Original Research Article

Assessing the Knowledge, Attitude, and Practice (KAP) of Antimicrobial Resistant among MBBS, BDS and BSc Nursing Students in the Northern State of India. An Observational-based Cross-sectional Study

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ARTICLE INFO

ABSTRACT

Introduction: The knowledge, attitude & Practice of antimicrobials use and resistance is very essential to combat global antimicrobial resistance (AMR). As there were many studies focused on MBBS undergraduates but none of these studies compared their outcome between two other major medical disciplines like BDS & BSc Nursing. **Methods:** It was an observational-based cross-sectional study, including 23 validated objectives based questionnaire. Out of 440 students, 359 students (94 MBBS, 52 BDS & 213 BSc Nursing) fulfilled the criteria and participated. Statistical Package for Social Sciences (SPSS) version 23 for Chicago Inc. was used and considered for descriptive analyses. **Results:** More than 81% of all participants had adequate knowledge of AMR but in the case of sore throat and cold 50% BDS, 49.3% BSc Nursing opt antibiotics as the first choice of drugs as compared to 33% MBBS students. More than 81% of participants not willing to prescribe their choice of drug in the sickness of family members. Giving leftover antibiotics was higher among MBSS students than others. **Conclusion:** As we observed, even after completion of pharmacology more specifically, antibiotics & chemotherapy chapters in their courses many students didn't understand what; where; when; and whom they can use antibiotics in real scenarios. We have to teach them the practicality of global emergence of AMR because these students going to become doctors, dentist, and nurses in various medical fields and will help to combat against global AMR.

INTRODUCTION

In this twenty-first century, there is no country immune whether it is developed or developing countries to resist against antimicrobial resistance (AMR). Although the prevalence of AMR was most commonly observed with developing countries (1). As many meta-analyses demonstrated that, the very important cause of developing AMR is irrational prescription and misuse of antibiotics which enhance the serious consequences like the failure of drug regimen, prolong the duration of previously treated shorter course diseases and highest treads to develop multi-drug resistance (1-5).

Medical students are the main pillars of the future health care system irrespective of any disciplines such as MBBS, BDS, BSc Nursing and other health care workers as well. Undergraduate training is most important for making them more confident and prepare them to prescribe medicine rationally. Whenever, there was a lack of proper structural training during under-graduation, it will defiantly posses with very hazardous outcomes and these future medical undergraduates will be responsible for the future outcome of global antimicrobial resistance (1). So, in view of our future AMR outcome, it is utmost important, to assess the knowledge, attitude, and practice (KAP) of our young medical students as we found very few or negligible studies which compared KAP on antimicrobial resistance among MBBS, BDS & BSc Nursing Students.

METHODS

Study Design and Setup

It was an observational-based cross-sectional study carried out at Indira Gandhi Medical College, Shimla, which is a Northern Himalayan state of India. To observe the knowledge attitude and practice (KAP) on antimicrobial resistance among medical undergraduates, 23 validated objectives based questionnaire was remodified and incorporated in this study for better understanding for our participants. These questionnaires were inspired by several author publications (6-11).

Study Population and Sample Size

MBBS & BDS students who completed pharmacology or at least completed their 2nd semester of pharmacology and BSc Nursing student who was in last semester or completed of pharmacology course in their syllabus were the target population in our study. This study was approved by the Institutional Ethical committee. Out of 440 students, 412 gave the consent to participate in this study in which 115 was MBBS, 63 BDS and 234 were BSc Nursing students. These students were further screened for their completion of Pharmacology (particularly completion of antibiotics and chemotherapy) course and finally, 94 students from MBBS, 52 from BDS & 213 from BSc Nursing students have fulfilled the criteria to participate in this study (illustrated in Figure 1). All participants were explained in details about the aim of this study and asked to participate without any stress and fear and they were instructed anonymously to indicate the most appropriate option they like the most. The participants were encouraged to furnish their opinion as an independent & unbiased manner. All respondents were also instructed not to provide any personal information, nor to reveal their identity in the questionnaire. Anonymity was maintained.

