledge regarding antibiotics has an important part along with it was led to increased health care cost along with morbidity and death.^{1,2,3,4} Antibiotic resistance is a worldwide problem. Most of the population was unaware of the antibiotic resistance.^{5,6}

Two most common contributing factors are (i) Over use of antibiotics and (ii) Insufficient infection control policies for prevention of irrational use of antibiotic drugs favoring

the spread of resistant microorganisms. Its lead to significantly increased antimicrobial drug resistance and due to that hospital stay will be increased.⁶

Healthcare doctors are directly involved in the prescribing antimicrobial drug and use of it. They might properly advice the patients regarding inappropriate requests or practices, which in turn increase the chances for antibiotic resistance among them along with also advice to complete course of antibiotic given to them at time of illness.^{7,8} Medical students are going to be primary care clinical practitioner to serve the community. These future medical

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prescribers are main leaders which fight against antibiotics resistance, by taking action against the rationally prescribing antibiotics and promoting patient awareness towards the proper use of antibiotic course that's why basic knowledge and attitude regarding use of antibiotic take importance for that good implimation of newer curriculum in medical education required.it is also improve student attitude towards the use of antibiotic.⁹ There is basic need to change the behavior of doctors while prescribing antibiotic and also show significant concern towards reduce the problem of antibiotic resistance. As newer antibiotic molecule preparation against multidrug resistance strain were very difficult.¹⁰ This can be improved through the proper knowledge and required training of new doctors.^{11,12}

Educating the next generation of medical and most importantly postgraduate students are a strategic goal. As antibiotic resistance is a global emerging problem and doctor and healthcare workers are involved with prescribing, dispensing, administering, and using antibiotics. This is united with the importance of educating patients and the public about appropriate practices regarding infection control & its monitoring, use of antibiotics and the effect of it on the environment. Therefore, it is crucial to ascertain whether institutions are effectively educating medical students about appropriate antibiotics use to change the impact the antibiotic resistance has on patient health. Infection prevention and control role for monitoring and prevention of further spread of hospital acquired infection.¹³ There is a requirement to change the antibiotic prescribing behavior of doctors and future prescribers to reduce the problem of antibiotic resistance. They are also required to advice basic culture & antimicrobial sensitivity test for detection of antibiotic sensitivity for identification of organism and antibiotic drug effectiveness against that bacteria.¹⁰ This can be done through the appropriate knowledge and training of next generation doctors and medical students.^{11,12} But, before conducting any teaching or training program for medical students , it is required to have conclusive evidence about baseline knowledge, attitude, and practices of that group. This evidence supports in devising an effective curriculum and sustainable program.

The present study aimed to assess the medical students' knowledge, attitudes and practice concerning antibiotic use & resistance.

2. Aims and Objective

1. To assess the basic knowledge, attitudes, and the practices of medical students with respect to antibiotic usage and resistance.
2. Research was done to focus on social aspects of antibiotic management especially the knowledge, attitude, and practice (KAP) among general population on antibiotic use.

3. Materials and Methods

The study was conducted in a tertiary health care center Shrimati Bhikhiben Kanjibhai Shah Medical Institute & Research Centre in Vadodara. The study was approved by Institutional Ethics Committee. The study population included under the study were 100 MBBS students. It was a Google form questionnaire-based study categorized on knowledge, attitude, and practice.

Collected data was compile in Microsoft office Excel 2007 format. Data was process using Epi info statistical software. Descriptive and analytical statistical methods were used for the preparation of results. In analytical methods chi square was apply to find out significance level. Data was presented in tabulated as well as graphical format. It was designed mainly to assess the students' understanding of antibiotics, and to compare the medical students' KAP towards antibiotic use which would bring the differences among the three groups.

This is Prospective Cross-Sectional study conducted at Sumandeep Vidyapeeth deemed to be university. Study is conducted on the Medical students and postgraduate students of institute and sample size consider is 100

3.1. Inclusion criteria

The undergraduate medical and postgraduate medical students were in the study and who are willing to participate in the study.

3.2. Exclusion criteria

Those who were not willing to participate in the study.

