

# Antibiotic Resistance and Usage—A Survey on the Knowledge, Attitude, Perceptions and Practices among the Medical Students of a Southern Indian Teaching Hospital

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## ABSTRACT

**Background:** Examining the knowledge, attitude, perceptions and practices (KAP) of the medical students regarding antibiotic resistance (ABR) and use can help us in devising suitable educational interventions for them, tailored according to their earlier held knowledge, beliefs, capabilities and experience.

**Methods:** A cross sectional, questionnaire based survey was conducted among the second year medical students of a teaching hospital, whereby their KAP regarding antibiotic use and resistance was assessed by using a five point Likert scale, whose responses ranged from 'strongly agree' to 'strongly disagree,' 'always' to 'never and 'very important' to 'unimportant'. The data was analysed by using simple descriptive statistics. Wherever it was relevant, the Chi-square test was used to determine any significant difference.

**Results:** The response rate was 100 per cent. The number of respondents who agreed that ABR was an important and a serious public health issue in our teaching hospital (n = 66, 68 per cent), was significantly less (p < 0.001) as compared to the number

of respondents who agreed that ABR was an important and a serious issue which the country (n = 86, 88.65 per cent) and the world (n = 88, 90.7 per cent) were facing. Only 77.3 per cent (n = 75) of the respondents were aware that bacteria were not responsible for causing colds and flu, while the remaining 22.7 per cent (n = 22) were not knowledgeable about this fact. More than 80 per cent rated the adverse effect profile of the antibiotic and the risk of a superinfection as the important factors which deserved consideration. Cost of the antibiotic was considered to be an important factor deserving consideration by only 56.7 percent (n=55) of the participants.

**Conclusions:** Our survey revealed that most of the students were aware of the antimicrobial resistance and its consequences. The only concern was their casual attitude regarding the antibiotic use. Further educational interventions are necessary to improve their understanding and perceptions on antibiotic resistance, as well as their attitude towards antibiotic use.

**Key words:** Education, Undergraduates, Knowledge, Antibiotics, Antimicrobial chemotherapy

## INTRODUCTION

The threat of antimicrobial resistance is rapidly progressing and intensifying. The awareness on its seriousness and significance is the first step towards curtailing its progress. Various approaches have been taken worldwide, to meet the challenges which are posed by its spread. One of the approaches which is commonly suggested is to undertake instructional and educational campaigns among the general population [1] as well as among the health care personnel [2] about antibiotic resistance and its dangerous consequences and regarding the steps which can limit its development and spread [3,4].

Prescribers have an important role to play in the battle against antibiotic resistance, not only through their safe and rational prescribing, but also by promoting patient awareness and knowledge and imparting health education to the community regarding safe medication practices concerning antibiotics.

Various studies have described the inability of the prescribing physicians in creating awareness and providing adequate education to the patients regarding antibiotic usage [1].

The lack of adequate training during their undergraduate and postgraduate years may be responsible for their inability to undertake these tasks confidently. Hence, teaching about antimicrobial chemotherapy should form a vital part of both the undergraduate and postgraduate medical curricula, considering the frequency with which these agents are prescribed and our continuing and increasing concern regarding antibiotic resistance [5].

It has been greatly emphasised that adequate training should be provided for the undergraduate medical, pharmacy and nursing students regarding the proper prescribing, dispensing and the usage of antibiotics respectively. It is an important measure which is widely proposed and documented, in order to promote the judicious use of antibiotics [6].

Young doctors should be given more education during their undergraduate training regarding antibiotic resistance and appropriate prescribing. This is a crucial time period during which the importance of these issues should be emphasized, because once the doctors become qualified, it is difficult to change their deeply entrenched views and behaviour [7].

The interventions which are undertaken to prevent and control antimicrobial resistance, usually aim to bring about behavioural changes in the target group, and the outcome of these interventions is affected by the previous beliefs and motivations which are held by this group [8].

Hence, for any educational intervention to be successful and for the changes to be sustained, it should change the knowledge, attitudes and practices (KAP) of the target group [9].

Therefore, before planning any training programme or an educational activity, we have to be aware of the baseline KAP of the target population, which will assist us in devising a suitable approach and an effective curriculum.

It is in this regards that this study was undertaken among second

year undergraduate medical students, in order to assess their knowledge and attitude concerning antibiotic resistance, as well as their self reported practices which are related to antibiotic usage.

A better understanding of what the students know and believe about the issues of antimicrobial use and resistance can assist us in planning and devising an effective and a tailored educational intervention for them.

