

Awareness of Antibiotic Resistance among Medical Students of Fourth and Fifth Year MBBS: A Cross- Sectional Study

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Abstract

Background: Antibiotic resistance is a growing public health concern. One of the main reasons contributing to it is the inappropriate use of antibiotics. As medical students will soon be responsible for prescribing antimicrobials tomorrow, it is important to know their understanding of this issue today.

Objective: This questionnaire- based study aims to judge the awareness among medical students regarding antibiotic resistance.

Study type, settings & duration: A descriptive cross- sectional study conducted at CMH Lahore Medical College, Lahore, Pakistan from November to December 2021.

Methodology: This study was conducted among fourth and final year students of MBBS. The questionnaire was shared in Google docs and disseminated to students via social media. The data was analyzed using SPSS version 26.

Results: Most students (97.3%) were aware of antibiotic resistance and knew that skipping antibiotic doses affects the treatment outcome. Students of 5th year (43%) were more aware that taking antibiotics will not speed up the recovery process of a sore throat or cough ($p=0.002$). However, students of 4th year were more aware that antibiotics are to be used solely for bacterial infections than their counterparts in 5th year ($p<0.001$).

Conclusion: This study shows that the theoretical knowledge gained by medical students is not necessarily reflected in their actual behavior. Therefore, more emphasis must be laid upon outcome- based learning in medical schools so that students learn to handle antibiotics in a more responsible manner.

Key words: Antibiotic resistance, medical students, education, microbial.

Introduction

Antibiotics have been central in treating bacterial infections since the discovery of penicillin revolutionized their treatment in the 20th century. The aim of using antibiotics is to reduce the burden of an infection to a smaller number of

organisms that can be cleared effectively by the immune system. The use of antibiotics helps reduce the duration of illness and limit the spread and complications of bacterial infections. As a result, the healthcare costs of bacterial infections are also reduced.¹ Keeping in mind the individual, societal and economic benefits of antibiotics, it is pertinent that antibiotics remain effective. However, this is proving to be a challenge as antibiotics become increasingly ineffective against bacteria, requiring much higher doses or the use of less-favored, potent second-line agents. The phenomenon by which antibiotics lose their effectiveness against bacteria is termed antibiotic resistance.² Resistant bacteria that are not cleared continue to spread and a vicious cycle is set up where antibiotic resistance can lead to the use of more antibiotics against such bacteria, resulting in the development of superbugs: bacteria that are resistant to multiple antibiotics.³ This results in a greater difficulty in achieving complete cure, greater incidence of adverse effects

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Authors Contribution

AS & AA conceptualized the project. MHS & AA did the data collection. SA, AA & NSS performed the statistical analysis. Literature search, drafting, revision & writing of manuscript were done by AS, DAH, AA, NSS, MHS & AA.

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and an increase in costs as more expensive drugs are used.⁴

Due to the presence of random mutations, it is always possible that antibiotic use will result in the production of resistant bacteria.⁵ However, the incidence is greater than by chance alone, meaning that other factors influence the development of resistance. The most influenceable factors are those related to how antibiotics are used by physicians and patients.⁶ There is a lack of awareness of diligent antibiotic use among the general population of Pakistan. A local study revealed that the majority of its participants self-medicated with antibiotics and did not complete their prescribed antibiotic course and discontinued them when they started feeling better.⁷ This finding is echoed by studies elsewhere in the region, such as Bangladesh, where self-medication with antibiotics is similarly rampant.⁸ Physicians, therefore, have an increased responsibility towards protecting patients from the harm of antibiotic misuse. They must take steps to ensure that patients are well informed about the antibiotics they are prescribed and counsel them to encourage adherence to the complete regimen.⁹ Therefore it is increasingly important that all physicians, including junior doctors, are familiar with antibiotic resistance.

Having just completed pharmacology, 4th and 5th year medical students in Pakistan are at a point in time where it is most effective to enhance the awareness of medical students of antibiotic resistance. To implement any changes in training however, the present knowledge gap regarding antibiotics must be addressed. The aim of the present study was to evaluate the students' baseline level of knowledge and common misconceptions so that future teaching plans could be tailored to address these issues and thus ultimately result in safer doctors that can help prevent the spread of antibiotic resistance.

