



## Research Article

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# ASSESSMENT OF KNOWLEDGE, ATTITUDE, AND PRACTICES ON ANTIBIOTIC USE AND ITS RESISTANCE AMONG MEDICAL STUDENTS IN TERTIARY CARE TEACHING HOSPITALS OF MAHARASHTRA

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Antibiotic resistance, Antibiotic use, medical students, Knowledge

### ABSTRACT

**Background:** One of the issues concerning public health today is the development and spread of antibiotic-resistant pathogenic microorganisms. The primary cause of this is the irrational use of these agents. To avoid antibiotic resistance, it is imperative to have correct knowledge of its rational use. This study was carried out among MBBS undergraduates who will work as healthcare providers in the future regarding their knowledge, attitudes, and practices about the usage of antibiotics and their resistance. **Materials and Method:** An online cross-sectional study conducted using Google Forms. A structured questionnaire was sent to medical students across Maharashtra. Data was acquired through responses to a self-administered questionnaire and analyzed with descriptive statistics. A one-way ANOVA test was applied to statistically compare students' knowledge levels based on their academic year. **Results and Discussion:** 344 students replied to Google Forms from eight medical institutes around Maharashtra. Regarding the usage of antibiotics, students' mean scores for knowledge, attitude, and practice were  $6.03 \pm 1.46$ ,  $4.97 \pm 1.74$ , and  $4.00 \pm 1.98$ , respectively. Of the total number of students, 234 (68.02%) had good knowledge, 134 (38.95%) had a good attitude, and only 43 (12.5%) had good practices for the usage of antibiotics. Students' knowledge levels varied significantly depending on the year they were studying. **Conclusion:** The present study indicates that medical students have a good degree of knowledge about antibiotic use and resistance. Improvement must be made regarding attitudes and practices.

### INTRODUCTION

Treatment and outcomes for infectious diseases have changed because of antibiotics [1]. Over the past 50 years, antibiotics

have shown to be a vital and successful tool in the fight against various diseases. The problem of antibiotic-resistant pathogenic bacteria spreading throughout the human population is

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becoming more widespread in the twenty-first century. It carries a grave threat to public health, especially in developing nations [2, 3]. The progressive threat of antimicrobial inadequacy has arisen from the global proliferation of antibiotic-resistant microbes. Patients with these antibiotic-resistant organism infections may need to stay in the hospital for extended periods of time and receive therapy with second and third-line medications, which may be less effective and more hazardous [4]. Antimicrobial resistance (AMR) may be primarily caused by self-medication, incorrect prescriptions, inappropriate consumption, and overuse of these antimicrobial treatments, in addition to other equally important social and cultural factors [5-7]. Eventually, antibiotic resistance will reduce their therapeutic efficacy, raise treatment failure rates, and result in more severe side effects [8].

The challenges caused by antibiotic resistance spread have been discussed in several ways, including teaching, and educating the public [9] and medical professionals [10], its harmful effects, and strategies to stop it from developing and spreading [11,12]. In addition to safely and judiciously administering medications, prescribers play an important role in counteracting antibiotic resistance by raising patient awareness, educating the public about safe antibiotic treatment practices, and supporting patient education. Numerous studies have demonstrated that prescribing doctors are unable to raise patients' awareness of the issue and give them the necessary instruction for the use of antibiotics [9]. Considering the frequency of these prescribed medicines and ongoing and growing concern about antibiotic resistance, it has been proposed that their incapacity to perform these jobs may be due to inadequate training received throughout their undergraduate and postgraduate years [13].

It is anticipated that medical students will practice in primary care and work with the public. By rationally prescribing antibiotics and educating patients, future prescribers have a critical role in counteracting antimicrobial resistance [14]. The appropriate knowledge and training of medical students can help in combating antibiotic resistance. Before developing or enhancing any teaching or training program, it is imperative to have impactful proof of the baseline knowledge, mindset, and behaviours of a target population. This evidence would support devising an effective curriculum and sustainable program [15,16]. Considering these circumstances, the aim of this study was to assess medical students' knowledge, attitudes, and

practices regarding the use of antibiotics and antibiotic resistance.