## MATERIAL AND METHODS

This study was a cross-sectional, questionnaire based survey which was undertaken in a teaching hospital in Kerala among a batch of second year fresh MBBS undergraduate students before they received any teaching on antibiotics in their pharmacology or microbiology classes. The questionnaire which we used was developed by modifying the earlier ones which were used by Wester CW et al., [10], Eng JV et al., [3] and others [1,11–13]. Prior to the study, the questionnaire was validated by subject experts for its content and relevance. The final questionnaire consisted of 31 questions. A 5-point Likert scale, whose responses ranged from ‘very important’ to ‘unimportant’ was used, both to assess the students’ perceptions on the causes of ABR, as well as the factors which influenced their decision about the antibiotic selection and prescribing. A series of questions which were intended to study the attitude of the participants [Table/Fig-1] regarding antibiotic resistance and usage, were analysed by using a 5-point Likert scale, whose responses ranged from ‘strongly agree’ to ‘strongly disagree’. Their self reported practices regarding antibiotic usage were also assessed by using a Likert scale which ranged from ‘always’ to ‘never’.

The participants’ knowledge was assessed by using a set of four questions. Three of these were of the True/False type and one was a Likert scale based question.

The questionnaire was distributed to a batch of 97 medical students in their second year of MBBS, during one of their pharmacology classes. They were asked to complete the questionnaire anonymously. Informed consent was obtained from the participants, to utilize their data for research purposes.

Simple descriptive statistics was used to generate frequencies, percentages and proportions. Wherever it was relevant, the Chi-square test was used to determine any statistical significance.

## RESULTS

The response rate was 100 per cent among the 97 students who were asked to participate in the survey. In order to simplify the analysis, we reduced the five point response options of the Likert scale into three, such as agree/uncertain/disagree, important/neutral/unimportant, and usually/sometimes/seldom.

The number of respondents who agreed that ABR was an important and a serious public health issue in our hospital (n = 66, 68 per cent), was significantly less (p < 0.001) as compared to the number of respondents who agreed that ABR was an important and a serious issue which the country (n = 86, 88.65 per cent) and the world faced (n = 88, 90.7 per cent). More than 85 per cent of the respondents agreed that an indiscriminate and an injudicious use of antibiotics could lead to an ineffective treatment, increased adverse effects, the emergence of bacterial resistance and an additional burden of medical costs to the patient.

A majority, 88 per cent (n = 85) respondents were aware that if antibiotics were taken too often, they are less likely to work in the future. Only 77.3 per cent (n = 75) of the respondents were aware that bacteria were not responsible for causing colds and flu, while the remaining 22.7 per cent (n = 22) were not knowledgeable about this fact.

The attitudes and the self reported practices of the students’, which pertained to antibiotic use and resistance were examined on a

Questions	
<b>Knowledge Questions (True/False)</b>	
K1. Indiscriminate and Injudicious use of antibiotics can lead to	
a) Ineffective treatment	T/F
b) Increased A/E	T/F
c) Exacerbation or Prolongation of illness	T/F
d) Emergence of bacterial resistance	T/F
e) Additional burden of medical cost to the patient	T/F
K2. If taken too often, antibiotics are less likely to work in the future.	T/F
K3. Bacteria are germs that cause common cold and flu.	T/F
K4. Antibiotic Resistance is: (Rated Response: Strongly agree, somewhat agree, undecided, somewhat disagree, strongly disagree)	T/F
a) An important and serious public health issue facing the World.	
b) An important and serious public health issue in our Country.	
c) An important and serious public health issue in our Hospital	
<b>Attitude Questions (Rated Response: Strongly agree, somewhat agree, undecided, somewhat disagree, strongly disagree)</b>	
A1. When I have a cold, I should take antibiotics to prevent getting a more serious illness.	
A2. When I get fever, antibiotics help me to get better more quickly.	
A3. Whenever I take an antibiotic, I contribute to the development of antibiotic resistance.	
A4. Skipping one or two doses does not contribute to the development of antibiotic resistance.	
A5. Antibiotics are safe drugs, hence they can be commonly used.	
<b>Medication Practice Questions (Rated Response: always, usually, sometimes, seldom, never)</b>	
P1. The Doctor prescribes a course of antibiotic for you. After taking 2–3 doses you start feeling better.	
a) Do you stop taking the further treatment?	
b) Do you save the remaining antibiotics for the next time you get sick?	
c) Do you discard the remaining, leftover medication?	
d) Do you give the leftover antibiotics to your friend/roommate if they get sick?	
e) Do you complete the full course of treatment?	
P2. Do you consult a doctor before starting an antibiotic?	
P3. Do you check the expiry date of the antibiotic before using it?	
P4. Do you prefer to take an antibiotic when you have cough and sore throat?	
<b>[Table/Fig-1]: Questions included in a survey of KAP of second year medical students regarding antibiotic use and resistance</b>	

Likert scale, the results of which are shown in the [Table/Fig-2] and [Table/Fig-3], respectively.

The questionnaire also consisted of a list of possible causes which could be responsible for the development of antibiotic resistance and the students were asked to rate them according to their importance. The corresponding ratings which were given by the students have been depicted in [Table/Fig-4].

