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Assessment of Knowledge, Attitude and Perception of Medical and PharmD Students towards Antimicrobial Stewardship

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Research Article

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Abstract

Introduction: With the increasing antimicrobial (AM) resistance and the cost of AMs, the implementation of AMs education is crucial as mere guidelines are not enough to change the behaviour of future prescribers and clinical pharmacists. Understanding the knowledge, attitude, and perception (KAP) of our future prescribers about AMs education will facilitate better and more effective education for them. Objective: To access the knowledge, attitude, and perception (KAP) of the Medical and Pharm D students towards AM stewardship. Methodology: A prospective questionnaire based survey was carried out among 221 medical and 68 Pharm D students using a validated modified KAP questionnaire from September 2018 to January 2019. Data was analyzed using IBM SPSS Statistics 23. A Chi-square test was used to compare the responses of Medical and Pharm D students. Results: The overall knowledge score percentage of medical participants was found to be only 51% and that of Pharm D students 39.9%. The performance and scores of medical and Pharm D participants in the attitude section was 80.2% and 76.1%, respectively. The perception scores were however very low for both groups (35.7% for medical and 28.6% for Pharm D students). Both categories of participants had poor knowledge and perception regarding antimicrobial stewardship and antimicrobial use, with Pharm D students lagging behind the medical participants. There was no significant difference (P-value is 0.67955) in the overall scores of both groups. Conclusion: The study indicates the lacunae in the training curriculum in the fields of antimicrobial use, which need to be identified and filled to enforce proper AM use.

Key words: Antimicrobial stewardship, KAP, Medical, Pharm D

Introduction

The major boost of the 20th century to therapeutics is antimicrobial medicines. Their development altered the physician's view on the impact that medications have on diseases. They are among the few treatments that can alleviate the disease and not palliate it. In developing countries where infectious diseases prevail, the impact of antimicrobials is magnified. As a class, they are one of the most commonly used and exploited drugs. Drugs in this group differentiate from all others in that they are meant to prevent or destroy the infecting organism and have little or negligible effects on the receiver. This form of therapy is termed chemotherapy, which indicates "treatment of systemic infections with specific compounds that selectively kill the infecting microorganism without impacting the host substantially". Because of the analogy between malignant cells and pathogenic microbes, drug treatment of neoplastic diseases is often called "chemotherapy".[1] There are several substances - and many words used to categorize such compounds - that can inhibit the growth of microorganisms. Antimicrobials, antibacterial, and antibiotics are frequently used terminology that can be often used interchangeably, but between these words, there are significant differences. Antimicrobial applies to those substances that work against microbes, viruses, parasites, and fungi. The word "antimicrobials" originate from the Greek terms anti (against),

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mikros (little), and bios (life). The word "antibiotics" is derived from the Greek word anti (against) and biotikos (concerning life).[2]

With improved sanitation, water purification, and scientifically improved, less clustered housing units, dramatic improvements have been made to reduce the spread of infectious agents. Furthermore, routine large-scale immunization and the discovery of antimicrobials helped to mitigate the morbidity and mortality associated with all of these agents. However, the advent of antimicrobial resistance (AMR) in the latter part of the last century, and the global rise in such cases is a risk that threatens to reverse the advances achieved by the discovery of antimicrobial agents. The increasing build-up of resistance is due to the overall, indiscriminate use of antimicrobials. This triggers bacterial gene mutations due to selective survival pressure, which contributes to new resistance genes being acquired. These genes are passed amongst bacteria thereafter. In addition to this, inadequate infection management procedures have resulted in the dissemination of multi-drug resistant organism (MDRO) between patients, intra-, and inter-hospital. In addition, the production of newer antimicrobial drugs is diminishing. Antimicrobial resistance can lead to higher cost, prolonged hospitalization, and superinfections with Enterococci spp. that are vancomycin-resistant and Staphylococcus aureus that is methicillin-resistant. Among the gram negatives, increased prevalence of extended-spectrum beta-lactamases (ESBLs), AmpC Beta-lactamase, quinolone resistance, Cabapenamase, and the Metallo beta-lactamase among Enterobacteriaceae, Pseudomonas spp., and Acinetobacter spp. are seen with alarming rates.[3]

One of the most notable advances in modern medicine is the availability of effective antibiotics, contributing to slipping out of the top five leading causes of death in the United States due to infectious disease. Continued improper use of antibiotics leads to increased antibiotic resistance growth as well as to an increased risk of adverse medical effects such as Clostridium difficile (C. difficile) and other adverse events.[4]

It has been known for many decades that up to 50% of antibiotic usage was inaccurate, meaning there was no infection, the wrong antibiotic was administered, or the length of medication was incorrect.11 According to the Center for Disease Control and Prevention (CDC), "... at least 2 million people are infected with antibiotic-resistant bacteria and at least 23,000 people die each year as a direct result of the infection. Improper use and over-prescription are two of the many causes that are of immense concern to the healthcare system regarding antibiotic resistance, because these are the two places where we can work to make improvements."

