

Assessment of knowledge, attitudes, and practices about antibiotic resistance among medical students in India

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ABSTRACT

Context: To reduce the magnitude of antimicrobial resistance, there is a need to strengthen the knowledge for future prescribers regarding use and prescription of antibiotics. Before that, it is required to have a conclusive evidence about knowledge, attitude, and practices of that group. **Aim:** To assess the knowledge, attitudes, and the practices of medical students in India with respect to antibiotic resistance and usage. **Settings and Design:** It was a cross-sectional study which was done online through Google forms for a period of 4 months from July to October 2018. **Materials and Methods:** A structured questionnaire containing a five-point Likert scale was sent to medical students across India by sharing link through contacts of Medical Students Association of India. Respondent-driven sampling technique was also adopted for the study. **Statistical Analysis Used:** Descriptive statistics, parametric (Chi-square), and nonparametric (Kruskal-Wallis and Mann-Whitney U) tests. **Results:** A total of 474 responses were received from 103 medical colleges across 22 states of India. The mean score of knowledge was 4.36 ± 0.39 . As compared to first year students, knowledge was significantly higher among students of all the years. As much as 83.3% students have consumed antibiotics in previous year of the survey. Around 45% of medical students accepted that they buy antibiotics without a medical prescription. **Conclusion:** The knowledge level of medical students was quite satisfactory. As far as attitude and practices are concerned, there is a substantial need for improvements.

Keywords: Antibiotic resistance, knowledge, medical students, practices

Introduction

The era of antibiotics has changed the pattern of treatment and outcomes of infectious diseases. But at the same time, irrational use of antibiotics has created a havoc of antibiotic resistance.^[1] Worldwide spread of the antibiotic resistant organisms has gradually created the threat of antimicrobial insufficiency. Patients infected with these antibiotic resistant organisms are likely to face long durations of hospital stay and require treatment with second- and third-line drugs, which may be more toxic and less effective.^[2]

Medical students are going to be primary care physicians to serve the community. These future prescribers are frontline

fighters against antimicrobial resistance, by rationally prescribing the antibiotics and promoting patient awareness.^[3] There are sufficient evidences to support that newly licensed doctors/prescribers are not adequately trained to prescribe medications safely.^[4,5] Lack of adequate training during medical degree course may be one of the reasons for that.

There is a need to change the antimicrobial prescribing behavior of doctors and future prescribers to reduce the magnitude of the problem of antimicrobial resistance.^[6] This can be ensured through the appropriate knowledge and training of next generation doctors and medical students through in a formal way.^[7,8] But, before planning or strengthening any teaching or training program for any target group, it is required to have a conclusive evidence about baseline knowledge, attitude, and practices of that group. This evidence support in devising an effective curriculum and sustainable program. With this

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background, this study was planned with the objective to assess the knowledge, attitudes, and the practices of medical students in India with respect to antibiotic resistance and usage.

Subjects and Methods

It was a cross-sectional study which was done online through Google forms from July to October 2018. Data were collected through specifically developed structured questionnaire, which was developed based on the literature review of comparable studies.^{9,10} This was validated by a pilot study on 30 medical students. The questionnaire had three sections. First section was dealing with basic information about medical students like; names, year of study, name of medical college etc., The second section was having 15 different statements (ten positive and five negative) on a five-point Likert scale ranging from one (strongly disagree) to five (strongly agree) to assess the knowledge of students. In this, three statements were related to identification of antibiotics, three related to role of antibiotics, three regarding side effects of antibiotics, and six were related to knowledge about antibiotic resistance. Section three was having questions for assessment of attitude and practices.

The questionnaire was sent to medical students across India by sharing link through contacts of Medical Students Association of India which has many students from medical institutes across India as its members. They were asked to recruit further respondents into the study from their respective colleges. Thus, a respondent-driven sampling technique was also adopted for the study.

The study was approved by an institutional ethics committee. Informed consent was taken before attempting the questionnaire.

The purpose of the study was explained before starting the questionnaire and queries of all natures related to this research were invited for satisfactory explanation to ensure informed consent for participation. Data were analyzed using SPSS v. 23 and Microsoft Excel 2016. Appropriate tables and graphs were prepared and inferences were drawn by applying descriptive statistics, parametric (Chi-square) and nonparametric (Kruskal--Wallis and Mann--Whitney U) tests.

Results

Figure 1 depicts that a total of 474 responses were received from 103 medical colleges distributed across 22 states of India. Maximum responses were received from Rajasthan (177) followed by Delhi (59), Maharashtra (42), and Uttar Pradesh (36).