A list of factors which had to be considered before prescribing an antibiotic were provided and the students were asked to rate them according to the importance which they felt that these factors deserved. More than 80 percent of them gave importance to the adverse effect profile of the antibiotic and the risk of a super infection as well as the immune status of the patient. Nearly three quarters (75 per cent) of the participants felt that the following factors were important to be considered—the ability of the antibiotic to promote resistance, the in-vitro antibiotic sensitivity of the causative organism and the pharmacokinetic profile of the antibiotic. Only 55 (56.7 per cent) participants felt that the cost was an important factor which deserved consideration before the prescription of an antibiotic.

## DISCUSSION

Our study provides useful information about the knowledge, attitudes, perceptions and the practices of second year medical students with respect to antibiotic resistance and usage, which may be utilized to plan suitable educational interventions that aim at improving the antimicrobial prescribing and use.

A majority of the students in our study were well aware of the global as well as the nationwide problem of antimicrobial resistance, but at the local hospital level, the antibiotic resistance was not considered

to be a problem. A similar response was noted in previous studies [14], where most of the respondents underestimated the prevalence of the antibiotic resistance at their own institution [10,15]. Case vignettes which illustrate the harmful effects of antibiotic resistance, may be utilized to improve the effectiveness of educational interventions or antibiograms that were previously used less successfully, to facilitate the correct estimation of the prevalence of the resistance at the institutional level [10].

The attitude of the study participants with regards to antibiotic use and resistance was found to be casual and lax. Thirty Seven

(38 per cent) of them reported that antibiotics should be taken on developing a cold and 60 per cent of them believed that taking antibiotics on having a cold made them feel better more quickly. Fifteen (15.5 per cent) participants believed that antibiotics were safe drugs; and that hence, they could be commonly used and 22.7 per cent (n = 22) were not knowledgeable of the fact that bacteria were not responsible for causing cold and flu.

Various studies have similarly reported that more than 60 per cent of their participants believed that antibiotics should be prescribed for viral illnesses [4]. Such wrong beliefs may lead to inappropriately high

S No.	Survey item	Agree n (%)	Uncertain n (%)	Disagree n (%)
A1	When I have a cold, I should take antibiotics to prevent getting a more serious illness	37 (38.1%)	5 (5.15%)	54 (56%)
A2	When I get fever, antibiotics help me to get better more quickly	58 (60%)	7 (7.21%)	31 (32%)
A3	Whenever I take an antibiotic, I contribute to the development of antibiotic resistance	52 (53.6%)	17 (17.5%)	27 (27.8%)
A4	Skipping one or two doses does not contribute to the development of antibiotic resistance	30 (30.9%)	20 (20.6%)	46 (47.4%)
A5	Antibiotics are safe drugs; hence they can be commonly used	15 (15.5%)	5 (5.15%)	76 (78.4%)

[Table/Fig-2]: Respondents attitude regarding antibiotic use and resistance

S No.	Survey item	Always or Usually n (%)	Sometimes n (%)	Seldom or Never n (%)
P1	The Doctor prescribes a course of antibiotic for you. After taking 2–3 doses you start feeling better			
	f) Do you stop taking the further treatment?	21 (21.6%)	22 (22.7%)	54 (55.6%)
	g) Do you save the remaining antibiotics for the next time you get sick?	15 (15.5%)	24 (24.7%)	57 (58.8%)
	h) Do you discard the remaining, leftover medication?	29 (30%)	31 (32%)	36 (37%)
	i) Do you give the leftover antibiotics to your friend/roommate if they get sick?	21 (21.6%)	31 (32%)	44 (45.4%)
	j) Do you complete the full course of treatment?	72 (74.2%)	22 (22.7%)	3 (3.1%)
P2	Do you consult a doctor before starting an antibiotic?	90 (92.8%)	4 (4.1%)	3 (3.1%)
P3	Do you check the expiry date of the antibiotic before using it?	84 (86.6%)	8 (8.2%)	5 (5.2%)
P4	Do you prefer to take an antibiotic when you have cough and sore throat?	19 (19.6%)	39 (40.2%)	39 (40.2%)