#### **MATERIAL AND METHOD**

This was a cross-sectional study conducted using online Google Forms for the duration of one month in October 2022. The study population included MBBS students from Maharashtra's tertiary care teaching hospitals who were in their second, pre-final, and final years of study. The study was scrutinized and accepted by the institutional ethical committee (Reference No. 3838/EC/Pharmac/GMC/NGP). Data was collected through a Google form consisting of a semi-structured questionnaire. Based on a review of the literature, the research team created a systematic questionnaire that addressed every important aspect of the study. Most of the structured questions were drawn from earlier research. The faculties of my institute validated the questionnaire.

There were four sections to the questionnaire. The students' demographics were covered in the first section, and their knowledge was evaluated with eight questions in the second. Eight questions in the third segment tested the students' attitudes about rational antibiotic usage, while five questions in the fourth section addressed the practices of students. Three points—one for agree, two for neither agree nor disagree and three for disagree—were used to analyze knowledge and attitude. A scale with response options ranging from "always" to "never" was also used to evaluate the practices of the students. Through the contacts of the Medical Students Association of Maharashtra, which is made up of students from different medical institutes around the state, the questionnaire was distributed to medical students all over the state of Maharashtra by sending a Google link. Participants were requested to enlist more participants in the study from their own colleges. As a result, the study used a respondent-driven sampling strategy. Prior to attempting the questionnaire, informed consent was obtained. The aim of the study was elucidated thoroughly prior to initiating the questionnaire.

Every right response was given one point. Participants in the knowledge and attitude questionnaire were classified as having good, moderate, and poor knowledge and attitude, respectively, based on their scores of 6-8, 4-5, and 0-3. A practice-based questionnaire would classify a score of 6–9, 4-5, and 0–3 as good, moderate, and poor, respectively.

Data were entered in Microsoft Excel 2021 and analyzed using statistical software GraphPad Prism 8.4.2. The qualitative data were expressed using descriptive statistics. Students' knowledge levels were statistically compared based on their academic year using one-way ANOVA followed by Tukey's multiple comparisons.

## RESULTS

A total of 344 responses were received from MBBS students of eight medical colleges distributed across Maharashtra. Out of which 235(68.3%) were male and 109(31.67%) were female (Figure 1). From the responses received 210(61%) students were from 2<sup>nd</sup> MBBS while 82(24%) students were studying in pre-final and 52(15%) in final year (Figure 2). The mean score of knowledge, attitude, and practice was  $6.03 \pm 1.46$ ,  $4.97 \pm 1.74$ , and  $4.00 \pm 1.98$  respectively (table no 4). Knowledge and Attitude were assessed on the basis of 8 questions each in the questionnaire. Similarly, nine questions were included related to the practices of antibiotic use. Each of these questions was scored for every participant and based on the total score of participants, they were categorized as good, moderate, and poor. The average knowledge score was  $6.03 \pm 1.46$  overall. The mean score of knowledge in second-year students was  $5.95 \pm 1.52$  while in pre-final and final-year students was  $6.01 \pm 1.48$ , and  $6.51 \pm 1.03^*$  respectively (table no 6). Depending on the academic year, a significant difference was observed in the student's knowledge level (p-value- 0.0346) which may be due to an increase in depth of knowledge.

Out of the total students, 234(68.02%) had good knowledge while 134 (38.95%) students had good attitudes whereas only 43(12.5%) had good practices towards antibiotics use (Table no 5). Three hundred and fifteen students (98.8%) knew that antibiotic resistance is a significant and grave issue for worldwide public health. Of the students, 340(98.8%) knew antibiotics are effective against bacterial infections. According to 91 students (26.5%), antibiotics are safe medications that can be used frequently. Three hundred and three (88%) students agree that there should be effective antimicrobial stewardship program guidelines for the institute.

## DISCUSSION

The motive of this study was to appraise the knowledge, attitude, and practices of future prescribers of the community in relation to antibiotic resistance. The medical students' level of

knowledge of the usage of antibiotics and their resistance was found to be good in this study. In terms of attitudes and behaviors, 50% of respondents reported poor practice and a moderate attitude.