As much as 32.3% of the students accepted that any of their family member was working in health-related field. The descriptive of knowledge about antibiotics and its resistance in terms of mean score, mean score%, and median for each statement is depicted in Table 1.

Table 2 depicts that maximum (40%) students were studying in prefinal year, followed by second year (27%). Reverse coding was done for five negative statements for calculating the mean score for each participant. The overall mean score was 4.36 ± 0.39 . A significant difference was observed in knowledge level of students according to their year of study.

To explore the exact level of difference between each category, Mann--Whitney U test was applied [Table 3].

Table 1: Descriptive of knowledge about antibiotics and its resistance

Knowledge about	Statements	Mean score**	Mean score %***	Median
Identification	Penicillin or amoxicillin are antibiotics	4.89	97.3	5
	Aspirin is an antibiotic*	1.16	4.0	1
	Paracetamol is an antibiotic*	1.24	6.0	1
Role of antibiotics	Antibiotics are useful for bacterial infections (e.g., tuberculosis)	4.67	91.8	5
	Antibiotics are useful for viral infections (e.g. common cold, flu)*	1.61	15.3	1
	Antibiotics are indicated to reduce any kind of pain and inflammation*	1.61	15.3	1
Side-effects of antibiotics	Antibiotics can kill "good bacteria" present in our body	4.34	83.5	5
	Antibiotics can cause secondary infections after killing good bacteria in our body	4.12	78.0	5
	Antibiotics can cause allergic reactions	4.46	86.5	5
Antibiotic resistance	Ampicillin is effective in treating Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) infections*	2.09	27.3	1
	Clindamycin is effective in treating MRSA infections	3.05	51.3	3
	Antibiotic resistance is a phenomenon in which a bacterium loses its sensitivity to an antibiotic	4.72	93.0	5
	Misuse of antibiotics can lead to a loss of sensitivity of an antibiotic to a specific pathogen	4.72	93.0	5
	If symptoms improve before completing the full course of antibiotic, you can stop taking it*	1.45	11.3	1
	Poor or lack of infection control measures is a cause for development of resistance	3.61	65.3	4

*Negative statements. **{(total responses in strongly disagree x 1) + (total responses in disagree x 2) + (total responses in neutral x 3) + (total responses in agree x 4) + (total responses in strongly agree x 5)}/total responses (474). ***mean score % = (mean score-1) *100/(5-4)

