

Knowledge-Based Attitudes of Medical Undergraduates at King Edward Medical University in Antibiotic therapy and Antibiotic Resistance

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ABSTRACT

Objective: To assess knowledge gaps among medical undergraduates regarding antibiotic use and resistance.

Study Design: Cross-sectional study.

Place and Duration of Study: King Edward Medical University, Lahore Pakistan, from Jul to Aug 2024.

Methodology: Data were collected using a pre-designed, pre-tested questionnaire from 300 medical students divided into two groups: Group-A (Years 1–3) and Group-B (Years 4–5).

Results: Of the 300 participants, 42% were male and 57% female. Group A comprised 25% of students, while Group B accounted for 74%. Most students reported using antibiotics within the past six months, with sore throats being the most common reason (21%). Academic year significantly correlated with knowledge of antibiotics ($p < 0.001$) and compliance with antibiotic courses ($p = .010$). More students in Group B (82%) rated their understanding of antibiotics as “good” or “very good” compared to Group A (17%). Group B also received more instruction on antibiotic resistance (94.2% vs. 81.6%, $p = 0.001$). Despite their advanced years, 68% acknowledged antibiotic resistance as a serious issue, and 76% expressed a desire for more information on responsible antibiotic use. Additionally, students highlighted gaps in practical training on antibiotic stewardship, emphasizing the need for hands-on learning approaches and case-based teaching methods.

Conclusion: Significant knowledge gaps exist among medical undergraduates, particularly in earlier years, regarding antibiotic use and resistance. These findings underscore the importance of targeted curriculum modifications and active learning strategies to equip future healthcare professionals better to combat antimicrobial resistance.

Keywords: Antibiotic Use, Attitude, Antibiotic Resistance, Knowledge, Medical Students.

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INTRODUCTION

Over the past few decades, there has been a steady rise in the number of bacterial types that are resistant to drugs. These strains present a serious hazard to the treatment of infectious diseases. They are linked to higher rates of treatment failure, prolonged hospital stays, higher medical expenses, higher mortality rates, and an increased risk of disease transmission.¹ According to a recent study, infections with resistant microorganisms cause about 700,000 fatalities annually; if this problem is not immediately addressed, that number might rise to 10 million deaths annually by 2050.² In a preceding study, 317 medical students in the United States were asked about their knowledge, attitudes, and practices. The findings showed that 90% of the students wanted more instruction on the proper use of antibiotics, and only 33% thought they were adequately prepared for some basic antimicrobial use principles.³

Examining medical students' baseline knowledge is crucial for the appropriate design and execution of an extremely successful training program on the use of antibiotics and AMR management strategies.⁴ An appreciable proportion of the global burden of AMR is reported to be from South Asian countries, including Pakistan. Both multi-drug-resistant (MDR) and extensively drug-resistant (XDR) bacteria have been identified in different regions of Pakistan.⁵

Antibiotic resistance has emerged as a significant healthcare concern in developing nations like Pakistan, primarily as a result of self-medication. It is anticipated that this issue will only get worse with time. Scarcely any research on antibiotic use and resistance has been carried out in Pakistani universities.⁶ This study aims to assess the knowledge gaps of medical undergraduates at various levels of medical education regarding antibiotic therapy and resistance.

METHODOLOGY

It was a cross-sectional study carried out from July to August 2024 among the medical students of

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King Edward Medical University, Lahore Pakistan with the approval Institutional Review Board from the university (IRB no 250/RC/KEMU; date of approval: 13/07/2024).

Inclusion Criteria: The eligible participants were undergraduate students only. The students were divided into two batches: Group-A consisting of students from 1-3 years and Group-B consisting of students from 4-5 years. The division was because students in years 1-3 have only preclinical subjects and students in years 4-5 have clinical subjects as well.

Exclusion Criteria: Graduates in house job and doctors doing post-graduate training were excluded from the study.

The sample size of 300 students was calculated by open-epi version 3 calculator by keeping the confidence level at 95%, 3% absolute precision, and with the expected % of the frequency of students likely to broaden their knowledge on antibiotic therapy as 92%.⁷ Due to time and funding constraints the sampling technique employed was the nonprobability convenient method although we do completely acknowledge that the results from random sampling methods are more authentic.