3.3. Feasibility issues

Optimum sample size in respect to resources, data will collect rapidly, no complicated procedure involved so this project is feasible in current set up and condition

3.4. Knowledge, attitude, and practices questionnaire

The evaluation of medical students' knowledge, attitudes, and practices was conducted using an anonymous questionnaire distributed via Google Forms. Participation in the study was voluntary. Informed consent was provided on the first page of the questionnaire. The survey was divided into two sections. The first section gathered general information and demographic data from undergraduate students, including age, gender, field of study, year of study (first, second, or third), and their consent to participate in the study. The second section of the survey comprised 30 questions aimed at evaluating students' knowledge, attitudes, and practices regarding antibiotic use and resistance. This section included ten questions focused on knowledge about antibiotics, ten questions assessing attitudes that reflect awareness and beliefs about antibiotics, and ten questions related to practices that indicate efforts to prevent antibiotic overuse. The

questions were self-designed and underwent a validation process before implementation. Initially, the questionnaire was distributed to the faculty members of the Microbiology department and one representative from each field of undergraduate students for their feedback.

Knowledge Questionnaire: Information, Understanding and skills regarding antibiotic usage and antimicrobial stewardship programme.

1. Are you familiar to the antibiotics?
 - a. Yes/no
2. What are antibiotics primarily used for
 - a. Against bacteria
 - b. Against fungus
 - c. Against virus
 - d. Against parasites
 - e. More than 1 option is correct
3. How do bactericidal antibiotics differ from bacteriostatic antibiotics?
 - a. Bactericidal antibiotics kill bacteria while bacteriostatic antibiotic inhibit their growth
 - b. Bactericidal inhibit their growth while bacteriostatic kill bacteria
 - c. Both bacteriostatic and bactericidal kill bacteria
 - d. Both bactericidal and bacteriostatic inhibit their growth
4. Do you think the use of antibiotics will speed up the recovery of cold and cough?
 - a. Yes
 - b. No
5. From the scale of 1-4 what would you rate the knowledge about antimicrobial resistance
 - a. I don't have any idea about this topic
 - b. I have some idea about what it means
 - c. I am aware about its meaning and effects
 - d. I am aware about the dire situation of antimicrobial resistance and upcoming superbugs
6. Prolonged courses of antibiotics
 - a. May encourage the development of antimicrobial resistance
 - b. Do not increase the risk of side effects
 - c. Are needed as prophylaxis for patients undergoing surgical procedures
 - d. Are needed for all the patients with serious infections
7. How can healthcare providers help prevent the spread of antibiotic resistant bacteria in health care setting
 - a. Prescribe antibiotics more frequently
 - b. Use prophylactic antibiotics for all surgical procedures
 - c. Practice good infection control measures such as hand hygiene
 - d. Discontinue antibiotic stewardship program
8. Anti-microbial stewardship programmes
 - a. Aim to improve patient putcome
 - b. Raise awareness of the problem of antimicrobial

resistance

- c. Encourage rational usage of antimicrobials
- d. All of the above
9. How you been exposed to the topic of antimicrobial stewardship programme
 - a. Yes
 - b. Somewhat
 - c. No
10. Who plays crucial role in implementing an antimicrobial stewardship programme
 - a. Only pharmacist
 - b. Only physician
 - c. Only microbiologist
 - d. All health care workers

Attitude Questionnaire: The way that you think, feel, or behave about the antimicrobial stewardship programme.

1. In your opinion how effective are public education campaign in reducing antibiotic misuse
 - a. Very effective
 - b. Somewhat effective
 - c. Not very effective
 - d. Not effective at all
2. In your opinion what is the primary cause of antibiotic resistance
 - a. Overuse of antibiotics in human
 - b. Overuse of antibiotic use in animals
 - c. Poor hygiene and sanitation
 - d. Other
3. How often do you discuss the potential risk and benefits of antibiotics with your Healthcare providers Bedford taking them
 - a. Always
 - b. Most of the time
 - c. Sometime
 - d. Rarely
4. How concerned are you about the side effects from antibiotics?
 - a. Very concerned
 - b. Somewhat concerned
 - c. Not very concerned
 - d. Not concerned at all
5. Do you believe that antibiotic resistance is serious problem?
 - a. Yes, very serious
 - b. Somewhat serious
 - c. Not very serious
 - d. Not serious at all
6. How much do you trust your healthcare provider decision to prescribe antibiotic?
 - a. Completely trust
 - b. Mostly trust
 - c. Sometimes trust
 - d. Rarely
7. How often do you seek alternative treatments before