The most commonly given medications in day-to-day are antibiotics, yet they are frequently misused [17]. Global concern over antibiotic resistance is growing as it spreads around the world [18, 19]. The appropriate use of antibiotics by patients, doctors, and retailers is essential to their therapeutic efficacy [20]. Several factors, including fear of losing the patient, ignorance about appropriate antibiotic use, overuse and unnecessary prescriptions, improper dosage, or delivery method, prescribing of antibiotics for nonbacterial infections, and patient requests, can affect a prescriber's decision-making [21–24]. Self-medication, sharing drugs, not following through on therapy, and saving a portion of the treatment for future use are patient-related variables linked to improper antibiotic use [25]. Concern over antibiotic resistance has spread throughout the world because of inadequate infection control procedures and rising antibiotic use in farming, aquaculture, and agriculture [26].

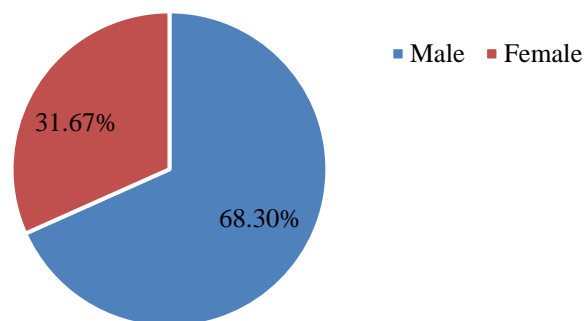


Figure 1: Distribution of participants as per gender

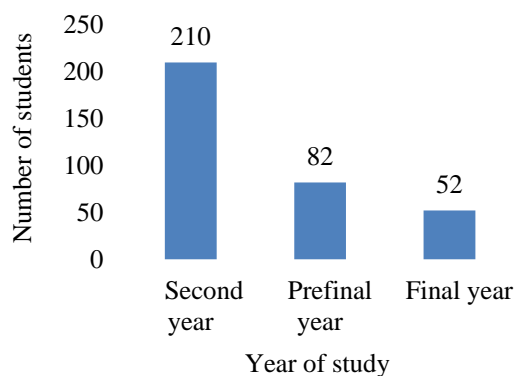


Figure 2: Numbers of students as per the year of study

**Table 1: Understanding the knowledge of antibiotics and their resistance.**

Questions	Agree n (%)	Neither agree nor disagree n (%)	Disagree n (%)
1. When treating bacterial infections, antibiotics are helpful.	340(98.8)	01(0.3)	03(0.9)
2. Viral infections can be effectively treated with antibiotics.	93(27.1)	30(8.7)	221(64.2)
3. Bacteria cause common colds and influenza.	84(24.4)	22(6.3)	238(69.3)
4. The recovery from flu and cold symptoms can be accelerated using antibiotics.	147(42.7)	82(23.8)	115(33.5)
5. What is antimicrobial resistance? a) Microorganism's resistance to antimicrobials that were once able to treat an infection by that microorganism b) Drugs will not act	306(89)	18(5.2)	20(5.8)
6. Antibiotic resistance is a significant and grave global public health concern.	315(91.6)	19(5.5)	10(2.9)
7. The use of antibiotics carelessly and indiscriminately can result in: - a) Ineffective treatment; b) an increase in side effects; and c) a greater financial burden on the patient.	307(89.2)	26(7.6)	11(3.2)
8. Secondary infections can be caused by antibiotics due to the destruction of good bacteria in the body.	234(68)	69(20.1)	41(11.9)

**Table 2: Attitude toward the use of antibiotics**

Questions	Agree n (%)	Neither agree nor disagree n (%)	Disagree n (%)
1. The use of antibiotics is common because they are safe drugs.	91(26.5)	71(26.6)	182(52.9)
2. Missing one or two doses does not affect the development of antibiotic resistance.	75(21.8)	93(21.03)	176 (51.17)
3. The duration of viral illness is shortened by injudicious use of antibiotics.	52(15.1)	88(25.6)	204(59.3)
4. Antibiotics are the main line of treatment for sore throat and cough.	144(41.9)	82(23.8)	118(34.3)
5. When prescribing, it is recommended to start with higher doses of antibiotics	31(9)	65(18.9)	248(72.1)
6. Inadequate infection control practices in the hospital promote antimicrobial resistance	265(77)	45(13.1)	34(9.9)
7. The lack of rapid diagnostic tests for the diagnosis of infections is causing antimicrobial resistance	215(62.5)	66(19.2)	63(18.3)
8. There should be effective antibiotic stewardship program guidelines for an institute	303(88)	31(9)	10(3)