"Antimicrobial stewardship refers to organized interventions to promote and measure the effective use of antimicrobials by fostering the selection of antimicrobial optimal dosage, length of therapy, and route of administration. The goal of antimicrobial stewards is to achieve optimum clinical results related to antimicrobial use, reduce toxicity and other adverse events, reduce healthcare costs for infections and restrict the option of antimicrobial tolerant strains".[5]

The benefits have to be balanced against the potential dangers associated with increased tolerance and adverse health effects when administering antibiotics. Starting with the introduction of antimicrobial stewardship programs (ASPs) in hospitals is the perfect way to continue to tackle this issue. An antimicrobial stewardship initiative should include specific protocols for an agency to address antibiotic prescribing and incorporate surveillance programs within their facility to monitor infection rates and resistance trends.[6]

Materials and Methods

Study design and setting

A prospective questionnaire based survey was carried out among 221 medical and 68 Pharm D students using a validated modified KAP questionnaire from September 2018 to January 2019. Data was analyzed using IBM SPSS Statistics 23. A Chi-square test was used to compare the responses of medical and Pharm D students.

Subjects

Inclusion criteria

- All fourth year, intern, and PG Medical students of Navodaya Medical College, Raichur.
- All fourth year and fifth year PharmD students and PharmD interns of NET Pharmacy College, Raichur.

Exclusion criteria

- Students who are not willing to participate.

Sample size determination

The sample size is determined from the overall population of the study that satisfies inclusion criteria by the following formula: $n=Z2\ P(1-P)/D2$

Where:

- n - Sample size
- Z - Confidence level=95% (1.96)
- P - Anticipated proportion=50% (0.5) to allow maximum sample size
- D - Margin of errors=5% (0.05)

On substituting the values:

$n=Z2\ P(1-P)/D2$

$n = (1.96)2\ (0.5)\ (1-0.5)/\ (0.05)2$

$n = 384.16$

There was a total of 346 medical and Pharm D students who fulfill the inclusion criteria.

So,

$N = 346$

Therefore, the corrected sample size (Nf) is calculated as:

$Nf = n/(1+n/N)$

$Nf = 384.16/(1+384.16/346)= 182.04 \approx 182$

Allowance of 5%=$0.05 \times 102 = 5$

Therefore, total sample size = 182+5 = 187

Sampling technique: Proportional sampling technique is used (Stratified random sampling was used and proportional allocation to each stratum). The proportion of the candidates of the study from their respective academic year is calculated as follows:

- Fourth year MBBS = 93, then the sample will be taken 187/346(93) = 50.2 ≈ 50
- MBBS Interns = 96, then the sample will be taken 187/346(96) = 51
- Medical PG students = 85, then 187/346(85) = 45.9 ≈ 46
- Fifth year Pharm D = 24, then 187/346(24) = 12.97 ≈ 13
- Fourth year Pharm D = 24, then 187/346(24) = 12.97 ≈ 13
- Pharm D Interns = 26, then 187/346(26) = 14.05 ≈ 14

Total = 87

Ethical clearance

The ethical approval to conduct the study was obtained from the Ethical Review Committee of Navodaya Medical College Hospital and Research Centre. Written consents were obtained from each participant.

Materials used

For the assessment of KAP of the participants towards antimicrobial stewardship, a questionnaire was initially designed by using basic questions regarding the topic from the articles: "Assessment of knowledge, attitude, and perception (KAP) of the future prescribers about antimicrobial (AM) education" by Sharma K et al.[7], "Knowledge, perception and preparedness of future prescribers about antimicrobial stewardship" by Ferdoush J et al.[8], and "Medical students' perceptions and knowledge about antimicrobial stewardship: How are we educating our future prescribers" by Abbo L M et al.[9] The questionnaire is divided into three sections - Knowledge, Attitude, and Perception. Knowledge, Attitude, and Practice sections include 8, 9, and 13 questions, respectively. All questions were formulated to have four options and one right answer except question numbers 8 and 13, which have two right options.

