ISSN 2515-8260 Volume 9, Issue 06, 2022

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

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ABSTRACT

Background - To reduce the magnitude of antimicrobial resistance, future prescribers' knowledge of antibiotic use and prescription must be strengthened. Prior to that, conclusive evidence about that group's knowledge, attitude, and practises is required.

Aim: To assess the knowledge, attitudes, and the practices of medical students in India with respect to antibiotic resistance and usage.

Materials and Methods- A semi-structured questionnaire with a five-point Likert scale was distributed to medical students. The study also used a respondent-driven sampling technique.

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 medical students. 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: Medical students' knowledge level was quite satisfactory. There is a significant need for improvement in terms of attitude and practises.

Introduction- Antibiotics have altered the pattern of infectious illness treatment and its outcomes. However, irrational usage of antibiotics has led to the development of antibiotic resistance. Antimicrobial deficiency has gradually become a hazard as a result of the global expansion of antibiotic-resistant organisms. Patients infected with these antibiotic-resistant organisms are likely to

require lengthy hospitalizations and treatment with second and thirdline medications, which may be more toxic and less effective. Medical students will become primary care physicians in order to help the community. These future prescribers are in the front of the fight against antimicrobial resistance, prescribing medicines sensibly and boosting patient knowledge. [3] Sufficient data suggests that freshly licensed physicians and prescribers are not appropriately taught to safely prescribe drugs. Lack of proper training during the medical degree programme may be one of the contributing factors. To lessen the severity of the antimicrobial resistance problem, physicians and future prescribers must modify their antimicrobial prescribing practises. [6] This can be ensured through the formal education and training of the next generation of physicians and medical students. Before planning or enhancing any teaching or training programme for any target group, clear evidence regarding the baseline knowledge, attitude, and practises of that group is essential. This evidence aids in the development of an effective curriculum and a programme with longevity. With this context in mind, this study was designed to evaluate the knowledge, attitudes, and practises of medical students about antibiotic resistance and usage.

Materials and Methods- The present study was carried out at a tertiary care hospital in central India. This cross-sectional survey was conducted to assess the KAP's of Antibiotic Resistance. The questionnaire was developed in accordance with the aims of the study and with reference to existing questionnaires used to assess KAP's contribution to antibiotic resistance. The survey consisted of three sections. The first portion dealt with basic information regarding medical students, such as their names, study year, medical school, etc. To measure students' understanding, the second component contained 15 different statements (ten positive and five negative) on a fivepoint Likert scale ranging from one (strongly disagree) to five (strongly agree). There were three assertions regarding antibiotic identification, three regarding antibiotic function, three involving antibiotic adverse effects, and six regarding antibiotic resistance knowledge. The third section had questions assessing attitudes and practises.

Results- Table 1 shows As many as 32.3% of the students acknowledged that at least one member of their family was employed in a health-related area. The description of each statement's average, mean score%, and median regarding knowledge of antibiotics and their resistance

Table 1: knowledge about antibiotics and its resistance

Knowledge about	Statements	Mean score**	Mean %***	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 *Staphylococcus aureus* (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

Table 2 shows that the majority of students (40%) were in their second year of study, while 27% were in their prefinal year. Five negative statements were reverse coded in order to determine the mean score for each participant. The average score was 4.36 0.39 overall.

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

Year	*n*	Mean score
First year	68	4.10±0.35
Second year	128	4.27±0.40
Prefinal year	187	4.52±0.32
Final year	68	4.38±0.39
Internship	23	4.34±0.44
Total	474	4.36±0.39

The Mann-Whitney U test was used to determine the precise degree of difference between each category. **[Table 3].**

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

The attitudes and behaviours of medical students about the usage of antibiotics are shown in Table 4. As many as 83.3% of students reported using antibiotics the year before, according to the poll. The majority of them had taken antibiotics once to three times throughout the entire year. Their degree programmes served as a significant source of information about antibiotics and resistance.

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

Particulars	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)	8 (17.0)	28 (24.1)	38 (24.8)	13 (22.4)	9 (42.9)	96 (24.3)	0.247
1							
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	30 (44.1)	63 (49.2)	102 (54.5)	44 (64.7)	13 (56.5)	252 (53.2)	0.14

proper medical prescription							

Discussion- As future prescribers who will provide primary care to the community, the purpose of this study was to investigate the knowledge, attitudes, and practises of medical students regarding antibiotic resistance. According to studies, medical students have generally positive attitudes toward antimicrobial resistance. [11,12] Self-medication is also more widespread among medical students compared to their peers in non-medical areas, as supported by evidence. [13]