Methodology

This cross-sectional study was conducted at CMH Lahore Medical College & Institute of Dentistry from November to December 2021. The participants of this study were medical students in the 4th and 5th years. A total of 185 students were selected via convenience-based sampling. After acquiring informed consent, the participants were asked to fill out a 10-point questionnaire which was distributed using Google forms.

The questionnaire was constructed using items from pre-existing literature. The only demographic measure recorded was the students' current year of college. Nine out of 10 of the questions were simple yes or no questions, while one question had a total of three possible responses. The questionnaire assessed two main components: academic knowledge and behavior of the students. Six items on the questionnaire assessed the theoretical knowledge of the students regarding the use of antibiotics while the remaining four items investigated how proactive the students were in the practical application of this knowledge in their daily lives.

The data gathered was then analyzed using SPSS version 26. Descriptive statistics (frequencies) and inferential statistics (chi-square test) were determined and the value of *p*-value was set to be significant at <0.05.

The ethical approval was obtained from Research Review Board (RRB) of Combined Military Hospital, Lahore vide IRB # 342/2021.

Results

A total of 185 students from the clinical years of MBBS participated in the study, of which 92 students (49.7%) were from 4th Year MBBS and 93 students (50.3%) were from 5th Year MBBS. The overall awareness of the students regarding antibiotic use and subsequent resistance is shown in Table-1. In Figure, the response of the participants when inquired about the purposes for which antibiotics could be used is shown, about 50 students or 27% of participants responded that antibiotics could be used for both bacterial and viral infections. The comparison of knowledge of the two participating batches is reflected in Table-2.

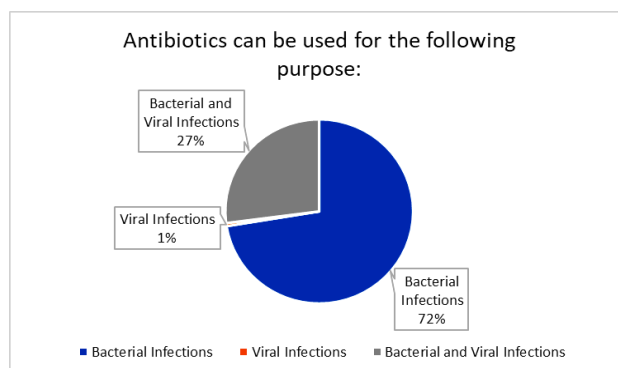


Figure: Purposes for which antibiotics can be used, according to students.

Table 1: Percentage of responses obtained from participants.

Frequency Table	Yes (%)	No (%)
The flu or common cold is caused by bacteria. (CR: No)	22 (11.9)	163 (88.1)
When experiencing a sore throat or cough, do you think antibiotics can be used to speed up recovery? (CR: No)	125 (67.6)	60 (32.4)
Do you think antibiotics can be used without prescription? (CR: No)	24 (13.0)	161 (87.0)
Do you complete the course of the antibiotic when it is prescribed to you? (CR: Yes)	168 (90.8)	17 (9.2)
Do you think skipping 1-2 doses of antibiotics will affect the treatment outcome? (CR: Yes)	164 (88.6)	21 (11.4)
Do you stop taking the antibiotic as soon as your symptoms get better? (CR: No)	34 (18.4)	151 (81.6)
Have you heard of "antibiotic resistance"? (CR: Yes)	180 (97.3)	5 (2.7)
Have you informed your friends and family about the risks of using unprescribed antibiotics? (CR: Yes)	157 (84.9)	28 (15.1)
When someone tries to self-medicate with antibiotics, do you try to stop them from doing so? (CR: Yes)	153 (82.7)	32 (17.3)
CR: Correct response		

Table 2: Response rate for each batch.