- resorting to antibiotics?
- Always
 - Often
 - Sometimes
 - Never
- How do you think antibiotic resistance affects global health?
 - It has no significant impact
 - It increases healthcare costs
 - It limits treatment option for bacterial infections
 - It encourages the development of new antibiotics
 - How do you perceive the role of antibiotics in public health and antibiotic resistance?
 - They are essential for treating an illness
 - They should be used sparingly to preserve their effectiveness
 - They have no impact on public health
 - They are only effective against viral infections
 - When you observe someone else taking antibiotics for a minor illness what is Your reaction
 - I think it is a wise decision to prevent complications
 - I believe it is unnecessary and potentially harmful
 - I do not have any opinion on it
 - I would advise them to consult a healthcare professional
 - Most of the time
 - Sometimes
 - Rarely
 - What sources do you typically consult for information on antibiotics and their appropriate use
 - Healthcare provider
 - Reliable medical website
 - Friends or family
 - Social media or internet
 - When you observe someone else taking antibiotics for a minor illness, what is your reaction?
 - I think it is a wise decision to prevent complications
 - I believe it is unnecessary and harmful
 - I do not have any opinion on it
 - I would advise them to consult a healthcare professional
 - What is recommended action if you miss a prescribe dose of antibiotics?
 - Take a double to make up for mixed antibiotic dose volume
 - Skip the missed antibiotic dose and continue the next upcoming dose
 - The missed antibiotic dose along with the next scheduled dose
 - Stop taking the antibiotics all together
 - What action do you take to prevent infections and reduce the need for antibiotics?
 - Practicing good hygiene
 - Getting vaccinated
 - Avoiding close contact with sick individual
 - All of the above
 - What is appropriate action if you experience and allergic reaction to an antibiotic
 - Continue taking the antibiotic and monitor the reaction
 - Stop taking the antibiotic and consult a healthcare professional
 - Take an over-the-counter anti-histamine
 - None

Practice: Action rather than idea or thoughts regarding antimicrobial stewardship programs.

- What do you do with the leftover antibiotics after you have completed your course of treatment?
 - Dispose the antibiotic properly
 - Keep them with you for future use
 - Give them to someone else
 - Other
- How often do you ask your healthcare provider if there are non-antibiotic treatment options available for your condition?
 - Sometimes
 - Rarely
- How often do you finish the full course of antibiotic prescribed by your doctor even if you know about antimicrobial resistance?
 - Always
 - Most of the times
 - Sometimes
 - Rarely
- How often do you avoid taking antibiotics unless they are prescribed by a healthcare worker
 - Always
 - Most of the time
 - Sometimes
 - Rarely
- How often do you discuss antibiotic stewardship and responsible use with friend and family
 - Always

4. Result

- Knowledge of AMR and AMSP:
 - 82% of 2nd-year and 76% of 3rd-year students correctly identified antibacterial use.
 - Chi-square tests show no significant association between knowledge and practices ($p = 0.29$).
- Attitudes
 - 69% of 2nd-year and 71% of 3rd-year students consider AMR a 'very serious issue.
 - Variation in belief about public education effectiveness (60% 2nd-year, 67% 3rd-year).

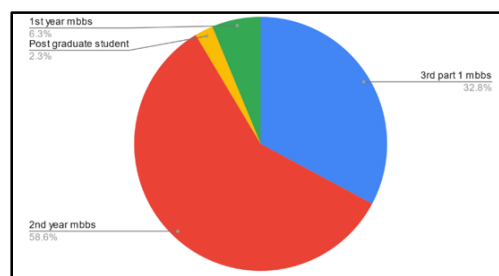


Figure 1: Participation of medical students in KAP study

As per Figure 1 shows the participation of MBBS and post graduate student in the study.

2nd year (58.6%) and 3rd year MBBS (32.8%) students maximum participate in this study.