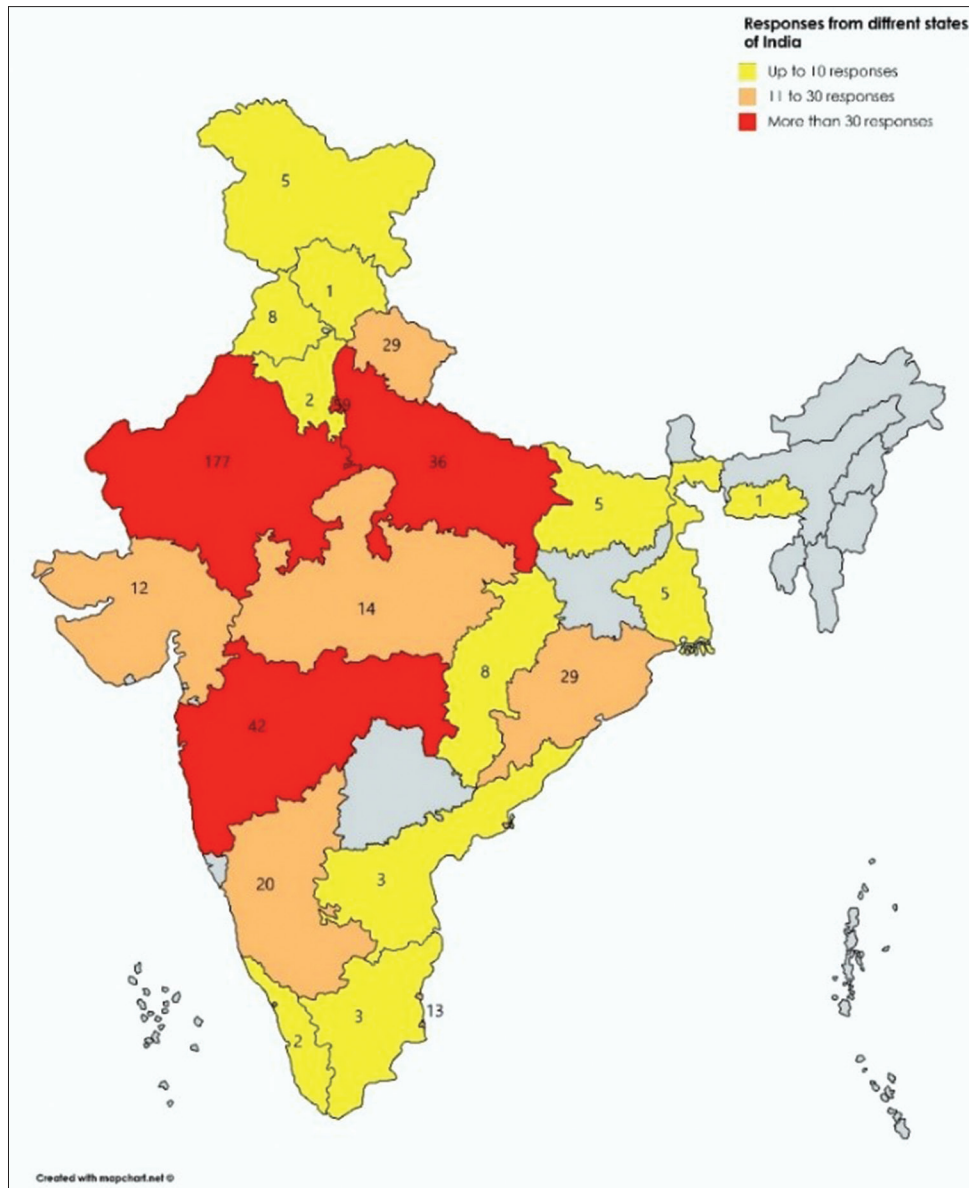


Figure 1: Distribution of responses from the different states of the country

Table 4 represents the attitude and practices of medical students regarding use of antibiotics. As much as 83.3% students have consumed antibiotics in previous year of the survey. Most of them have consumed antibiotics for once to three times in the whole year. Major source of information about antibiotics and its resistance was their degree courses.

Discussion

This study has tried to explore the knowledge, attitude, and practices of medical students regarding antibiotic resistance, as they are going to become future prescribers to provide the primary care to the community. Studies advocate that medical students generally have positive attitudes about antimicrobial resistance.^[11,12] There are also supportive evidence to prove that practices of self-medication is more prevalent among medical

students as compared to their peer group from the nonmedical fields.^[13]

Knowledge about antibiotics and its resistance

In the present study, majority of the students could correctly identify the antibiotics. Similar kinds of knowledge regarding identification of antibiotics have been observed by Scaioli *et al.* (2015)^[9] among students of a school of medicine in Italy and Sharma *et al.* (2016)^[14] among medical students in Kerala, India.

The level of knowledge about the fact that antibiotics are useful for bacterial infections was quite high (91.8%) among medical students. Similar level of knowledge has been witnessed by many other studies.^[9,10] Most of the students in the present study expressed their denial to the statement that antibiotics are useful for viral infections like common cold and flu. Comparable

Table 2: Distribution of respondents according to their year of study and mean score of knowledge

Year	n	Mean score	Mean rank	Kruskal--Wallis	P
First year	68	4.10±0.35	139.86	73.395	<0.01
Second year	128	4.27±0.40	205		
Prefinal year	187	4.52±0.32	293.45		
Final year	68	4.38±0.39	242.35		
Internship	23	4.34±0.44	237.8		
Total	474	4.36±0.39			

Bold values represent statistical significance

Table 3: Comparison of mean score of knowledge according to their year of study

Year	Mean rank	Year	Mean rank	Mann--Whitney U	P
First year	80.86	Second year	107.87	3152.5	0.001
	68.21	Prefinal year	149.74	2292	<0.01
	53.57	Final year	83.43	1296.5	<0.01
	40.73	Internship	61.59	423.5	0.001
Second year	123.31	Prefinal year	181.74	7528	<0.01
	93.09	Final year	108.69	3659	0.066
	74.23	Internship	85.87	1245	0.239
Prefinal year	135.4	Final year	107.65	4974.5	0.008
	108.57	Internship	80.54	1576.5	0.036
Final year	46.07	Internship	45.8	777.5	0.967