Knowledge of antibiotics and resistance to them

The majority of participants in this study accurately identified the drugs. Scaioli et al. (2015)[9] and Sharma et al. (2016)[14] showed comparable levels of knowledge on the identification of antibiotics among medical school students in Italy and Kerala, India, respectively. The percentage of medical students who were aware that antibiotics are effective against bacterial illnesses was relatively high (91.8%). Numerous investigations have demonstrated a comparable degree of understanding. [9,10] The majority of students in this survey refuted the claim that antibiotics are effective against viral diseases such as the common cold and influenza. Similar results were obtained by Ahmad et al., (2015) among B.Sc. pharmacy students in Trinidad[15] and by Nair et al., (2019) among allopathic physicians in India[16]. Numerous studies have revealed poor levels of student awareness in this area. [17–19] Antibiotics are recommended to relieve pain and inflammation in the body, according to an overwhelming majority of students (84.7%). Sakeena et al. (2018)[19] and Jamshed et al. (2018)[20] observed a similar type of disagreement (2014). In contrast, Ajibola et al. (2018) found a comparatively lower level of disagreement in this regard (62.8%). [17] Among medical students, knowledge of antibiotic side effects ranged from 78% to 86.5%, which is lower than the results obtained by Scaioli et al. (2015) and Jamshed et al (2014). [9,20] Medical students lacked enough knowledge of the drugs used to treat methicillin-resistant Staphylococcus aureus (MRSA) infections. The majority of students were aware of the process of antibiotic resistance and acknowledged that antibiotic overuse can result in resistance to a particular infection. Numerous research have revealed similar results. [9,15,19] In a number of further investigations, students' comprehension of the fundamental process of antibiotic resistance was found to be quite inadequate. [17,21–23] As much as 88.7% of respondents disagreed with the statement, "You can stop taking the antibiotic if your symptoms improve before finishing the complete course." Numerous scholars have observed mixed results in this area. [3,15,17,19,20,24] In this study, 63% of participants were aware that inadequate or nonexistent infection control methods contribute to the development of resistance. Other research from throughout the world have covered a comparable level of consciousness. [21,22,25].

The average knowledge score of the pupils was 4.36 0.39. Ayepola et al. (2018) determined that the mean score for knowledge was 5.51 0.14 (out of 10). [24] Jairoun et al. (2019) determined the total knowledge attitude and practise (KAP) score for antibiotic use to be 56 (out of a possible 100). [26] There was a considerable disparity between the knowledge levels of pupils based on their academic year. Huang et al. have made similar types of observations (2013). [10] The mean knowledge score for students of all years was much higher than that of first-year students. This is corroborated by Huang et alfindings. .'s (2013). [10] Pre-final year students were also shown to have much greater

knowledge than students in previous years. This may be a result of the pharmacology training they have received during the past year.

Antibiotic usage patterns and behaviours of medical students

The majority of students (83.3%) had used antibiotics in the year before to the study. This was significantly greater than the usage reported by Scaioli et al. (2015), Sakeena et al. (2018), and Ayepola et al (2018). [24]

All students in the present study have heard of antibiotic resistance. Similar levels of awareness have been recorded among medical students in India by Gupta et al. (2019). [27] Numerous additional studies have similarly documented a lack of understanding in this area. [10,17] Internet was the primary source of information concerning antibiotic resistance for first-year students, while academic courses were the primary source for students in future years, followed by the internet, general practitioners, newspapers, television, and in-home discussions. Similar results have been observed by several research. [18,21,27]

Almost one-fourth of students indicated that they routinely take antibiotics for a cold or sore throat. This technique was considerably less prevalent than many other research indicated. [9,13,14,28] Huang et al. (2013) noticed only 13.6% of Chinese pupils engaging in this behaviour. [10] Similar to the data published by Ahmad et al., slightly fewer than one-fifth of the students admitted that they typically took antibiotics for fever (2015). Numerous research have documented the existence of diverse practises in this area. [3,9,10,29]

Similar to the findings described by Ghaiet al., one out of every four students followed the incorrect practise of discontinuing antibiotics when they began to feel better, rather than finishing the complete course (2015). Studies have produced contradictory results regarding this approach. [9,14,24,29,30]

Similar to prior studies[13,29], significantly less than half of medical students in the present study acknowledged that they purchase antibiotics without a prescription. This practise was somewhat greater than the majority of other studies' findings. [3,9,14,26] This selfmedication activity was more widespread among Sakeena et al. (2018)[19] and Ayepola et al. (2018) study participants (2018). [24] Unlike prior studies[9,13], no significant differences in self-medication among medical students by year of study have been detected.

Approximately two-thirds of students had experience storing unused antibiotics for future use. This corresponded with the findings of Ayepola et al (2018). [24] This practise was far less prevalent (less than 50 percent) among medical students from the southern region of India. [3,29]

As many as 28.7% of students used these leftover antibiotics without contacting a physician. Scaioli et al. (2015) determined this number to be 17.7%. [9] According to other surveys, the majority of sick students distribute their remaining antibiotics to their friends, relatives, or roommates without consulting a physician. [14,17,29]

More than half of the students admitted initiating antibiotic treatment without a prescription after receiving phone consultation from a physician. Scaioli et al. (2015) discovered that around one-third of pupils engage in this behaviour. [9] According to Jamshed et al. (2014), 8.9% of students believe prescribing antibiotics over the phone is good patient care since it saves time. [20]

Conclusion: Medical students' understanding of antibiotics and their resistance was pretty satisfactory. Regarding attitudes and behaviours, there is a major need for enhancements.

Recommendations- Since medical students will be primary care physicians in the near future, it is essential that the medical curriculum include correct guidelines about the usage and logical prescription of antibiotics. In addition, there is a need and opportunity to investigate this topic with large sample sizes and multicentric studies.

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