The majority, 91.6% of the students in this study, knew about the global issue of antimicrobial resistance. The results were similar to a survey conducted in Nepal among medical students, where 88.6% of participants stated that antimicrobial resistance is a significant worldwide issue [27]. The study conducted in Italy revealed that 95.2% of medical students were aware that antibiotics are effective in treating bacterial illnesses, a finding that is consistent with the 98.8% of students in our study who knew this information [28]. However, 42.7% of students stated that using antibiotics speeds up recovery from cold and flu, and

27% of students felt that antibiotics are also helpful for viral infections. This finding contrasts with studies done in Iran [29] and China [30], where 72.6% of students thought that using antibiotics would hasten recovery from the flu and cold and 100% of medical students thought that using antibiotics would hasten the healing of viral infections. These false assumptions could result in unnecessarily high rates of antibiotic consumption, which could raise the level of bacterial resistance [27, 32]. By explicitly identifying these misconceptions, educational interventions can target these specific areas during

training sessions. Addressing these beliefs head-on, providing evidence-based information, and fostering a deeper understanding of the limitations and appropriate use of antibiotics can contribute to more responsible prescribing behaviors among medical students. 52.9% of respondents disagreed with the statement in the study that "antibiotics are safe drugs; therefore, they can be used commonly." This answer

was in line with a study done in Nepal when 64% of students answered the same question disagreeably [27]. According to 41.9% of students in this study, antibiotics are the first medication that doctors recommend for cough and sore throats which is in line with 52.32% of participants in a study done in Rajasthan [29].

**Table 3. Self-reported practices on antibiotics**

Questions	Always n (%)	Sometimes n (%)	Never n (%)
1. You were prescribed antibiotics by the doctor, and after taking 2–3 doses, you begin to feel better.			
a. Do not continue with any further treatment.	34(9.9)	174(50.6)	136(39.5)
b. Would you be keeping the remaining antibiotics for future use?	77(22.4)	174(50.6)	93(27)
c. Do you discard any remaining medicine?	48(14)	136(39.5)	160(46.5)
d. Do you provide your friend/family members with any leftover antibiotics if they become ill?	45(13.1)	183(53.2)	116(33.7)
e. Do you complete the full course of antibiotics?	238(69.2)	95(27.6)	11(3.2)
2. Do you take medical advice before beginning an antibiotic regimen?	194(56.4)	134(39)	16(4.6)
3. Before taking an antibiotic, do you check its expiration date?	303(88.1)	36(10.5)	5(1.4)
4. When you have a sore throat and cough, do you prefer to take antibiotics?	62(18)	240(69.8)	42(12.2)
5. Do you prescribe antibiotics?	36(10.5)	235(68.3)	73(21.2)

**Table 4. Mean KAP score of students (n=344)**

KAP parameter	Minimum score	Maximum score	Mean score(±SD)
Knowledge	0	8	6.03±1.46
Attitude	0	8	4.97±1.74
Practice	0	9	4.00±1.98

KAP- knowledge attitude practice; SD-standard deviation

**Table 5. Categorization of participants as per the total score(n=344)**

Parameter	Good (Total score >5) n (%)	Moderate (Total score 4&5) n (%)	Poor (Total score < 4) n (%)
Knowledge	234(68.02)	93(27.03)	19(5.52)
Attitude	134(38.95)	149(43.31)	63(18.31)
Practice	43(12.5)	153(44.47)	150(43.60)

SD-standard deviation

**Table 6. Distribution of participants as per the study and mean score of knowledge, attitude, and practice.**

Year of Study	Number of students	Mean score (±SD) of knowledge
Second year	210	5.95 ± 1.52
Prefinal year	82	6.01 ± 1.48
Final year	52	6.51 ± 1.03*

SD-standard deviation; one-way ANOVA followed by Tukey's multiple comparisons is used for statistical analysis; \*Statistically significant as compared to second-year mean score (p-value- 0.0346)

With reference to self-medication with antibiotics, 56.43% of students said they would never take antibiotics without first consulting a doctor. In contrast, an Italian study [28] discovered that 81.38% of medical students followed the same course of action. 70% of the students completed the entire course of antibiotics, which is comparable to research conducted in Kerala, India when 74.2% of medical students finished the course [17]. In this study, 13.1% of students suggested that they carry a practice of sharing leftover antibiotics with friends and family members. This kind of improper practice can be changed with targeted educational modules such as conducting interactive workshops and simulations that simulate real-world scenarios related to antibiotic use and engaging students in discussions, case studies, and role-playing exercises to enhance their understanding of responsible medication practices.