[Table/Fig-3]: Respondents' Self reported practices regarding the antibiotic use

Sl. No	Cause of Antibiotic Resistance	Important (N = 97)	Unsure (N = 97)	Unimportant (N = 97)
		n (%)	n (%)	n (%)
1	Use of antibiotics for self-limited non bacterial infections	55 (56.7%)	3 (3.1%)	40 (41.2%)
2	Use of antibiotics with a broader than necessary spectrum	67 (69%)	9 (9.3%)	21 (21.6%)
3	Use of antibiotics for shorter than standard duration	56 (58%)	13 (13.4%)	28 (29%)
4	Poor infection control measures	38 (39%)	13 (13.4%)	46 (47.4%)
5	Use of antibiotics for self limited bacterial infections	55 (56.7%)	7 (7.21%)	35 (36%)
6	Empirical antibiotic therapy (best guess therapy)	40 (41.2%)	19 (19.6%)	39 (40%)
7	Mutational and evolutionary changes in the micro organism	77 (79.4%)	6 (6.2%)	14 (14.4%)
8	Lack of restrictions on antibiotic usage	76 (78.3%)	4 (4.1%)	17 (17.5%)
9	Excessive antibiotic use in live stock (Animals reared for food)	53 (54.6%)	20 (20.6%)	24 (24.7%)
10	Use of antibiotics for longer than standard duration	48 (49.5%)	13 (13.4%)	36 (37.1%)

[Table/Fig-4]: Respondents' rating of the possible causes of antibiotic resistance according to their importance

rates of antibiotic consumption, which can result in a corresponding increase in the bacterial resistance [6].

But surprisingly, inspite of the casual attitude, the self reported practices of our study participants with regards to antibiotic use were found to be satisfactory. A majority 90 (92.8 per cent) always consulted a doctor before starting on an antibiotic and most of them 72 (74.2 per cent) always completed the full course of the prescribed treatment.

Previous studies have shown high rates of self medication (35 per cent) amongst medical students with respect to antibiotics [16]. However, this was not the case with our participants.

When they were asked to rate the important causes of antimicrobial resistance, most of the participants rated mutational and evolutionary changes in the microorganism and lack of restrictions on the antibiotic usage as very important causes. As in some previous studies, [8] poor or lack of infection control measures were not considered to

be an important cause for the resistance to develop, by most of the participants, which highlighted the lack of awareness regarding the significance of the infection control measures.

The failure in implementing basic infection control practices has been one of the principle causes of the emergence and the dissemination of resistant organisms [6,17].

Learning about the antimicrobial prescribing in pharmacology must be connected clearly with the infection control in microbiology [18]. The significance of simple measures like hand hygiene in the control of resistance should be endorsed [10] and its practice should be inculcated at an earlier stage of the medical education.

The virulence of the organism, the risk of adverse effects and superinfection as well as the immune status of the patient, were considered as the factors which deserved the most consideration before the prescription of an antibiotic. The ability of the antibiotic to promote resistance, the in-vitro antibiotic sensitivity of the

causative organism and the pharmacokinetic profile of the antibiotic were given second priority. This demonstrates that the students were more aware and concerned about the individual patient's benefit and harm, the dangerous consequences which result to the society due the indiscriminate antibiotic use may not be obvious to them.

One of the common misperceptions which is held by the prescribers while they treat their patients is that more is better, in treating the colonisation rather than the infection or in using broad-spectrum antimicrobials. This falsely held belief is considered to be a primary barrier which prevents the development of antibiotic resistance [19].

The students should be made aware of these important facts and a sense of responsibility should be nurtured, that as prescribers, they are not only responsible for the benefit and the welfare of their patients but also for the society at large.

Outcome-based education is said to be an important tool in which the requirements are explicitly defined in detail, to ensure that the medical graduates are fit for practice. This can be utilized for educating the students about antibiotics, so that as prescribers, they are fit to prescribe antibiotics, maximise their effective and efficient use and minimize the development of resistance [20].

Apart from teaching about antibiotic prescribing, the principles of the protocol development for antibiotic use in health care facilities, should form an integral part of the undergraduate teaching [17]. Small group exercises that facilitate the students in practising patient education skills such as negotiating with patients about the need for antibiotics and educating them about the proper use of antibiotics, should form an important part of the students' antibiotic curriculum [21].

The medical education strategies should aim, not only to increase the knowledge, but also to change the behaviour and to improve the patient outcomes [18]. They have to be tailored as per the youngsters development, capabilities and experience [4].

In spite of the lack of any formal training regarding antibiotics during their schooling or at the pre university level, the students who take admissions in the subjects which are related to the health sciences during their graduation, tend to have a better knowledge regarding antibiotics and their use as compared to the students who enter other streams [4,12]. This proves that students exposed to similar curriculum, and having the same learning experience, due to their differing capabilities, interests and development may have different knowledge levels and attitudes.

Moreover, antibiotic resistance has been widely discussed and publicised in the press, media and on the online discussion forums and the general public are becoming knowledgeable about the issue of resistance. Since the media and the internet have become important sources of information, especially among the youth [16], they have become the medium of gaining knowledge and awareness regarding various public issues.

Our study, despite its limitation of drawing conclusions, based on a convenience sample which involved only one batch of second year medical students from one single teaching hospital, provides an important insight regarding their knowledge, attitudes, perceptions

and practices, which can be considered, in order to plan for an effective undergraduate curriculum regarding antibiotic resistance and usage.

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