For each question in three sections, a maximum score of 1 could be obtained, and thus a total score of 30, i.e., 8 for Knowledge, 9 for Attitude, and 13 for Perception could be obtained. Marking of multiple options for a question will be scored zero, except for questions 8 and 13, for which marking of either of the right options or both right options (exception:

one right option and one wrong option) will be scored as one.

Statistical analysis

The data of the KAP questionnaire from both categories were analyzed using usual statistics like sum and percentage. Chi-square test was used to assess the significant difference in knowledge, attitude, and perception of medical and Pharm D students.

Results

A total of 289 students participated in the study of which 221 (76.5%) were medical students and 68 (23.5%) were Pharm D students. Of 221 medical students, 81 (28.0%) were fourth year MBBS students, followed by 83 (28.7%) MBBS interns and 57 (19.7%) postgraduate medical students. 24 (8.3%) PharmD fourth years, 20 (6.9%) PharmD fifth years, and 24(8.3%) PharmD Interns, thus a total of 68 PharmD students participated in the study.

Table 1: Professional course-wise distribution of participants (n=289)

Course	Fourth years (%)	Fifth years (%)	Interns (%)	PG (%)	Total (%)	Grant Total
Medical	81 (28.0)	-	83(28.7)	57 (19.7)	221 (76.5)	289
Pharm D	24 (8.3)	20 (6.9)	24(8.3)	-	68 (23.5)	

Table 2: Comparison of Knowledge of Medical and Pharm D students towards Antimicrobial Stewardship

Questions	Response	Medical(n=221)		Pharm.D D(n=68)		Chi-square Value	P-value
		No.	%	No.	%		
K1: What is Antimicrobial Stewardship?	Incorrect	142	64.3	55	80.9	6.626	0.01
	Correct	79	35.8	13	19.1		
K2: Its aim.	Incorrect	156	70.6	54	79.4	2.038	0.153
	Correct	65	29.4	14	20.6		
K3: Its significance.	Incorrect	144	65.2	56	82.4	7.214	0.007
	Correct	77	34.8	12	17.7		
K4: Difference between antimicrobials and antibiotics.	Incorrect	118	53.4	46	67.7	4.304	0.038
	Correct	103	46.6	22	32.4		
K5: Antibiotics in viral infection whether effective or not.	Incorrect	115	52.0	40	58.8	0.963	0.326
	Correct	106	48.0	28	41.2		
K6: Necessity for preserving the effectiveness of current antimicrobials.	Incorrect	49	22.2	20	29.4	1.5	0.221
	Correct	172	77.8	48	70.6		
K7: Meaning of Antimicrobial cross-resistance.	Incorrect	63	28.5	23	33.8	0.703	0.402
	Correct	158	71.5	45	66.2		
K8: Main reason for AR.	Incorrect	64	29.0	33	48.5	8.931	0.003
	Correct	157	71.0	35	51.5		

Question No: K1 assesses whether the students are aware of antimicrobial stewardship or not and only 79 (35.8%) medical students and 13 (19.1%) Pharm D students were aware of antimicrobial stewardship. Significant differences (P-value 0.01) were also found between Pharm D and medical students. Only 77 (34.8%) medical students and 12 (17.7%) Pharm D students were able to respond correctly to the identification of the significance of antimicrobial stewardship in Question No: K3, and

it can be noted easily that there is a considerable amount of difference in correct response to this question between the two comparative groups. This is again supported by the P-value of 0.007 for the question. Question No: K7 gauges the knowledge of the participants regarding antimicrobial cross-resistance, to which 158 (71.5%) medical and 45 (66.2%) Pharm D students were able to respond accurately. Significant differences (P-value 0.003) between the two categories are found on the assessment of their knowledge regarding the main reason for antimicrobial resistance.

Table 3: Comparison of attitude of medical and Pharm D students to wards antimicrobial stewardship