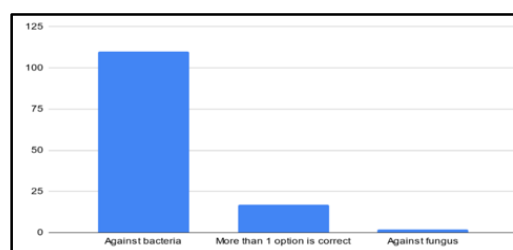


Figure 2: Knowledge regarding antibiotic use

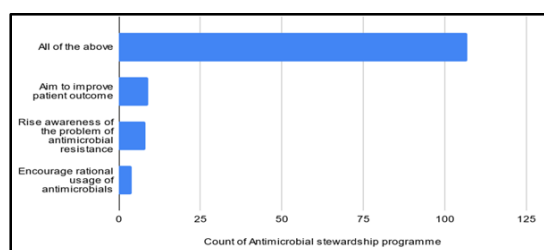


Figure 3: Knowledge regarding antimicrobial stewardship

Figure 2, Figure 3 shows the basic knowledge regarding the antibiotic use, its resistance along with knowledge regarding antimicrobial stewardship program and its goal for prevention of overuse of antibiotic and decrease the antimicrobial drug resistance.

Most of the medical students have basic knowledge regarding antibiotic and antimicrobial stewardships program.

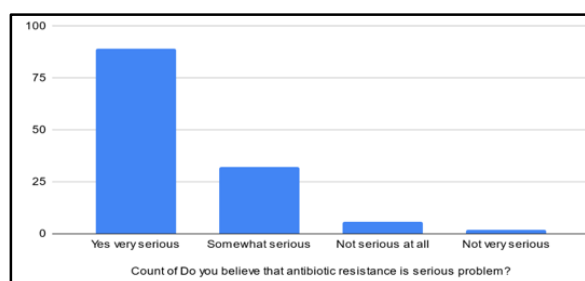


Figure 4: Do you believe that antibiotic resistance is serious problem?

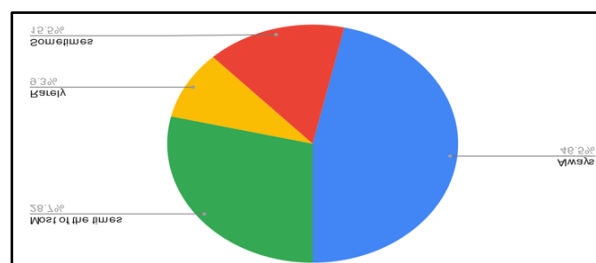


Figure 5: How often do you finish the full course of antibiotics prescribed by your doctor

Figure 4, Figure 5 shows attitude of medical students against the usage of antibiotic. Students were believing the antimicrobial resistance a serious issue but others side not all the student were complete their antibiotic course prescribed by doctor.

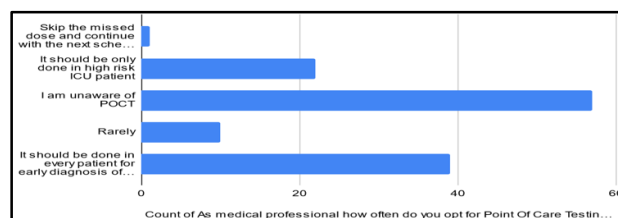


Figure 6: Medical professional how often do you opt for point of care testing (POCT)

Figure 6 shows most of the student were not aware about the point of care testing and as **Figure 7** shows practice towards the antibiotic use amongst all students' only 50 % students have concern regarding usage of antibiotic.

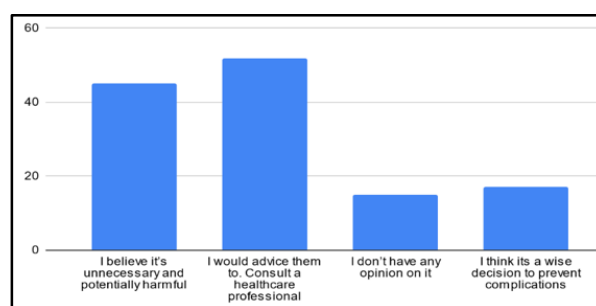


Figure 7: When you observe someone else taking antibiotics for a minor illness, what is your reaction.