Data Collection and Statistical Analysis

The data related to participants age, gender, behavioural and practical aspect of uses of antimicrobials on students routine life as well as the understanding about antimicrobial resistance were gathered.
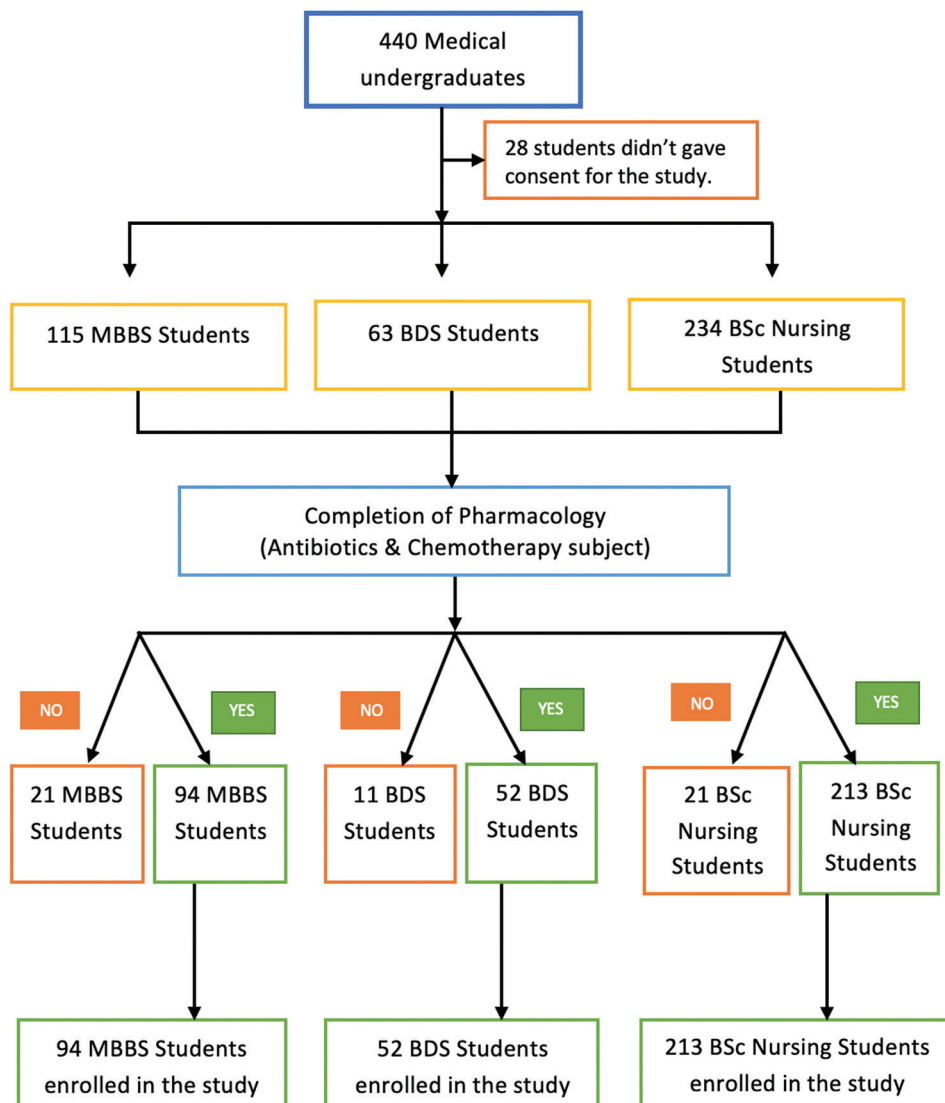

Figure 1. Illustration of participants selection for the study

Statistical Analysis

Data were entered in Statistical Package for Social Sciences (SPSS) version 23 for Chicago Inc. and considered for descriptive analyses. Chi-square test and unpaired student t-test were used for data analysis. A priori p-value of 0.05 was used throughout the analyses and the results were considered statistically significant at p<0.05.