Bold values represent statistical significance

findings have been observed by Ahmad *et al.*, (2015) among B.Sc. Pharmacy students of Trinidad^[15] and Nair *et al.* (2019) among allopathic doctors in India^[16]. Many studies have reported low level of awareness among students in this regard.^[17-19] A high level of disagreement (84.7%) was observed among the students to the point that antibiotics are indicated to reduce pain and inflammation in the body. Similar kind of disagreement has been observed by Sakeena *et al.* (2018)^[19] and Jamshed *et al.* (2014).^[20] Contrary to these, Ajibola *et al.* (2018) had observed relatively lower level of disagreement (62.8%) in this regard.^[17]

The magnitude of knowledge about side effects of antibiotics was ranging from 78% to 86.5% among medical students, which is lower than the findings observed by Scaiola *et al.* (2015) and Jamshed *et al.* (2014).^[9,20] The knowledge about the kinds of antibiotics used for methicillin-resistant *Staphylococcus aureus* (MRSA) infections was not satisfactory among medical students. Majority of the students were aware about the mechanism of antibiotic resistance and also accepted that misuse of antibiotics can lead to antibiotic resistance to a specific pathogen. Similar findings have been reported by many studies.^[9,15,19] There are other studies also in which understanding of students about the basic mechanism of antimicrobial resistance was reported quite lower.^[17,21-23] As much as 88.7% disagreement was observed for the statement that, "if symptoms improve before completing the full course of antibiotic, you can stop taking it." Mixed findings have been observed by many authors in this regard.^[3,15,17,19,20,24] The mean score percentage of awareness for the fact that poor or lack of infection control measures is a cause for development of resistance was 63% in the present study. Similar level of

awareness has been coated by other studies from different parts of the world.^[21,22,25]

The overall mean score of knowledge for the students was 4.36 ± 0.39 . Ayepola *et al.* (2018) found the mean knowledge score as 5.51 ± 0.14 (out of 10).^[24] Jairoun *et al.* (2019) found the total knowledge attitude and practice (KAP) score pertaining to antibiotic use as 56 (on a scale of 0-100).^[26] A significant difference was observed in knowledge level of students according to their year of study. Similar kinds of observations has been made by Huang *et al.* (2013).^[10]

As compared to first year students, mean score of knowledge was significantly higher among students of all the years. This is supported by the findings of Huang *et al.* (2013).^[10] A significantly better knowledge was also observed among pre final year students as compared to other years. This may be due to their updated knowledge of pharmacology which they have completed in recent past year.

Behaviors and practices of medical students regarding use of antibiotics

Majority (83.3%) of the students had used antibiotics in previous one year of the survey. This was relatively higher than the use reported by Scaiola *et al.* (2015),^[9] Sakeena *et al.* (2018),^[19] and Ayepola *et al.* (2018).^[24]

In the present study, all the students had heard about antibiotic resistance. Similar level of awareness has been reported by Gupta *et al.* (2019) among medical students in India.^[27] Lower level of knowledge in this regard has also been reported by many other studies.^[10,17] Major source of information about antibiotic resistance for the first year students was internet, and for subsequent years it was through their academic course, followed by internet, general practitioners, newspaper, television, and discussions at home. Similar findings have been reported by other studies as well.^[18,21,22]

Nearly, one fourth of students gave positive affirmation regarding usually taking antibiotic for cold or sore throat. This practice was quite lower than reported by many other studies.^[9,13,14,28] Huang *et al.* (2013) observed this practice among only 13.6% of Chinese students.^[10] Slightly less than one fifth students accepted that they were usually taking antibiotics for fever, which is similar to the findings reported by Ahmad *et al.* (2015). Variable practices in this regard have been reported by many other studies.^[3,9,10,29]

Every one out of four students were following wrong practice of stopping antibiotics when start feeling better without completing the full course, which is similar to the findings reported by Ghaieth *et al.* (2015). Studies have reported diverse findings regarding this practice.^[9,14,24,29,30]

Similar to other studies,^[13,29] in the present study slightly less than half of medical students accepted that they buy antibiotics without a medical prescription. This practice was somewhat higher than the practices reported by many other studies.^[3,9,14,26] This self-medication practice was more prevalent among study participants of Sakeena *et al.* (2018)^[19] and Ayepola

