



## **Awareness towards Antibiotic Resistance in Healthcare Undergraduate Students of Indian Tertiary Care Hospital**

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### **Abstract**

#### **Objective**

Poor Knowledge and attitude towards antibiotics an important factor for antibiotic resistance among healthcare personnel. Therefore, this study was planned to assess the knowledge, attitudes, and practice among undergraduate medical and nursing students

concerned for antibiotic resistance and usage.

#### **Methods**

The study was an observational, questionnaire-based study conducted on MBBS and Nursing undergraduate students. A questionnaire was designed

to get insight into the student's understanding of antibiotics usage and resistance entailing knowledge, attitude, and practice.

### **Results**

Academic year was found to be significantly associated with knowledge and attitudes, with fourth-year mbbs students have better knowledge, more appropriate attitudes than second year students. There has been positive correlation between each pair of the knowledge-attitude ( $p = 0.000$ ), knowledge- practice ( $p = 0.023$ ) and attitude- practice ( $p = 0.000$ ) scores for MBBS students.

The Academic year was also found significantly associated with knowledge, attitudes, and practice, with fourth-year nursing students, have better knowledge, more appropriate attitudes, and better practice than all academic years. A positive correlation found between knowledge-practice ( $p = 0.000$ ) and attitude- practice ( $p = 0.008$ ) scores for nursing students.

### **Conclusion**

There has been significant association with the academic year and a positive correlation between knowledge, attitude, and practice of healthcare undergraduate students towards antibiotic resistance. The study provides important insight regarding their knowledge, attitudes, and practices, which can be considered, to plan for the development of effective tools for improving the understanding of students regarding antibiotic resistance and usage.

### **Keywords**

Antibiotic Resistance, Knowledge, Attitude, Practice, Healthcare Undergraduate.

### **Introduction**

The emergence and spread of antibiotics resistant bacteria in the human population is a growing

problem worldwide. Antibiotic resistance presenting with a significant threat to public health [1].

Antibiotic resistance can be developed due to various factors like; incorrect prescription, inappropriate consumption and excessive use of these antimicrobial drugs, self-medication etc. [2,3]. Poor Knowledge and attitude towards antibiotics, easy access to antibiotics is also an important factor for antibiotic resistance among healthcare personnel [4,5].

Antibiotic resistance will eventually lead to diminish therapeutic effectiveness and increase chances of treatment failures, which further lead to more severe illnesses with an impact on increasing morbidity, mortality, and costs [6].

Undergraduates of medical and nursing are going to be to serve as future healthcare providers to the community. They will be frontline fighters against antimicrobial resistance, by rationally using and promoting patient awareness towards antibiotics. There was various evidence that poor knowledge and lack of training about antibiotic resistance during undergraduate medical studies can lead to increase irrational use of antibiotics and increases chances of development of antibiotic resistance [7-9].

Understanding and behaviour of students can be changed by providing better knowledge and appropriate training for antimicrobial resistance [10-12]. Before planning any teaching or training program, it is very important to determine the understanding and belief of students toward antibiotics usage and resistance.

There is no previous research assessing undergraduate medical and nursing students' understanding of antibiotic resistance. Therefore, this study was planned to assess the knowledge, attitudes, and practices among undergraduate medical and nursing students concerning antibiotic resistance and

make necessary interventions suitable to meet their needs and aspiration.

## **Material and Methods**

### **Study design and study population**

The present research was a cross - sectional, observational, questionnaire - based study conducted on MBBS and Nursing students at AIIMS Patna. The study period was from July to August 2021.

### **Sampling Technique and Data Collection**

A structured questionnaire was designed by a team of experts after a detailed review of relevant literature. A small-scale pilot study was conducted among the small number of students using this questionnaire before the commencement of the main study. Based on the pilot study outcome, the questionnaire was modified and improved.

The final version of the questionnaire has four sections: The first section was dealing with basic information about students like age, sex, residence, academic year. In the second section, twelve questionnaires were used to assess the knowledge of the student with options 'yes,' 'no,' and 'don't know.' The third section had ten attitude questionnaires designed according to the five-point Likert scale having options of 'strongly agree,' 'agree,' 'neutral,' 'disagree,' and 'strongly disagree'. The last section had eight questions also designed according to five-point Likert scale focused on practices about antibiotics with options 'always,' 'often,' 'sometimes,' 'seldom,' and 'never'.