Questions	Response	Medical(n=221)		Pharm D(n=68)		Chi-square value	P-value
		No.	%	No.	%		
A1: Whether there is an abuse of antimicrobials in the current scenario.	Negative	25	11.3	10	14.7	0.563	0.453
	Positive	196	88.7	58	85.3		
A2: Prescribing broad-spectrum antibiotics is right when effective narrow-spectrum antibiotics are available?	Negative	77	34.8	24	35.3	0.005	0.945
	Positive	144	65.2	44	64.7		
A3: Will better use of antimicrobials reduce the incidence of antimicrobial resistance.	Negative	19	8.6	9	13.2	1.278	0.258
	Positive	202	91.4	59	86.8		
A4: Do you think antimicrobials are overused?	Negative	32	14.5	10	14.7	0.002	0.963
		189	85.5	58	85.3		
A5: Do you think stron g knowledge of antimicrobials is important in medical practice?	Negative	22	10.0	8	11.8	0.183	0.669
		199	90.0	60	88.2		
A6: Antimicrobial education is insignificant for medical/Clinical Pharmacy students?	Negative	48	21.7	20	29.4	1.71	0.191
		173	78.3	48	70.6		
A7: Education of antimicrobial use is significant to health care professionals?	Negative	56	25.3	15	22.1	0.302	0.583
		165	74.7	53	77.9		
A8: Is antimicrobial resistance a significant problem at the hospitals where you have rotated?	Negative	57	25.8	31	45.6	9.623	0.002
		164	74.2	37	54.4		
A9: How should Antimicrobial pharmacology be taught.	Negative	58	26.2	19	27.9	0.077	0.782
		163	73.8	49	72.1		

Question No: A1 assessed the opinion of the responders regarding the abuse of antimicrobials in the current scenario. Most, 196 (88.7%) medical and 58 (85.3%) Pharm D, students agreed that there is antimicrobial abuse in the current scenario. Only half of the participants [144 (65.2%) medical and 44 (64.7%) Pharm D] considered that prescribing broad-spectrum antimicrobials when equally effective narrow-spectrum antibiotics are available is an irrational approach (Question No: A2). About 202

(91.4%) medical and 59 (86.8%) Pharm D students concurred that appropriate use of antimicrobial agents reduces incidences of antimicrobial resistance (Question No: A3). Both categories of responders [189 (85.5%) medical and 58 (85.3%) Pharm D students] noted that antimicrobials are overused in their area of clinical practice (Question No: A4).

The majority of the medical reciprocators [164 (74.2%)] and nearly half of the Pharm D responders [37 (54.4%)] noted that antimicrobial resistance is a significant problem in the hospital where they have rotated (Question No: A8) and significant differences (P-value 0.002). The majority of the students [163 (73.8%) medical and 49 (72.1%) Pharm D] expressed that antimicrobial pharmacology should be taught with clinical case exercises rather than detailed theory (Question No: A9).

Table 4: Comparison of perception of medical and Pharm D students towards antimicrobial stewardship

Questions	Response	Medical(n=221)		PharmD(n=68)		Chi-square value	P-value
		No.	%	No.	%		
P1: Recognize the risks of antimicrobial use.	Incorrect	48	21.7%	18	26.5%	0.666	0.414
	Correct	173	78.3%	50	73.5%		
P2: Scenarios where the application of antibiotics is not required.	Incorrect	175	79.2%	57	83.8%	0.706	0.401
	Correct	46	20.8%	11	16.2%		
P3: What do you mean by Pre-XDR –TB?	Incorrect	144	65.2%	47	69.1%	0.364	0.546
	Correct	77	34.8%	21	30.9%		
Selection of appropriate antimicrobial for the following:							
P4: Community-acquired Pneumonia.	Incorrect	116	52.5%	35	51.5%	0.022	0.883
	Correct	105	47.5%	33	48.5%		
P5: Complicated UTI (cystitis) in severe cephalosporin allergic patients with Creatinine Clearance 25ml /min.	Incorrect	193	87.3%	65	95.6%	3.703	0.054
	Correct	28	12.7%	3	4.4%		
P6: Most effective antimicrobial against E. coli.	Incorrect	156	70.6%	56	82.4%	3.682	0.055
	Correct	65	29.4%	12	17.6%		
P7: First-line agent for MRSA (Methicillin-resistant Staphylococcus aureus) infection.	Incorrect	145	65.6%	49	72.1%	0.98	0.322
	Correct	76	34.4%	19	27.9%		
P8: First choice of drug in Multi-drug resistant Acinetobacter baumanii.	Incorrect	147	66.5%	50	73.5%	1.179	0.278
	Correct	74	33.5%	18	26.5%		
P9: Last choice of antibiotic.	Incorrect	167	75.6%	55	80.9%	0.825	0.364
	Correct	54	24.4%	13	19.1%		
P10: First choice of antimicrobial in Meningitis caused by MDR aeruginosa.	Incorrect	158	71.5%	52	76.5%	0.649	0.421
	Correct	63	28.5%	16	23.5%		
P11: Treatment of XDR-TB with resistance to all FQs.	Incorrect	151	68.3%	55	80.9%	4.005	0.045
	Correct	70	31.7%	13	19.1%		
P12: Endocarditis caused by Vancomycin-resistant Enterococci.	Incorrect	167	75.6%	55	80.9%	0.825	0.364
	Correct	54	24.4%	13	19.1%		
P13: Drug of choice for typhoid.	Incorrect	79	35.7%	37	54.4%	7.54	0.006
	Correct	142	64.3	31	45.6%		