A significant difference in the student's degree of knowledge was discovered when mean scores were compared. Students across final year and pre-final years had a higher mean score on knowledge than second-year students did. This was most likely caused by their deeper understanding of pharmacology and clinical knowledge as they progressed through the professional year. Huang et al. (2013) [30] have reported similar kinds of observations. Interactive Workshops and Case Studies, integrating antibiotic stewardship principles into the curriculum, simulation exercises, guest lectures, expert talks, and small-group discussions are some of the proposed targeted interventions that can be helpful to junior students to improve their knowledge regarding antibiotic use. Regular updates on guidelines can emphasize the importance of staying updated on antibiotic prescribing guidelines [33].

Despite having adequate knowledge about antibiotic use and resistance, medical students may exhibit moderate attitudes and practices due to various factors. Delving deeper into these factors can provide insights into the complexities surrounding antibiotic prescribing behaviors among MBBS students. Peer pressure and social norms within medical communities can influence prescribing behavior. The culture of the clinical environment, including the practices of senior clinicians and role models, can impact students' behaviors. In hierarchical medical settings, students may follow the examples set by experienced practitioners, even if those practices are not in line with guidelines. Busy clinical schedules and time constraints may lead to quick decision-making without thorough consideration

of appropriate antibiotic use. Concerns about patient satisfaction and expectations may drive students to prescribe antibiotics unnecessarily. The integration of knowledge into attitudes and practices is a complex and multifaceted process influenced by cognitive, emotional, social, and behavioral factors. Changing behavior and practices is a gradual process that requires consistent effort and time. Even with knowledge, breaking old practices and establishing new ones can be challenging [31].

Addressing these factors requires a multifaceted approach, including changes in educational strategies, clinical culture, and feedback mechanisms. Interventions should not only target knowledge gaps but also aim to reshape attitudes, behaviors, and the clinical culture surrounding antibiotic use among medical students. Implementing regular audits, feedback loops, and mentorship programs can contribute to sustained improvements in antibiotic prescribing practices [33].

### **CONCLUSION**

One of the greatest concerns to world health today is antibiotic resistance. The irrational use of antibiotics in humans is accelerating the process. This study reveals important insights into medical students' knowledge, attitudes, and practices related to antibiotic use and resistance. The present study shows that the knowledge level of students about the use of antibiotics and their resistance is good, but half of the students had moderate attitudes and poor practices regarding antibiotic use.

Hence, there is a need for improvement. Medical students are future doctors; so, if they have a clear idea about the rational use of antibiotics, its resistance can be largely reduced. In addition to increasing information, medical education methods should give sufficient training on the rational use of antibiotics. This can be achieved through implementing proper guidelines in the undergraduate curriculum and its effective implementation in practice. A strict implementation of antibiotic stewardship program in hospitals will be a key feature in combating antibiotic resistance.

### **Limitations of the study**

In this study, responses from students of 8 medical colleges received across Maharashtra. Therefore, it is not possible to extrapolate the findings to all medical students. Larger sample numbers and additional studies are required to gain a deeper understanding of young adults' and adolescents' awareness of the problem of antibiotic use and resistance.

**FINANCIAL ASSISTANCE**

Nil

**CONFLICT OF INTEREST**

The authors declare no conflict of interest

**AUTHOR CONTRIBUTION**

Planning the study, conducting a literature review, creating the report, and gathering data were all done by Bhushan Dudhe and Nikhil Kamdi. Together with Nikhil Kamdi, Akhil Giradkar finished the statistical analysis. Nikhil Kamdi, Bhushan Dudhe, Poonam Astankar, Nishikant Mankar, and Ulhas Ghotkar contributed to the work's writing, review, and editing. All authors have read and approved the final manuscript.

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