A modified questionnaire was distributed to the participants after obtaining their informed consent. Participation was entirely voluntary and neither they were forced nor coerced at any level. This final validated questionnaire written in English was administered to the students and the objectives of the study were explained to them and then asked to fill up

the questionnaire in a stipulated time of twenty minutes. The responses obtained were recorded and tabulated. Only complete filled questionnaires were included in the study for final analysis.

### **Data Management and Analysis**

Data were collected via paper-based questionnaires and the data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0 for Windows.

Responses to the knowledge questions were given a score of "1" for a correct response and "0" for incorrect or don't know responses, and scores were summed for respondents across each of the domains. For the attitudes and practices questions, responses were given a score based on the five-point Likert scale, ranging from "5" for the most appropriate answer to "1" for the least appropriate answer, and summed. The mean score based on responses to questions in each of the knowledge, attitudes, and practices sections was used as the cut-off to dichotomize the continuous variable for use as the dependent variable in ordinal regression analysis. Spearman's rank-order correlation coefficient was used to describe the strength and direction of the relationship between responses to the knowledge, attitudes, and practices questions.

### **Ethical Consideration and Consent to Participate**

The study was conducted after ethical approval of the Institutional Ethics Committee (IEC) of AIIMS-Patna (AIIMS/Pat/IEC/2020/677). Informed written consent will be taken from all the participants before starting the questionnaire. The identity of the participants was kept confidential.

## **Results**

### **Characteristics of Students**

The sample consisted of 339 MBBS students and 171 nursing students. MBBS participants have

more males (71.4%), whereas nursing participants were all females. [Table 1]

Table 1 depicts that maximum MBBS participants (32.4%) were studying in the first year, followed by the second year (24.1%) & maximum nursing participants (36.85%) were studying in the first year, followed by the second year (24.5%).

#### **Knowledge of Antibiotics resistance among MBBS Students**

As it is shown on Table 2, Fewer participants thought that multiple antibiotics can resolve infection faster (n = 77, 22.71%, Median =1, IQR =1). More than 80% of participants were aware that antibiotics can cause secondary infection by killing good bacteria (n = 277, 81.71%, Median = 1, IQR = 0) and antibiotics can cause side effects (n =278, 82.00%, Median = 1, IQR = 0). Majority of participants had knowledge that the improper use of antibiotics can cause antibiotic resistance (n =318, 93.80%, Median =1, IQR =0) and infection caused by antibiotic resistance bacteria very difficult to treat (n =326, 96.16%, Median =1, IQR =0). [Table 2]

#### **Attitude towards Antibiotics resistance among MBBS Students**

More than eighty percent of participants agreed that antibiotic use is not safe without a doctor's prescription (n = 299, 88.21%, Median = 4, IQR = 1). More than half of participants were disagreed that taking fewer antibiotics than prescribed is beneficial (n =223, 65.79%, Median = 4, IQR =1) and taking many antibiotics produce better results than single antibiotic (n = 194, 57.22%, Median = 4, IQR = 1). They also had belief on the necessity of completing the antibiotic course (n =277, 81.71%, Median =4, IQR = 1) and not to keep leftover antibiotics for future use without

consulting physician (n = 270, 79.66%, Median = 4, IQR = 1). [Table 3]

#### **Practice towards Antibiotics resistance among MBBS Students**

Only few of participants never consulted a doctor before starting an antibiotic (n =4, 1.17%, Median = 4, IQR = 2) and never read instructions in package insert before taking antibiotics (n = 20, 5.89%, Median = 4, IQR = 2). However, only less than half of participants always finished the full course of antibiotics (n = 167, 49.26%, Median = 4, IQR = 1). The majority of students kept leftover antibiotics at home in case of future requirements (n = 265, 78.15%, Median = 3, IQR = 2). [Table 4]