Only 173 (78.3%) medical and 50 (73.5%) Pharm D students were able to identify the risks of antimicrobial use (Question No: P1). A very few participants, 46 (20.8%) medical and 11 (16.2%) Pharm D students, were able to identify the condition in which antibiotic prescription is not required (Question No: P2). When the responders were asked about XDR-TB, only 77 (34.8%) medical and 21 (30.9%) Pharm D students acknowledged the meaning of XDR-TB (Question No: P3)

Question No: P4-P13 was designed to assess the antimicrobial prescribing practice skills of the participants in certain conditions. Question No: P11 requested the participants to choose an appropriate treatment option for XDR-TB with resistance to all FQs, to which only 70 (31.7%) medical and 13 (19.1%) Pharm D students responded accurately. 54 (24.4%) medical and 13 (19.1%) Pharm D were able to precisely opt the right antimicrobial choice for Endocarditis caused by Vancomycin-resistant Enterococci (Question No: P12). 142 (64.3%) medical and 31 (45.6%) Pharm D students rightly choose the drug of choice for typhoid from among the options provided (Question No: P13).

Table 5: Overall comparison of knowledge, attitude, and perception of medical and Pharm D students towards antimicrobial stewardship.

Parameter	The score of medical students (n=50)			The score of Pharm D students (n=68)		
	Score obtained	Maximum possible score	% of Score obtained	Score obtained	Maximum possible score	% of Score obtained
Knowledge	917	1768	51.9%	217	544	39.9%
Attitude	1595	1989	80.2%	466	612	76.1%
Perception	1027	2873	35.7%	253	884	28.6%
Chi-square value is 0.7726 at significance level of < 0.05 and the P-value is 0.67955.						

The overall knowledge score percentage of medical participants was found to be only 51% and that of Pharm D students 39.9%, while medical and Pharm D participant's performance scores in the attitude section were 80.2% and 76.1% respectively. The perception scores were very low for both groups (35.7% for medical and 28.6% for Pharm D students). There was no significant difference (P-value is 0.67955) in the overall scores of both groups.

Discussion

The majority of the participants were from the medical category (76.5%) in comparison with the Pharm D students (23.5%). This is because a maximum of 30 students only will be present in each Pharm D batch, whereas a maximum medical student will be there in each academic batch. The overall knowledge score percentage of medical participants was found to be only 51% and that of Pharm D students is 39.9%, while medical and Pharm D participant's performance scores in the attitude section were 80.2% and 76.1% respectively. The perception scores were very low for both groups (35.7% for medical and 28.6% for Pharm D students). Both categories of the participants had poor knowledge regarding antimicrobial stewardship and antimicrobial use with Pharm D students lagging behind the medical participants. The attitude of both categories is generally found to be positive with Pharm D students still lagging. In the case of perception, both the categories had a very poor response, with medical students leading. There was no significant difference (P-value is 0.67955) in the overall scores of both groups.

Since the Antimicrobial stewardship program is not followed in majority of hospitals in India, many medical, as well as Pharm D students, do not know the program. Similar studies were conducted among medical students, and a majority of the studies have concluded that the knowledge and practice of the medical students regarding antimicrobial use are very poor.10 No similar studies were found to be conducted among Pharm D students. Possible reasons for the lack of knowledge among the medical and Pharm D students would be lack of adequate

practical knowledge indicating lacunae in training curriculum regarding antimicrobial pharmacology and therapeutics. The possible reason for the slightly better knowledge and perception of medical students may be due to their extensive theoretical syllabus regarding infectious diseases

Conclusion

Antimicrobial stewardship is not introduced in the majority of the hospitals in India, the term was slapping the faces of many students both (medical and Pharm D), and many of them got it confused with the infection control committee. Also, both categories were found to have very poor knowledge and perception regarding antimicrobial use with medical students slightly ahead of the Pharm D students. The attitude towards antimicrobial use and resistance was found to be fair for both groups.

This study points out the need for assessment of the training curriculum of both medical and Pharm D students to isolate the void accounting for poor knowledge and perception regarding antimicrobial stewardship as well as antimicrobial use and subsequent introduction of improvements in the curriculum to fill the void.

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