	4 th year (%)	5 th year (%)	p-value
The flu or common cold is caused by bacteria. (CR: No)			
Yes	14 (15.2)	08 (8.6)	0.165
When experiencing a sore throat/cough, do you think antibiotics can be used to speed up recovery? (CR: No)			
Yes	72 (78.3)	53 (57.0)	0.002*
Do you think antibiotics can be used without prescription? (CR: No)			
Yes	14 (15.2)	10 (10.8)	0.366
Do you complete the course of the antibiotic when it is prescribed to you? (CR: Yes)			
Yes	87 (94.6)	81 (87.0)	0.079
Do you think skipping 1-2 doses of antibiotics will affect the treatment outcome? (CR: Yes)			
Yes	82 (89.1)	82 (88.2)	0.837
Do you stop taking the antibiotic as soon as your symptoms get better? (CR: No)			
Yes	17 (18.5)	17 (18.3)	0.972
Have you heard of "antibiotic resistance"? (CR: Yes)			
Yes	90 (97.8)	90 (96.8)	0.659
Have you informed your friends and family about the risks of using unprescribed antibiotics? (CR: Yes)			
Yes	80 (87.0)	77 (82.8)	0.430
When someone tries to self-medicate with antibiotics, do you try to stop them from doing so? (CR: Yes)			
Yes	80 (87.0)	73 (78.5)	0.128
Antibiotics can be used for the following purpose. (CR: Bacterial infections)			
Bacterial infections	79 (85.9)	55 (59.1)	
Viral infections	0 (0)	01 (1.0)	0.000*
Both infections	13 (14.1)	37 (39.9)	

About 88.1% of students from the two batches agreed that the flu or common cold is not caused by bacteria and that antibiotics should not be stopped when symptoms get better implying that the course should be completed. A vast majority of students were aware of antibiotic resistance and the fact that skipping antibiotic doses affects the treatment outcome. When compared between the batches, 40 students of 5th year (43%) were more knowledgeable of the fact that taking antibiotics does not speed up the recovery process of a sore throat or cough ($p=0.002$) while students of 4th year were more aware that the antibiotics are used solely for bacterial infections than their counterparts in 5th year ($p<0.001$).

Discussion

Antibiotic resistance is a budding global concern.¹⁰ Misuse of antibiotics has resulted in loss of sensitivity of microbes to these drugs and the consequent spread of resistant strains, with substantial clinical and economic impact.¹¹ Assessing the awareness of medical students regarding this alarming phenomenon is important, as they will soon be the ones prescribing antibiotics.

The majority of the students in our study were aware of the existence of antibiotic resistance (97.3%). Similarly, around 91.5% Pakistani medical students had knowledge of this phenomenon in another study.¹² Fourth year students (97.8%) had slightly greater results compared to their fifth year counterparts (96.8%); these findings are similar to a study in Zambia by A. Zulu et al.¹³ This suggests

that most academic syllabi do bring attention to this topic. There were also differences in responses observed between the 4th year and 5th year medical students. Firstly, in our study, 11.9% incorrectly believed that bacteria caused the common cold whereas in Khan et al.'s study this was around 22.7%.¹⁴ Our study showed 15.2% of these students were from 4th year MBBS and 8.6% were from 5th year MBBS, but the p value for this was not significant. However, this shows 5th year students had a relatively better idea about the etiology of flu and colds. Another study showed that students of clinical years had greater knowledge regarding antimicrobial usage as compared to non-clinical years. Majority of the clinical phase students showed good knowledge of antibiotic usage and resistance, showing that theory taught in the pre-clinical years was highlighted further during patient treatment in the wards.¹⁵

When asked about the use of antibiotics, 72% answered correctly stating bacterial infections are the only reason to use them; but another 27% thought that they can be used for bacterial and viral infections both. Another study on Pakistani medical students showed that 16% thought antibiotics could be used in viral infections as well (12). When asked if they take antibiotics to speed up recovery after a sore throat or cough, a greater proportion of 4th year students (78.3%) said yes as compared to their 5th year peers (57%). Kanneppady et al. and Meher B et al. similarly reported better findings from final year students.¹⁶ It is worth noting that although the 4th year students did worse, both groups performed rather poorly on this item of the questionnaire as a staggering 67.6% responded incorrectly overall. The more extensive coverage of clinical subjects and longer duration of time spent in clinical wards by 5th year students may have a role to play in their better responses regarding antibiotic knowledge.