#### **Knowledge of Antibiotics resistance among Nursing Students**

As it is depicted in Table 5, Only few of the participants belief that multiple antibiotics can faster resolve the infection (n =52, 30.40%, Median =1, IQR =1). More than 70% of participants were aware that antibiotics can cause secondary infection by killing good bacteria (n = 120, 70.17%, Median = 1, IQR = 1) and antibiotics can cause side effects (n = 124, 72.52%, Median = 1, IQR = 1). Majority of participants had knowledge that the improper use of antibiotics can cause antibiotic resistance (n =163, 95.34%, Median =1, IQR =0) and infection caused by antibiotic resistance bacteria are very difficult to treat (n =160, 93.56%, Median =1, IQR =0). [Table 5]

#### **Attitude towards Antibiotics resistance among Nursing Students**

Most of the participants agreed that antibiotic is not safe without a doctor's prescription (n = 112, 65.50%, Median = 4, IQR = 3). They also had belief on the necessity of completing the antibiotic course for effectiveness of treatment (n = 136, 79.53%, Median

=4, IQR = 1) and not to keep leftover antibiotics for future use without consulting physician (n = 153, 89.47%, Median = 4, IQR = 1). [Table 6]

#### Practice towards Antibiotics resistance among Nursing Students

Only 7% of students never finished the full course of antibiotics (n = 13, 7.60%, Median = 5, IQR = 2). More than 60 % of students never changed dose (n = 115, 67.25%, Median = 5, IQR = 2) and switched antibiotics (n = 104, 60.84%, Median = 5, IQR = 2) during the course of treatment. The most of participants kept leftover antibiotics at home in case of future requirements (n = 119, 69.60%, Median = 3, IQR = 3). [Table 7]

#### Factors associated with knowledge, attitudes, and practices relating to antibiotics resistance in MBBS students

In logistic regression analysis [Table 8], after adjusting for other variables, academic year was found to be significantly associated with knowledge and attitudes, with fourth-year students have better knowledge (odds ratio = 0.321, 95% CI = 0.172-0.600, p = 0.000), more appropriate attitudes (odds ratio = 0.842, 95% CI = 0.729-0.974, p = 0.020) than second year students. Age group was not significantly associated with knowledge, attitude and practice. female having appropriate attitude (odds ratio = 1.132, 95% CI = 1.021-1.254, p = 0.018) than males.

#### Relationship between knowledge, attitudes, and practices in MBBS students

Spearman rank-order correlation revealed a positive association between each pair of the knowledge-attitude (p = 0.000), knowledge- practice (p = 0.023) and attitude- practice (p = 0.000) scores for respondents [Table 9]. This means good knowledge is associated with an appropriate attitude and better

practice. Additionally, the appropriate attitude has also an influence on practice.

#### Factors associated with knowledge, attitudes, and practices relating to antibiotics resistance in nursing students

In logistic regression analysis [Table 10], after adjusting for other variables, the academic year was found to be significantly associated with knowledge, attitudes, and practice, with fourth-year students, have better knowledge, more appropriate attitudes, and better practice compared with all academic year students. Age group was significantly associated with the appropriate attitude, with 21-23 years age group (odds ratio = 3.061, 95% CI = 1.025-9.139, p = 0.045) being more likely to have appropriate attitude compared to  $\geq 24$  years age group.

#### Relationship between knowledge, attitudes, and practices in nursing students

Spearman rank-order correlation revealed a positive association between knowledge-practice (p = 0.000) and attitude- practice (p = 0.008) scores for respondents [Table 11]. This means good knowledge influences attitude and practice. Additionally, the appropriate attitude has also been associated with better practice.

#### Discussion

Antimicrobial resistance is a growing health problem not only in developed but in developing countries also. KAP studies towards antibiotic resistance help to understand the current perceptions of healthcare students. To our knowledge, there is no previous research assessing undergraduate medical and nursing students' understanding of antibiotic resistance. Therefore, this study was planned to assess the knowledge, attitudes, and practices among undergraduate medical and nursing students concerning

antibiotic resistance and usage. This study will be utilized to plan a suitable educational program for improving the understanding of antibiotic resistance.

Our study findings indicate that healthcare students had good knowledge about antibiotic usage and resistance. These results are similar to an earlier study documenting high knowledge of antimicrobial use and resistance among medical students [13-15]. In our study, most of the participants (93.80% mbbs, 95.34% nursing) agreed that inappropriate use of antibiotics could lead to antimicrobial resistance. This finding is slightly higher than a study done in Bahir Dar (69.7%), Jordan (50%) [16-17], while a similar finding (98%) was presented in another study on medical students [15]. Higher knowledge could be explained that healthcare students were more concerned about the use of antibiotics and the development of resistance. Healthcare students should promote and counsel the patient to help them better understand antibiotics uses and antibiotic resistance.