RESULTS

This study was carried out in 359 medical students, of whom 59.33% (n-213) were BSc Nursing, 26.18% (n-94) MBBS and 14.48% (n-52) BDS students. As illustrated in Table 1, most of the participants were female even among MBBS (60.2%) and BDS (78.8%). All participants fall under group age 18-28 year and the mean age of female participants was 19.33±1.63 years as compared to male participants 19.0±1.35 years (p>0.1). More than 80% of participants residing nearby their institution. As illustrated in Figure 1, out of total students, MBBS students >81.7% completed their pharmacology course as compare to >82.53% in BDS students, while >91% BSc Nursing students were in last semester of a pharmacology course.

Primarily, to observe the behavioural response of participants, we included 10 questions regarding the uses of antimicrobial in their daily life. We observed that, less than 12% of medical students (MBBS, BDS, & BSc Nursing) agreed that antibiotics can be consumed for minor illness. During the common cold, the consumption of antibiotics among MBBS was 7.4% as compare to BDS 21.2% and BSc Nursing 14.1% (Table 2). A similar question was reattempted with combining cold with fever and we found that the antibiotics

Table 1. Gender distribution of participants among MBBS, BDS & BSc Nursing undergraduate students.

Characteristics		MBBS(n-94)	BDS (n-52)	BSc Nursing (n-213)	2 tail-significant
Gender	Female	56 (60.22%)	41 (78.85%)	213 (100%)	0.2
	Male	38 (39.78%)	11 (21.15%)	0	

Table-2. Comparison of various behavioural response of uses of antibiotics among MBBS, BDS & BSc Nursing students. (In percentages)

Characteristic's	Response	MBBS (n-94)	BDS (n-52)	BSc Nursing (n-213)
Do you think, you should take antibiotics for every minor illness?	Yes	11.7%	11.5%	12.2%
	No	87.2%	84.6%	87.8%
	Uncertain	1.1%	3.8%	0
Do you think, you should take antibiotics for every common cold?	Yes	7.4%	21.2%	14.1%
	No	96.6%	76.9%	84.5%
	Uncertain	0	1.9%	1.4%
Do you think, you should take antibiotics for fever with cold ?*	Yes	16.3%	40.4%	45.5%
	No	83.2%	57.7%	41.8%
	Uncertain	3.2%	1.9%	12.7%
Do you store antibiotics in a place with exposure to the sun?	Yes	8.5%	7.7%	4.2%
	No	89.4%	86.5%	93%
	Uncertain	2.1%	5.8%	2.8%
If you took the wrong antibiotics, what would you do?	Induce vomiting	30.9%	28.8%	43.3%
	Visit the doctor immediately	61.7%	69.2%	50.7%
	Don't know	7.4%	1.9%	7%
If anybody in your family is sick, do you give them antibiotics of your choice?	Yes	17.3%	19.1%	18.8%
	No	82.7%	80.9%	81.2%
If you experience adverse effects after taking antibiotics, what would you do?	Stop taking the antibiotics	35.9%	42.2%	39.4%
	Visit the doctor immediately	63.8%	52.5%	56.3%
	Uncertain	0.3%	1.3%	4.2%
How would you take antibiotics?	With water	93.6%	94.2%	90.6%
	With tea	5.3%	5.8%	8.5%
	Directly	1.1%	0	0.5%
	Other methods	0	0	0.5%
Would you take antibiotics before meals?	Yes	15.9%	13.5%	18.8%
	No	84.1%	86.5%	81.2%
Do you think antibiotics are the same as an anti-inflammatory agents?	Yes	6.4%	13.5%	13.1%
	No	89.4%	84.6%	70.8%
	Uncertain	4.2%	1.9%	7%

*statistically significant <0.05.

taken by BSc Nursing students were significantly higher (45.5%) than other two disciplines BDS (40.4%) & MBBS (16.3%). In response to the storage of antibiotics, more than 85% of medical students from all three disciplines agreed that the antibiotics should not be stored in a place with exposure to the sun (Table 2).