1. Practices
 - a. 46% of 2nd-year and 48% of 3rd-year students always complete their antibiotic course.
 - b. Only 20% of 2nd-year and 17% of 3rd-year students regularly discuss stewardship with family.
2. Impact of Curriculum
 - a. 80% of 2nd-year and 83% of 3rd-year students are aware of AMSP, but knowledge does not significantly correlate with practices ($p = 0.44$).

Table 1: Knowledge, attitude and practice score of medical students in study

Question	Chi-Square Statistic	P-Value	Degrees of Freedom	Significant
How effective are public education campaigns in reducing antibiotic misuse?	3.78	0.29	3	No
What is the primary cause of antibiotic resistance?	1.58	0.66	3	No
How often do you discuss antibiotic risks/benefits with healthcare providers?	4.62	0.2	3	No
How concerned are you about the side effects from antibiotics?	5.12	0.16	3	No
Do you believe that antibiotic resistance is a serious problem?	1.15	0.56	2	No
Do you think antibiotics speed recovery from viral cold/cough?	1.48	0.48	2	No
How often do you prefer alternative treatments before antibiotics?	0.86	0.83	3	No
How does antibiotic resistance affect global health?	5.21	0.16	3	No
How do you perceive the role of antibiotics in public health and antimicrobial resistance?	1.31	0.52	2	No
What's your reaction to someone taking antibiotics for a minor illness?	0.78	0.67	2	No
What action should be taken to limit antimicrobial resistance (AMR) and promote AMSP?	1.61	0.66	3	No
How often do you ask healthcare providers for non-antibiotic treatment options?	4.24	0.24	3	No
How often do you finish the full course of antibiotics prescribed?	1.45	0.69	3	No
How often do you avoid antibiotics unless prescribed by a healthcare worker?	2.04	0.56	3	No
How often do you discuss antibiotic stewardship with friends/family?	4.87	0.18	3	No
What sources do you consult for information on antibiotics?	1.69	0.64	3	No
What's the recommended action if you miss a dose of antibiotics?	1.92	0.59	3	No
What's the appropriate action if you experience an allergic reaction to antibiotics?	5.76	0.12	3	No
How often do you opt for Point of Care Testing (POCT)?	3.41	0.33	3	No
How effective are public education campaigns in reducing antibiotic misuse?	3.78	0.29	3	No
What is the primary cause of antibiotic resistance?	1.58	0.66	3	No
How often do you discuss antibiotic risks/benefits with healthcare providers?	4.62	0.2	3	No
How concerned are you about the side effects from antibiotics?	5.12	0.16	3	No
Do you believe that antibiotic resistance is a serious problem?	1.15	0.56	2	No
Do you think antibiotics speed recovery from viral cold/cough?	1.48	0.48	2	No
How often do you prefer alternative treatments before antibiotics?	0.86	0.83	3	No
How does antibiotic resistance affect global health?	5.21	0.16	3	No
How do you perceive the role of antibiotics in public health and antimicrobial resistance?	1.31	0.52	2	No
What's your reaction to someone taking antibiotics for a minor illness?	0.78	0.67	2	No

5. Discussion

The issue of antibiotic use and resistance is emerging critical situation in healthcare system so basic knowledge is very much important among medical students who are future prescribers of these medications. This prospective analytical cross-sectional study aimed to evaluate the knowledge, attitude, and practices (KAP) of medical students & post graduate students regarding antibiotic use and resistance at a tertiary healthcare teaching center in Vadodara, Gujarat.

5.1. Knowledge of antibiotic use and resistance

The study findings indicate that while medical students generally possess a foundational knowledge about antibiotics, certain misconceptions persist. Previous studies have shown that knowledge gaps were prevalent in many healthcare settings. In our study most of the students were aware about antibiotic should use against the bacteria but only 20 %incorrectly answer as compare to a study by Khedkar et al. (2020) reported that 60% of medical students incorrectly believed that antibiotics were effective against viral infections, underscoring the need for enhanced educational interventions (Khedkar et al., 2020).¹⁴

Additionally, it is crucial to recognize that knowledge alone does not directly translate into safe practices. While many students demonstrated awareness of the phenomenon of antibiotic resistance, studies have highlighted that educational programs must go beyond basic knowledge and include practical implications for clinical practice to combat antibiotic resistance effectively.