Our study suggests that fourth-year mbbs ( $p = 0.000$ , 95% CI = 0.171-0.600), nursing ( $p = 0.001$ , 95% CI = 0.068-0.503) students have better knowledge compared to junior students. These results were similar to studies, where junior medical students had lower knowledge towards antimicrobial resistance compared to their seniors [18,19]. These results suggest that even antibiotic use is taught to junior students but knowledge on antibiotic usage and awareness on antibiotic resistance come through clinical posting, which starts in the later academic years. This could be the reason for better knowledge of antibiotics in senior students.

Overall, the respondents in our study had good knowledge about antibiotic use, with an exception being in regards to multiple antibiotics should be co-administered for faster resolution of the infection. Only

half of the students (55.75% mbbs, 56.14% nursing) were not agreed with this statement.

The current study has demonstrated that the student's attitude was appropriate towards antibiotic use and resistance. Most of the participants agreed that antibiotics are not safe without a doctor's prescription (88.21% mbbs, 65.50% nursing). These results are different from a study that showed that only 35.9% of participants agreed with this, which shows that there is a lower degree of confidence in doctor's prescription [20].

More than sixty percent of participants have disagreed that taking fewer antibiotics than prescribed is beneficial (65.79% mbbs, 67.25% nursing), these results are partially confirmed by a Nepalese (50.9%) and Palestinian (67%) study [21-22]. We found that students had belief on not to keep leftover antibiotics for future use without consulting a physician (79.66% mbbs, 89.47% nursing), other study results (52%, 45.4%) were lower than our study [14, 23]. Such false beliefs can lead to irrational use of antibiotics, which can result in the development of bacterial resistance. Knowledge has a strong effect on attitude, so these appropriate attitudes towards antibiotics may be driven by good knowledge.

Our study participants have appreciable practices about a concern to use of antibiotics. Only a few of the participants never consulted a doctor before starting an antibiotic (1.17% mbbs, 2.33% nursing). Similar results (3.1%) present in the Khan study [14], while contrast results in Ethiopian community study (65.3%) and Indian dental students' study (62.81%) participants self-prescribed antibiotics without consulting physicians [16,24]. The majority of participants kept leftover antibiotics at home in case of future requirements (78.15% mbbs, 69.60% nursing),



similar results were found in the pengchao study (85.0%) and Indian study (64.3%) respondents kept leftover for future use [20,25]. These are incorrect practices that can further increase the problem of resistance.

In our study we found that female have significant attitude for antibiotic resistance (odds ratio = 1.132, 95% CI = 1.021-1.254,  $p = 0.018$ ) compared to male mbbs students. The result of another study is different from this, where they found females have significant practice towards antibiotic use ( $p = 0.014$ ) compared to males [21]. In our study, all age group (mbbs) has no significant association with knowledge, attitude, and practice. Similar results were found in the Nepal community study, where they also did not find any significant association with all age groups [21].

Our study revealed a positive correlation between each pair of the knowledge-attitude ( $p = 0.000$ ), knowledge- practice ( $p = 0.023$ ) and attitude-practice ( $p = 0.000$ ) in mbbs students. We also found positive correlation between knowledge-practice ( $p = 0.000$ ) and attitude- practice ( $p = 0.008$ ) in nursing students. Similar results were also found in two studies where they revealed positive correlation ( $p = <0.01$ ) between each pair of the knowledge, attitude and practice scores for respondents [20, 21].

Overall, our study participant has good knowledge and better practice towards antibiotic use and resistance. Still, there is some exception like, only half have disagreed for use of multiple antibiotics for faster resolution, only half of the participants completed a full course of treatment and more than seventy percent kept leftover antibiotics for future use. Hence, it seems like despite having a sufficient theoretical background, healthcare undergraduates do not practice what they learn. This highlights the importance of putting more

effort into educating students about antibiotic use and resistance, as well as placing a greater emphasis on the core curriculum of their academics, which can improve the understanding of rational use of antibiotics [26, 27]. Antimicrobial stewardship programs should be encouraged to standardize our healthcare students' knowledge and habits around antibiotic use [28].