Table 4: Attitude and practices of medical students regarding use of antibiotics

	Year, n (%)					Total	Sig.
	First	Second	Pre Final	Final	Interns		
Used antibiotics in the last year	47 (69.1)	116 (90.6)	153 (81.8)	58 (85.3)	21 (91.3)	395 (83.3)	0.003
Number of times antibiotics used in last year (n=395)							
1	8 (17.0)	28 (24.1)	38 (24.8)	13 (22.4)	9 (42.9)	96 (24.3)	0.247
2	10 (21.3)	44 (37.9)	45 (29.4)	15 (25.9)	4 (19.0)	118 (29.9)	0.142
3	10 (21.3)	20 (17.2)	38 (24.8)	18 (31.0)	2 (9.5)	88 (22.3)	0.144
4	9 (19.1)	11 (9.5)	20 (13.1)	9 (15.5)	2 (9.5)	51 (12.9)	0.492
≥5	10 (21.3)	13 (11.2)	12 (7.8)	3 (5.2)	4 (19.0)	42 (10.6)	0.036
Heard about antibiotic resistance	68 (14.3)	128 (27.0)	187 (39.5)	68 (14.3)	23 (4.9)	474 (100)	NA
Source of information about antibiotic resistance							
Academic course	27 (39.7)	119 (93.0)	181 (96.8)	63 (92.6)	21 (91.3)	411 (86.7)	<0.01
General practitioner	12 (23.1)	39 (38.2)	36 (27.3)	23 (40.4)	6 (35.3)	116 (32.2)	0.138
Internet	24 (46.2)	39 (38.2)	56 (42.4)	21 (36.8)	9 (52.9)	149 (41.4)	0.665
Television	14 (26.9)	8 (7.8)	9 (6.8)	8 (14.0)	0 (0.0)	39 (10.8)	0.001
Newspaper	17 (32.7)	26 (25.5)	36 (27.3)	13 (22.8)	1 (5.9)	93 (25.8)	0.264
Discussion at home/school/friends	2 (3.8)	4 (3.9)	3 (2.3)	4 (7.0)	1 (5.9)	14 (3.9)	
Usually take antibiotic for cold or sore throat	19 (27.9)	29 (22.7)	39 (20.9)	21 (30.9)	2 (8.7)	110 (23.2)	0.17
Usually take antibiotic for fever	30 (44.1)	22 (17.2)	23 (12.3)	8 (11.8)	2 (8.7)	85 (17.9)	<0.01
Usually stop taking antibiotic when start feeling better	29 (42.6)	38 (29.7)	44 (23.5)	17 (25.0)	3 (13.0)	131 (27.6)	0.016
Buy antibiotics without a medical prescription	26 (38.2)	52 (40.6)	85 (45.5)	40 (58.8)	12 (52.2)	215 (45.4)	0.093
Keep leftovers antibiotics for use in future	45 (66.2)	82 (64.1)	118 (63.1)	45 (66.2)	15 (65.2)	305 (64.3)	0.987
Use leftovers antibiotics without consulting the doctor	21 (30.9)	33 (25.8)	49 (26.2)	27 (39.7)	6 (26.1)	136 (28.7)	0.252
Ever started antibiotic therapy after getting consultation from doctor over phone, without a proper medical prescription	30 (44.1)	63 (49.2)	102 (54.5)	44 (64.7)	13 (56.5)	252 (53.2)	0.14

Bold values represent statistical significance

et al. (2018).^[24] Unlike other studies,^[9,13] no significant difference has been observed in self-medication practice among medical students as per their year of study.

Around two third of students were having practice of keeping leftover antibiotics for future use. This was similar to the findings by Ayepola *et al.* (2018).^[24] This practice was relatively lower (less than 50%) among medical students from southern part of India.^[3,29]

As much as 28.7% students were using these leftovers antibiotics in future without consulting the doctor. Scaioli *et al.* (2015) found this figure as 17.7%.^[9] Other studies have reported that most of the students give the leftover antibiotics to their friends, relatives, or roommate without doctor's consultation when they are sick.^[14,17,29]

More than half of students accepted that they had ever started antibiotic therapy after getting consultation from doctor over phone, without a proper medical prescription. Scaioli *et al.* (2015) found this practice prevalent among around one third of students.^[9] Jamshed *et al.* (2014) reported that 8.9% of students were having perception that prescribing antibiotics over the phone is good patient care since it can save time.^[20]

Conclusion and Recommendations

The knowledge level of medical students regarding antibiotics and its resistance was quite satisfactory. As far as attitude and practices

are concerned, there is a significant need for improvements. Since the medical students are going to be primary care physicians in near future, it is important to have proper guidelines in medical curriculum related to use and rational prescription of antibiotics. Further, there is need and scope to explore this area with large sample size and through multicentric studies.

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Conflicts of interest

There are no conflicts of interest.

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