5.2. Attitude towards antibiotic use

The results suggest that the attitude of students towards antibiotic use and resistance are predominantly positive. In our KAP study most of the medical and post graduate students have a basic knowledge regarding antibiotic and its use but still 46% of 2nd-year and 48% of 3rd-year students always complete their antibiotic course and Only 20% of 2nd-year and 17% of 3rd-year students regularly discuss stewardship with family so attitude regarding usage of antibiotic still lacking in our study.

A majority acknowledged the importance of responsible antibiotic prescribing. According positive attitudes towards antibiotic stewardship can significantly influence prescribing behaviors in a clinical setting. However, despite a generally positive outlook, some respondents expressed a belief that the pressure for immediate patient satisfaction could compromise appropriate prescribing practices.

The concept of patient expectations plays a significant role in antibiotic prescription practices. A study indicated that many doctors feel pressured to prescribe antibiotics due to patient demands, which can lead to inappropriate usage. This societal influence must be addressed through targeted education and public awareness campaigns to reduce

expectations for antibiotic prescriptions in non-bacterial infections.

5.3. Practices regarding antibiotic use

The practice patterns observed in this study reveal a concerning tendency towards self-medication high as they have basic knowledge regarding drugs and use of antibiotics without proper prescription among peers. As noted self-medication with antibiotics is prevalent among medical students, who might feel more knowledgeable than laypersons so here we are lacking of attitude and practicing behaviour of students. This Behavior poses a significant risk of contributing to antibiotic resistance and suggests an urgent need for reinforced guidelines on antibiotic use in both clinical and educational settings. Most of the students have a knowledge despite that, students do not always act on it, as shown by the lack of a statistically significant relationship ($p = 0.29$). To close this gap, integrating more practical applications, real-life reinforcement, and behavioural interventions into the curriculum is essential.

Furthermore, adherence to appropriate prescribing practices varies among students. A review by Davey et al. (2013) illustrated that even among medical professionals, there can be inconsistency in the application of knowledge to practice. Most of the student have knowledge regarding basics of antibiotic as part of their curriculum in medical and postgraduate course but due to lack of attitude, practice regarding antimicrobial resistance we required to assess them intermittently for that continuous medical education and regular workshops on antibiotic stewardship could play a crucial role in shaping the students' practices.¹⁵

To improve antibiotic prescribing practices and combat resistance, it is crucial to implement educational strategies that emphasize practical applications and real-life scenarios in the medical curriculum. This can be achieved by integrating antibiotic stewardship programs into the teaching modules, which highlight the principles of appropriate antibiotic selection, dosing, and duration.¹⁶ Case-based learning, utilizing real-life clinical scenarios, can help medical students develop critical thinking and decision-making skills for responsible prescribing. Additionally, updated educational materials, aligned with the latest guidelines and research, should form the basis of learning resources, such as those from the World Health Organization's Global Action Plan on Antimicrobial Resistance.¹⁷

6. Conclusion

In summary, this analytical cross-sectional study indicates that while medical and postgraduate students at the tertiary healthcare center in Vadodara, Gujarat, demonstrate a basic level of knowledge and positive attitudes towards antibiotic use and resistance, deficiencies remain in practice. It is essential to implement comprehensive educational strategies that not only enhance knowledge but also promote positive

changes in attitudes and practices regarding antibiotic use. By addressing these gaps, we can help ensure that future healthcare professionals contribute to the combat against antibiotic resistance, ultimately safeguarding public health. While 80-85% of students possess strong knowledge of AMR and AMSP, practices lag. Despite significant knowledge, students do not always act on it, as shown by the lack of a statistically significant relationship ($p = 0.29$). To close this gap, integrating more practical applications, real-life reinforcement, and behavioural interventions into the curriculum is essential.

7. Ethical Approval

This study was approved by Institute Ethical approval committee with ref. no. SVIEC/ON/Medi/SRP/May/24/80.

8. Conflict of Interest

We declare no competing interest.

9. Source of Funding

None.

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