There should be some exercises with an attempt to teach principles of antibiotic use in health care facilities that will improve the effectiveness of the educational interventions like; patient-oriented problem-solving exercises [29,30], protocol development for antibiotic use in health care facilities [31], small group exercises that allow students to practice patient education skills [32], should be a part of undergraduate curriculum.

There were several limitations of this study. First, our study participants were from a single teaching institution, rather than opening up to a different institution, which could have given different results. Second, use of a self-administered questionnaire was used, instead of the face-to-face interviews that are traditionally considered the gold standard method of survey administration [33]. Self-administered surveys could lead to a recall bias, caused by differences in the accuracy or completeness of the recollections retrieved by study participants, and to an under or over-reporting of respectively incorrect or correct behaviours and attitudes [34]. Third, we didn't compare the mbbs students' results with nursing students' results, it will be not right to compare the knowledge and behavior of mbbs students with nursing students because both have different exposure to antimicrobial training.

### **Conclusion**

Our study provides important insight regarding knowledge, attitudes, and practices of healthcare

undergraduate students towards antibiotic use and resistance. There has been a positive correlation between knowledge, attitude, and practice for antibiotic use and resistance. Our findings are critical to the battle to minimize antibiotic misuse, and they can be used to develop an effective undergraduate curriculum on antibiotic resistance and use. Adoption of suitable educational interventions and tactics is a critical tool for improving students' awareness of antibiotic use and is the first step toward halting the alarming rise in resistance.

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**Table 1. Demographic characteristics of students**

Variables	MBBS Students (339) N (%)	Nursing Students (171) N (%)
Age (Years)		
18-20	170 (50.1)	56 (32.74)
21-23	154 (45.4)	103(60.23)
>24	15 (4.4)	12(7.01)
Sex		
Male	242(71.4)	0 (0)
Female	97(28.6)	171 (100)
Area of residence		
Bihar	135(39.8)	80(46.78)
Rajasthan	52 (15.1)	18 (10.52)
Uttar Pradesh	36 (10.6)	12 (7.01)
West Bengal	16(5.0)	20(11.69)
Delhi	7 (2.06)	18 (10.52)
Kerala	23 (6.8)	3 (1.75)
Other states	70 (20.64)	20 (11.73)
Academic Year		
First Year	110(32.4%)	63(36.85%)
Second Year	82 (24.1%)	42 (24.5%)
Third Year	78 (23.1%)	33 (19.29%)
Fourth Year	69 (20.4%)	33 (19.29%)

**Table 2. Knowledge of MBBS students about antibiotics resistance (N=339)**

Question	Yes N (%)	No N (%)	Don't Know N (%)	Median (IQR)
Amoxicillin is an antibiotic	331 (97.64)	0 (0)	8 (2.36)	1 (0)
Paracetamol is an antibiotic	38 (11.20)	296 (87.32)	5 (1.48)	1 (0)
Antibiotics are useful for bacterial infections	329 (97.05)	9 (2.65)	1 (0.30)	1 (0)
Viral infection with fever should be treated with antibiotics	49 (14.45)	249 (73.45)	41 (12.10)	1 (1)
Multiple antibiotics should be co-administered for the faster resolution of the infection.	77 (22.71)	189 (55.75)	73 (21.54)	1 (1)
Newer antibiotics are better compared to old antibiotics	266 (78.46)	39 (11.50)	34 (11.04)	1 (0)
Unnecessary use of antibiotics is dangerous for health	306 (90.27)	25 (7.37)	8 (2.36)	1 (0)
Antibiotics can cause secondary infections after killing good bacteria in our body	277 (81.71)	27 (7.97)	35 (10.32)	1 (0)
Antibiotics are safer drugs they do not cause any side effects?	35 (10.33)	278 (82.00)	26 (7.67)	1 (0)
Antibiotic resistance is a phenomenon in which a bacterium loses its sensitivity to an antibiotic	302 (89.08)	32 (9.44)	5 (1.48)	1 (0)
Improper use of antibiotics can cause antibiotic resistance	318 (93.80)	8 (2.36)	13 (3.84)	1 (0)
If bacteria are resistant to antibiotic, it can be very difficult to treat the infection they cause	326 (96.16)	8 (2.36)	5 (1.48)	1 (0)