As illustrated in Table 2, In response to wrongly ingestion of antibiotics, the majority of participant agreed that visiting of a doctor is better (50.7%-69.2%) than self-induction of vomiting for the expulsion of the drug (28.8%-43.3%). Similarly, in response to antibiotics associated adverse effect, 52.5%-63.8% among all participants agreed to visit a doctor as compared to stopping of antibiotics (35.9-42.2%). More than 80% of all participants did not agree to prescribed their choice of antibiotics for the sickness of their family members. 90.6%-93.6% form all participants taken their antibiotics with water than tea/directly & 81.2% to 86.5% of participants took antibiotics after meals (Table 2). To understand whether there is a difference between antibiotics and antiinflammatory, a question was asked to these participants and we observed that 13.5% BDS and 13.1% BSc Nursing Students agreed that antibiotics and antiinflammatory had a similar role to each other while only 6.4% of MBBS students agreed for the same (Table 2).

In the second set of questionnaire, we included knowledge and practical based questions towards antibiotics uses and its resistance. As illustrated in Table 3, physician, pharmacist and nurses were the main sources for gathering information about antibiotics. Most of MBBS (77.7%) than BSc Nursing (75.1%) followed by BDS students (73.1%) agreed that they

Table 3. Comparison of knowledge and practice of antibiotics and antibiotics resistance among MBBS, BDS & BSc Nursing students. (In percentages)

Characteristic's	Response	MBBS (n-94)	BDS (n-52)	BSc Nursing (n-213)
From whom you get the best information about antibiotics?	Physicians	51.20%	53.96%	38.41%
	Pharmacist	33.68%	25.41%	33.82%
	Nurses	6.99%	9.69%	12.11%
	Major caregiver	2.35%	3.65%	6.93%
	Public health officers	1.15%	1.19%	3.60%
	Mass media	3.49%	3.65%	4.86%
	Others	1.15%	2.39%	0.27%
Do you take antibiotics according to the instructions on the package?	Yes	77.7%	73.1%	75.1%
Do you know some antibiotics have "teratogenic effects"?**	Yes	93.8%	69.2%	40.4%
Do some antibiotics cause adverse effects?*	Yes	98.4%	92.3%	69.5%
	No	1.3%	3.8%	18.8%
	Uncertain	0.3%	3.8%	11.3%
Do you think that taking fewer antibiotics than prescribed is more advantages?	Yes	25.5%	42.3%	41.3%
	No	72.3%	53.8%	54.9%
	Uncertain	2.1%	3.8%	3.8%
Antibiotics are safe drugs, hence they can be commonly used medication?**	Yes	14.7%	38.5%	63.4%
	No	82.1%	53.8%	31.0%
	Uncertain	3.2%	7.7%	5.2%
Skipping one or two doses does not contribute to the development of antibiotic resistance?	Yes	29.8%	42.3%	36.2%
	No	66%	48.1%	56.8%
	Uncertain	4.2%	9.6%	6.6%
Adverse effects of antimicrobials are reduced by using more than one antimicrobial at a time?	Yes	6%	13.5%	18.8%
	No	74.9%	65.4%	60.1%
	Uncertain	19.1%	21.2%	20.7%
Injudicious use of antimicrobials shorten the duration of illness?	Yes	11.7%	25%	15%
	No	64.9%	51.9%	68.1%
	Uncertain	22.4%	23.1%	16.4%
When you have a cough and sore throat, antimicrobials are the first drug of choice for early treatment and to prevent the emergence of resistant strains?	Yes	33%	50%	49.3%
	No	50%	36.5%	33.3%
	Uncertain	17%	13.5%	16.9%
Do you know, what is antimicrobial resistance [AMR]?	Yes	88.3%	86.5%	81.7%
	No	11.7%	13.5%	18.3%

*statistically significant <0.05, **statistically significant <0.005.