In our study, 87% of respondents were aware that a prescription was necessary for using antibiotics. Awareness rates were slightly higher in the 5th year (89.2%) compared to the 4th year students (84.8%). Majority of the students (90.8%) completed the course of the antibiotics once they had started taking it- 4th year students (94.6%) were more diligent than their 5th year peers (87%) in this aspect. The lower percentage for final year students points out that a higher class may not necessarily reflect more responsible behavior of medical students. These findings support Scaioli et al.¹⁷ and Lin et al.'s⁶ studies which stated that the greater the level of medical education, the higher the risk of self-medication. Another reason for the procurement of antibiotics without prescription could be the lax enforcement of drug regulations in the area. The

current legislature in Pakistan does not allow the sale of antibiotics without a valid prescription from a registered medical practitioner. Still, drug stores widely dispense antibiotics for common gastrointestinal or upper respiratory tract infections. Alarmingly, more than half the drug stores in Pakistan were found to sell antibiotics without any prescriptions.¹⁸ To highlight this, a study conducted on pharmacies in Islamabad & Rawalpindi revealed that up to 70% of antibiotics were purchased on demand without an official prescription and that 77% of these sales were being made by salesmen and not by licensed pharmacists themselves.¹⁹ This reveals the widespread ease with which antibiotics can be abused by consumers, which is further highlighted by a systematic review of lower to middle income countries that revealed that pharmacies where the major source of antibiotic abuse.²⁰

Furthermore, 87% of 4th year and 82.8% of 5th year students informed their friends and family about the dangers of using unprescribed antimicrobials. Similarly, 4th year students (87%) were much more proactive in preventing others from self- medicating with antibiotics compared to their 5th year counterparts (78.5%). Our findings show that despite better percentages for theoretical knowledge of antibiotics in 5th year students, their tendency of incorrect behavior also seems to be greater- as demonstrated by their lower response rate in these areas. Fifth year students seem to have better overall awareness of the theoretical aspects of antibiotic use; however when it came to putting those concepts into practice, they seem to perform worse than their fourth year peers. It was similarly reported that students were more confident with their knowledge in the final years of university with a greater risk of incorrect behavior.²¹

The awareness of the seriousness and significance of antibiotic resistance is the first step towards reducing its spread. Drug prescribers play a crucial role in the war against antibiotic resistance not only by safe and rational prescribing, but also by promoting patient awareness about the safe practices concerning antimicrobial use. The curriculum of medical students in Pakistan does not sufficiently emphasize antibiotic resistance and there is virtually no information on antimicrobial stewardship programmes.²² As medical students are the prescribers of tomorrow, there must be provision of outcome-based education (OBE) at the undergraduate level to bridge this gap in knowledge. The essentials for antibiotic protocol development should be taught at the undergraduate level²³ to promote safe prescription practices and avoid overuse. Students should be taught using practical

exercises or clinically-based scenarios on how to negotiate with patients; or how to impart knowledge to the community in general about the rational and responsible use of antimicrobials.²⁴ Such medical education strategies not only improve the knowledge of students but also help improve patient outcomes; and must be tailored according to student experience and capabilities to maximize benefit.²⁵

The questionnaire for this study was kept anonymous and voluntary, reducing the likelihood of our findings being influenced by social desirability bias. However, our limitations were that it was a single- center research and the overall number of students involved was relatively low. Since the present research only focused on medical students, future studies should be carried out on house officers, medical officers, postgraduate trainees and consultant practitioners for a more elaborate analysis of awareness on antibiotic resistance.

This study shows that the theoretical knowledge gained by medical students is not necessarily reflected in their actual behavior. Therefore, more emphasis must be laid upon outcome- based learning in medical school so that students learn to handle antibiotics in a more responsible manner.

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