Data was collected through a pre-designed and pre-tested questionnaire filled out by all those who were eligible and those who gave consent to participate in the survey voluntarily. The Structured questionnaire consisted of 26 items in 5 parts: (a) socio-demographic characteristics of the students (2 items); (b) Insights and attitudes about antimicrobial use (9 items); (c) Teaching and education on antibiotics (4 items); (d) Sources of information about antibiotics (3 items); attitudes towards antimicrobials (2 items); (e) knowledge about antimicrobial resistance (AMR) (4 items). The validity of the questions in the questionnaire was checked through a pilot survey, conducted on selected group of students of medical university of Warsaw.⁷

Data was analyzed Using Statistical Package for Social Sciences (version 25). Data were expressed as Frequency and percentages for all the categorical variables. To identify the differences between the groups (Group-A: 1st year, 2nd year & 3rd year and Group-B 4th year and final year) and Perceptions about antimicrobial use, education, sources of information, attitudes based on knowledge and knowledge about AMR Chi-square test was applied. p -value <0.05 was considered significant.

RESULTS

Out of 300 responses 172(57%) were female and 128(42%) were male. The Students in Group-A (1-3 years) of study were 76(25%) and students in Group-B (4-5 years) were 224(74%). Majority of students reported having taken antibiotics within the last 6 months, with 32.3% ($n=97$) reporting use in the last 3-6 months. Table-I shows the insights and attitudes about the antibiotic use. The sore throat was the most common reason for antibiotic use, reported by 21% of students ($n=65$) shown in the figure-1. Most students obtained their antibiotics through a medical prescription from a family practitioner (39%, $n=118$). Approximately 78% of students in Group-B reported completing their last antibiotic course compared to 21% in Group-A. Students in Group-B rated their knowledge of antibiotics higher, with 82% ($n=72$) rating it as good or very good, compared to 17% ($n=15$) in Group-A. Significant Association was only observed between academic years and compliance with the full course of antibiotics, $p=.010$ & knowledge on antibiotics, $p<.001$.

Table-I: Insights and Attitudes about Antimicrobial Use ($n=300$)

	1-3 Years of Medical Education n(%) n=76	4-5 Years of Medical Education n(%) n=224	Total n=300	p- value sig. *
How did you acquire the last course of antibiotics that you used?				
From a medical prescription –family physician	26(34%)	92(41%)	118(39%)	0.679
From a medical prescription –doctor of other specialty	23(30%)	57(25%)	80(26%)	
From a medical prescription –dentist	2(2%)	12(5%)	14(4%)	
Without a prescription from a pharmacy	11(14%)	15(6%)	26(8%)	
Spare from a previous therapy	0(0%)	4(2%)	4(1%)	
From friends/family member	1(1%)	4(2%)	5(1%)	
Reason for your last Intake of antibiotics?				
Common cold	9(17%)	10(6%)	19(9%)	0.420
Cough	4(7%)	7(4%)	11(5%)	
Sore throat	14(26%)	51(32%)	65(31%)	
Pharyngitis	1(2%)	13(8%)	14(6%)	
Toothache	3(5%)	10(6%)	13(6%)	
Flu	2(3%)	6(3%)	8(3%)	
Pharyngitis	1(2%)	13(8%)	14(6%)	
Acute Bronchitis	0(0%)	3(2%)	3(1%)	
Pneumonia	1(3%)	3(2%)	4(2%)	
Diarrhea	8(15%)	25(16%)	33(15%)	
When should antibiotics be prescribed as a foremost treatment according to you?				
Common cold	0(0%)	1(0.4%)	1(0.3%)	0.120
Cough	2(2%)	3(1%)	5(2%)	
Sore throat	3(3%)	6(2%)	9(3%)	
Toothache	5(6%)	5(2%)	10(3%)	
Flu	7(9%)	20(8%)	27(9%)	
Pharyngitis	7(9%)	35(15%)	42(14%)	
Acute bronchitis	9(11%)	41(18%)	50(16%)	
Pneumonia	13(17%)	48(21%)	61(20%)	
Urinary tract infection	16(21%)	47(21%)	63(21%)	
Diarrhea	1(1.3%)	4(1.8%)	5(1.7%)	
How would you rank your knowledge about antibiotics?				
Very Bad	6(7%)	4(2%)	10(3%)	<0.001*
Bad	9(11%)	4(2%)	13(4%)	
Below Satisfactory	19(25%)	24(10%)	43(14%)	
Satisfactory	25(32%)	74(33%)	99(33%)	
Good	15(19%)	72(32%)	87(29%)	
Very Good	2(2%)	46(20%)	48(16%)	
Have You Used the Whole Anti Biotic?				
YES	44(57%)	165(73%)	209(69%)	0.010*
NO	32(42%)	59(26%)	91(30%)	

*Denotes significant association having p -value <0.05

81% of students in Group-A and 94% in Group-B reported receiving teaching about antimicrobial

resistance shown in Table-II. The chi-square test for independence indicated a statistically significant association between the academic year group and whether students were taught about antimicrobial resistance, $p=0.001$. The linear-by-linear association was also significant $p=0.001$. This suggests that teaching about antimicrobial resistance is more prevalent in the later years of study. 7% of students in Group-A and 2% in Group-B reported that their studies "definitely did not" increase their knowledge. 23% of students in Group-A and 46% in Group-B indicated that their studies "definitely" increased their knowledge. The chi-square test showed a statistically significant association between the academic year group and the influence of studies on knowledge, $p<0.001$. depicted in Table-II. The linear-by-linear association was significant as well, $p<0.001$. These findings indicate a stronger perceived influence of studies on antibiotic knowledge in the later years.