follow the instructions on the package before consuming any antibiotics. We also observed that the knowledge of teratogenicity associated with antibiotics was higher among MBBS (93.8%) and poorest with BSc Nursing students (40.4%). Similarly, MBBS students (98.4%) has better knowledge of antibiotics associated with adverse drug reaction rather than BDS (92.3%) & BSc Nursing students (69.5%). Only MBBS student (72.3%) were not agreed that fewer than prescribed antibiotics will have the advantage to cure illness while 42.3% and 41.3% of BDS and BSc Nursing students respectively agreed that, fewer than prescribed antibiotics can possess more advantage than a multidrug regimen.

As many participants knew of the wide therapeutic index of antibiotics, >63% of BSc Nursing students agreed that antimicrobial agents can be used for common illness while 82.1% MBBS students disagreed for the same. 66% of MBBS students agreed that skipping of doses of antibiotics may possess AMR in future as compared to 42.3% BDS & 36.2% BSc Nursing students. It was also observed that, only 6% of MBBS students agreed that Multi-drug regimen can be used to reduce the antibiotics associated side effects, as compared to 13.5% BDS & 18.8% BSc Nursing students. In response to the question of injudicious use of antimicrobials cause shortens the duration of illness, 25% BDS student agrees with this statement while the lowest 11.7% were observed with MBBS students. Similarly, the first choice of the drug during sore throat and cold were asked and we observed that 50% BDS and 49.3% BSc Nursing students opt antibiotics as the first choice as compares to 33% MBBS students. We also found that, among all participant, more than 81% of students had an adequate knowledge about antimicrobial resistance (Table 3).

Thirdly, for assess & compare the attitude of medical undergraduates towards antimicrobial resistance, we plotted a question that shows their casual attitude. As illustrated in Table 4, In a response to undergoing antimicrobial therapy

with symptomatic improvement, 89.4% of MBBS students did not stop their further antibiotics therapy as compared to 86.8% BSc Nursing & 82.7% BDS students. 31% BSc Nursing students Kept their remained antibiotics after antibiotics course completion as compared to 25% BDS & 24.5% MBBS students. Similarly, 31% BSc Nursing, 25% BDS and 23.4% MBBS students discard their leftover antibiotics. 43.6% of MBBS students agreed that they used to distribute leftover antibiotics to their roommates/friends as compared to 23.1% BDS & 36.6% BSc Nursing students. In this study, we found that more than 83% of students completed their full course of antimicrobial therapy.

Fourthly, as illustrated in Table 5, multiple responses gathered from all participation for preventing antimicrobial resistance. The commonest suggestion among MBBS (20.64%) & BDS (20%) students was the culture-based prescription of antimicrobial therapy while completion of the full course of antimicrobials in the prescribed dose was commonest among BSc Nursing students (16.33%). The second most common suggestion among MBBS students (15.56%) was the completion of the full course of antimicrobials in the prescribed dose as compare to BDS students (14.79%) avoidance of self-medication and among BSc Nursing students (15.81%) culture based prescription of antimicrobial therapy. To avoid of self-medication was the third common suggestion given by MBBS students while Completion of antimicrobials therapy & rational use of antibiotics was suggested by BDS & BSc Nursing students, respectively.

DISCUSSION

In this study, we tried to demonstrate the knowledge, attitude, & practical aspect of antibiotics uses and awareness of antimicrobial resistance among medical undergraduates. Most of our participants were from BSc Nursing and @80% were females. In this study, we compared KAP on AMR

Table 4. Comparison of attitude toward antimicrobial drug therapy among MBBS, BDS & BSc Nursing students. (In percentages)