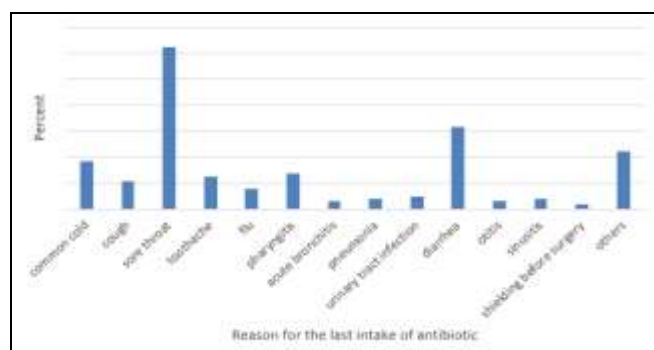


Figure-1: Reasons for the last intake of antibiotic (n=300)

When seeking information on antibiotic use at the doctor, about 31% of students across both groups reported that they seek information to a considerable extent. Group-B students were more likely to seek information on the Internet to a considerable extent (17%) compared to Group-A (6%). This difference was statistically significant $p=0.044$. 21% of Group-B and 13% of Group-A students conveyed seeking information to a considerable extent in the literature and drug Leaflets. The overwhelming part of students, 76% in Group-A and 79% in Group-B expressed a strong wish to increase their knowledge of antibiotics. The most desired topic for further exploration among students was "general principles for the rational use of antibiotics," with 45% of Group-A students and 32% of Group-B students showing interest.

Majority of respondents across all academic years tend to check other sources before starting antibiotic treatment, with 56% of the total participants doing so.

A smaller proportion, 37%, would start the treatment with full confidence in their doctor's advice without seeking additional information. Some respondents slightly agree (32%) that an antibiogram should be ordered before administering antibiotics. There is a fraction that slightly disagrees (26%), indicating some level of skepticism or uncertainty about the necessity of antibiograms. Our results indicate a statistically significant difference between academic year groups in their perception of ordering an antibiogram (p -value =0.050).

Table-II: Effect Educational Background on Antimicrobial Resistance (n=300)

	1-3 Years of Medical Education n(%) n=76	4-5 years of Medical Education n(%) n=224	Total n n=300	p-value sig.*
Were you educated during your medical education about the increasing problem of antibiotic resistance?				
YES	62(81%)	211(94%)	273(91%)	<0.001*
NO	14(18%)	13(5%)	27(9%)	
Did the knowledge you gain on antibiotics during your medical education have an impact on nullifying the antibiotic prescribed by a doctor?				
YES	46(60%)	145(64.7%)	191(63%)	0.510
NO	30(39%)	79(35%)	109(36%)	
Did your medical education make you more knowledgeable about the use of antibiotics?				
Not	6(7%)	4(2%)	10(3%)	<0.001*
Probably not	5(6%)	3(1%)	8(2%)	
Possibly	9(11%)	25(11%)	34(11%)	
Probably	16(21%)	46(20%)	62(20%)	
Probably yes	22(28%)	41(18%)	63(21%)	
Definitely Yes	18(23%)	105(46%)	123(41%)	

*Denotes significant association having p -value <0.05

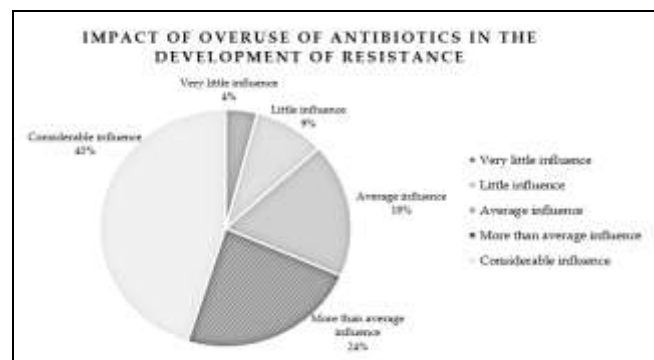


Figure-2: Perceived Impact of Antibiotic Overuse on the Development of Antimicrobial Resistance

A majority (68%) of students across all years believe that antibiotic resistance is a major problem. A considerable influence is perceived by 35% of students, on the development of antimicrobial resistance with excessive use of antibiotics by doctors and the Impact of Excessive Use of Antibiotics by Dentists with 24% of students perceiving considerable influence. A notable proportion (31%) sees considerable influence on the excessive use of antibiotics by the nurses. A significant portion (53%)

believe low awareness of the hazards of antibiotic resistance influences resistance. 31% of students agreed that there was considerable influence on the Impact of Too Long Antibiotic Therapy. 57% of the students believed that the usage of too low doses of antibiotics has a considerable influence on the development of Resistance. 44% believed that the overuse of antibiotics has a considerable influence on the development of resistance shown by Figure-2. Significant difference ($p=0.030$), was observed only on the impact of using too low doses of antibiotic indicating that perceptions may vary more by academic year group.

DISCUSSION

This study examined the knowledge and attitudes of medical students at King Edward Medical University regarding antibiotic use and antimicrobial resistance (AMR). While most students recognized AMR as a serious issue, many lacked trust in doctors' advice and sought additional information before following prescriptions. Majority of the students supported including AMR education in the curriculum, indicating a desire for better knowledge. The study reveals gaps in both student's understanding and trust in medical professionals, suggesting the need for enhanced education to promote responsible antibiotic use.

Globally, antimicrobial resistance (AMR) is emerging as a growing public health issue. In Pakistan National Action Plan for anti-microbial resistance was developed by the government of Pakistan in 2017.⁸ Several studies conducted about the knowledge of medical students on AMR show that medical university curricula do not well incorporate the principles of proper antibiotic use, even though education is crucial to antimicrobial stewardship.⁹

The majority of participants in our study were well-versed with the overall knowledge of antimicrobials, resistance-promoting variables, and antimicrobial resistance-fighting initiatives which is in harmony with studies conducted in Nigeria and East Africa.^{10,11}

About 32% of students reported their last use in the last 3-6 months which is coherent with the 34% use in another study.¹² This could be an indication that inappropriate and inadequate antibiotic prescribing is quite common in the general population with a maximum of fifty percent of all antimicrobials recommendations being controversial.¹³ In this study, the majority of the students (69%) reported having

completed their most recent antibiotic course which is supported by a study conducted in Ethiopia (65%).¹⁴ However, it is less than the 84% found in the Italian study.¹⁵ The most common reason for last intake of antibiotics was sore throat, diarrhea, and common cold which is in line with the studies conducted in Rwanda and Sri Lanka.^{16,17}

Across all years, majority of students (68%) perceived antibiotic resistance to be a serious issue with 40% perceiving it to be a problem at the global level, seconded by a study conducted in Spain which regarded it to be a medium to long-term problem.¹⁸ This highlights a positive trend. Students understand that improper use and abuse of antibiotics might increase antibiotic resistance. They relate it with inappropriate and irrational consumption of antibiotics with more than half of the respondents strongly agreeing with it. Similarly, 50% of antibiotic prescriptions are thought to be improper, according to earlier studies.¹⁹ In our study two elements have been suggested to be the primary contributors to AMR: lack of knowledge about the risks associated with AMR and overuse of antibiotics. These findings are supported by a study in Saudi Arabia with a 38% positive response.²⁰

Majority of students (78%) in our study looked forward to being taught about antibiotic use and resistance as a part of university curricula. This is in agreement with a study carried out in Nigeria in 2023(100%) and 2019(87%).^{10,20} This demonstrates willingness among students to learn and update their knowledge about AMR.

In our study, 31% of the respondents claimed doctors and nurses to be the main sources of information about antibiotic use and antibiotic resistance which is moderately higher than a study conducted in Nepal with 24%.²¹ This slight increase could be due to students responding based on what the ideal source should be. A lower percentage, 37%, would begin the treatment fully trusting their doctor's suggestion without looking for more information compared to another study in which more than half of the students fully trust their doctor's prescription.¹¹ This is highly alarming as it suggests that medical students have a mistrust of their senior colleagues regarding their knowledge of antibiotics.

CONCLUSION

This study reveals substantial gaps in knowledge and practices regarding antibiotic use and resistance among medical undergraduates, particularly between students in

earlier and later years of medical education. While students in later years demonstrated better knowledge and higher compliance with antibiotic courses, misconceptions remain prevalent, such as inappropriate antibiotic use for conditions like sore throat and common colds.

Furthermore, many students expressed a strong desire to expand their knowledge on rational antibiotic use, underscoring the need for enhanced and earlier integration of antimicrobial stewardship in the medical curriculum.

The results of this study can inform strategies intended to incorporate comprehensive antibiotic resistance training and direct future research toward more successful educational approaches. The study will help prepare medical personnel to fight antibiotic resistance more successfully by filling in these gaps, which will have long-term positive effects on public health.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AR & ASM: Data acquisition, data analysis, critical review, approval of the final version to be published.

MA & SHR: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AR & SA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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