The doctor prescribes a course of antibiotics for you. After taking 2–3 doses you start feeling better		MBBS (n-94)	BDS (n-52)	BSc Nursing (n-213)
a) Do you stop taking further treatment?*	Yes	10.6%	11.5%	12.7%
	No	89.4%	82.7%	86.8%
	Uncertain	0	5.8%	0.5%
b) Do you save the remaining antibiotics for the next time you get sick?	Yes	24.5%	25%	31%
	No	74.5%	73.1%	68.5%
	Uncertain	1.1%	1.9%	0.5%
c) Do you discard the remaining, leftover medication?	Yes	23.4%	25%	31%
	No	73.4%	69.2%	62.4%
	Uncertain	2.1%	5.8%	3.8%
d) Do you give the leftover antibiotics to your friend/roommate if they get sick?*	Yes	43.6%	23.1%	36.6%
	No	54.3%	73.1%	62.9%
	Uncertain	2.1%	3.8%	0.5%
e) Do you complete the full course of treatment?	Yes	83.3%	86.5%	83.1%

*Statistically significant <0.05.

Table 5. Comparison various responses for the prevention of antimicrobial resistance among MBBS, BDS & BSc Nursing students for reducing global AMR. (In percentages)

What according to you is the solution for the growing problem of Antimicrobial Resistance?	MBBS (n-94)	BDS (n-52)	BSc Nursing (n-213)	2 tail-significant
Careful, judicious and rational use of medicines	11.87%	13.48%	14.45%	0.03
Complete the full course of antimicrobials in the prescribed dose	15.56%	14.14%	16.33%	
Stopping the medication as soon as you feel better.	0.94%	3.03%	4.36%	
Avoid self-medication	14.23%	14.79%	11.63%	
Buy and use the same medicine with which you got relieved from the illness last time.	5.01%	2.60%	7.03%	
Multidrug therapy	6.59%	8.03%	5.36%	
Using antibiotics prescribed by the different physician at the same time.	5.80%	4.34%	3.76%	
Symptomatic management of self -limiting conditions	3.69%	3.05%	6.20%	
Awareness among patients by organizing public health campaigns	9.22%	9.55%	7.75%	
Taking a double dose of medicine to get early relief.	0.67%	2.17%	2.94%	
Prescribe using culture sensitivity reports	20.64%	20.02%	15.81%	
New drug discovery	5.77%	4.80%	4.40%	

between three major medical disciplines which are the pillar of our healthcare. These undergraduates will become young doctors, dentists and nurses after 2-3 years and will possess their direct/indirect associated with the future antimicrobial resistance.

In this study, most of our medical undergraduates had adequate knowledge of miss-use of antimicrobials for minor illness, as we found that more than 84.6% of students from MBBS, BDS & BSc Nursing didn't consider any antibiotic therapy for minor illness and even for the common cold but up to 21% BDS students used antimicrobials for the common cold. In response with a trickier question of illness with cold & fever; 45.5% BSc Nursing, 40.4% BDS and 16.3% MBBS students consumed antibiotics. This statements directly indicate their poor educational judgment between viral and bacterial respiratory illness. A similar observation was cited by Khan et al in 2013 among MBBS students (12).

Visiting a doctor was the commonly cited response observed by most of the participants in response to wrongly ingested of antibiotics & antibiotics associated side effects, a similar response was also cited by Mahajan et al. but only among MBBS students (13). Most of our participant knows antibiotics shouldn't be store with exposure to the sun. More than 90% of participants consumed medicine with water and >80% post-meal. Majority of our participants were aware about the irrational use of antimicrobial therapy, it was found that 82.7% MBBS students did not agree to prescribe their choice of antibiotics even in the sickness of a family member as compared to BSc Nursing (81.2%) & BDS Students (80.9%). We were unable to find any articles which contradict or concur with this statement. Similarly, there was no studies which compare the difference of mechanism of action of antibiotics with antiinflammatory drugs among MBBS, BDS & BSc Nursing students as we found in our study, 6.4% of MBBS students believed that, the action of antibiotics & antiinflammatory drugs were the same as compared to 13.5% BSc Nursing & 13.1% BDS students.

Physician, Pharmacist & Nurses were the utmost sources for gathering the information regarding antibiotics observed

among all three groups. It was also observed that>73% of medical undergraduates checked the package inserts before using antibiotics, a similar response among MBBS students was observed by Khan et al (12). The knowledge about teratogenic & side effect associated with antibiotics was highest among MBBS students (93.8% & 98.3%) and poorest among BSc Nursing students (40.4% & 69.3%), respectively but we were unable to find any articles which contradict or concur with this statement. In 2014, Mahajan et al. demonstrated of 86 MBBS students 37 (43.02%) believed that antibiotics were safe drugs, and hence they could be commonly used. It was surprisingly, these observations were lowest found with MBBS students (14.7%) as compared with the other two disciplines 69.5% BSc Nursing & 38.5% BDS) (13).

In 2014, Abera et al. cited that, 72% of their participants had expected level of knowledge on AMR (82.8% physician & 63.5% nurses) as compared to our study more than 81% of our medical undergraduates (88.3% MBBS, 86.5% BDS & 81.7% BSc Nursing) know and understand about antimicrobial resistance (14). There was a significant difference among these participants about the perception of antimicrobial resistance. Most of MBBS undergraduates believed that skipping of antibiotics (66%) and taking fewer than prescribed antibiotics (72.3%) may predispose AMR & poor treatment outcome as compare to BDS (48.1% & 53.8%) and BSc Nursing students (56.8% & 54.9%) respectively, as we found there were no comparative study available to compare the outcome of our study. It was depressing that, significant percentage of participants (50% BDS, 49.3% BSc Nursing & 33% MBBS) believed that antibiotic could be the drug of choice for common cold with a sore throat for the early treatment and prevention of emergence of resistant strains, we are unable to find any comparative study to compare these outcomes, although Mahajan et al. demonstrated that 52.32% MBBS undergraduates also believed that antibiotics as the choice of drug for above cited statement (13).

Few studies were demonstrated the casual attitude towards antibiotics therapy and it was mainly focused on MBBS students, not BDS and BSc Nursing students. For comparing

the attitude towards antibiotics therapy, we created a scenario in which our participants were under antimicrobial therapy with symptomatic improvement after administrating 2-3 doses of antibiotics. As illustrated in Table 4, we observed that more than 83% of participants completed the full course of antibiotics therapy even after symptomatic improvement while <12% stopped the therapy. We also observed that most of MBBS students (43.6%) gave leftover antibiotics to their friend/roommates, while only 23.4% discard their antibiotics and 24.5% reused the leftover antibiotics for next episode of sickness. Similarly, 25% BDS students discard & reused the remained antibiotics while 23.1% gave leftover antibiotics to their friend/roommates. We also found that the stopping of antibiotics therapy was higher among BSc Nursing students (12.7%). As we observed 31% of nursing students discard as well as reused the leftover antibiotics while 36.6% distributed their leftover drugs. As it was mentioned previously, we did not find any comparative study but similar observation among MBBS students by other authors (12,13). To prevent AMR, multiple responses were advocated by our undergraduates. More than 20% of students from MBBS & BDS suggested that culture-based prescription of antimicrobial therapy will help to combat antimicrobial resistance globally but among BSc Nursing students, the commonest suggestion was the completion of the full course of antimicrobials therapy in the prescribed dose. Mahajan et al. had similar observation among MBBS students while Abera et al. compared the potential intervention to combat AMR Among physician and nurses (13,14).

CONCLUSION

It will be very challenging for young medical graduates to fight against antimicrobial resistance. Changing their perception, practice and attitude play a pivotal role toward antibiotics uses. As we observed, even after completion of pharmacology more specifically antibiotics & chemotherapy chapters in their courses many students didn't understand what; where; when; and whom they can use antibiotics in a real scenario. Nowadays, only awareness about antimicrobial resistance is not sufficient even among medical undergraduates. We have to teach them the practicality of global emergence of AMR because these students going to become doctors, dentist and nurses in various medical fields and will help to combat against global AMR. With poor educational background & lack of practical knowledge will make them impossible for treating any critical illness where the last resort of drugs was already used for some minor ailments.

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