**Table 3. Attitude of MBBS students about antibiotics resistance (N = 339)**

Question	SA N (%)	A N (%)	N N (%)	D N (%)	SD N (%)	Median (IQR)
Do you think antibiotic resistance is a public health problem and potential threat to mankind?	223 (65.78)	103 (30.38)	13 (3.84)	0 (0)	0 (0)	5 (1)
Do you think overuse of antibiotics results in antibiotic resistance?	217 (64.01)	107 (31.57)	8 (2.35)	4 (1.17)	3 (0.90)	5 (1)
Do you think skipping one or two doses does not contribute to the development of antibiotic resistance?	13 (3.84)	48 (14.16)	126 (37.16)	114 (33.64)	38 (11.20)	3 (1)
Do you agree antibiotics should be prescribed for all type of infections?	2 (0.60)	14 (4.13)	44 (12.98)	190 (56.05)	89 (26.24)	4 (1)
Do you think antibiotic use without a doctor's prescription is safe?	15 (4.43)	8 (2.35)	17 (5.01)	153 (45.14)	146 (43.07)	4 (1)
Do you think that taking fewer antibiotics than prescribed is more beneficial?	9 (2.65)	32 (9.44)	75 (22.12)	151 (44.55)	72 (21.24)	4 (1)
Do you think taking many antibiotics produce the better result than one antibiotic?	9 (2.65)	35 (10.33)	101 (29.80)	138 (40.70)	56 (16.52)	4 (1)
Do you think the effectiveness of treatment would be reduced if a full course of antibiotics was not completed?	135 (39.83)	142 (41.88)	36 (10.62)	15 (4.42)	11 (3.25)	4 (1)
Do you think it is better to stop taking antibiotic when symptoms are improved?	14 (4.12)	47 (13.87)	62 (18.28)	130 (38.36)	86 (25.36)	4 (2)
Do you think the leftover antibiotics can be saved and used for the similar symptoms without consulting the physician?	3 (0.88)	17 (5.01)	49 (14.45)	139 (41.00)	131 (38.66)	4 (1)

SA: strongly agree, A: agree, N: neutral, D: disagree, SD: strongly disagree

**Table 4. Practices of MBBS students about antibiotics resistance (N = 339)**

Question	Always N (%)	Often N (%)	Sometimes N (%)	Seldom N (%)	Never N (%)	Median (IQR)
Do you prefer to take antibiotic when you have cough and sore throat?	9 (2.65)	57 (16.83)	129 (38.06)	90 (26.54)	54 (15.92)	3 (1)
Do you consult a doctor before starting an antibiotic?	144 (42.47)	108 (31.88)	68 (20.05)	15 (4.43)	4 (1.17)	4 (2)
Do you read the instructions in the package insert carefully before taking antibiotics?	114 (33.63)	95 (28.03)	75 (22.12)	35 (10.33)	20 (5.89)	4 (2)
Have you ever advised antibiotic use to someone?	13 (3.82)	30 (8.85)	111 (32.75)	64 (18.88)	121 (35.70)	4 (2)
Do you finish the full course of antibiotic treatment?	167 (49.26)	105 (30.99)	29 (8.55)	22 (6.49)	16 (4.71)	4 (1)
Did you change the dose during antibiotic treatment?	9 (2.65)	17 (5.01)	52 (15.33)	73 (21.54)	188 (55.47)	5 (1)
Did you switch antibiotics during the course of treatment?	4 (1.17)	25 (7.37)	62 (18.28)	66 (19.50)	182 (53.68)	5 (2)
Do you keep leftover antibiotics at home in case of future need?	34 (10.02)	101 (29.80)	96 (28.33)	34 (10.02)	74 (21.83)	3 (2)

**Table 5. Knowledge of Nursing students about antibiotics resistance (N=171)**

Question	Yes N (%)	No N (%)	Don't know N (%)	Median (IQR)
Amoxicillin is an antibiotic	170 (99.42)	1 (0.58)	0 (0)	1 (0)
Paracetamol is an antibiotic	21 (12.28)	150 (87.72)	0 (0)	1 (0)
Antibiotics are useful for bacterial infections	168 (98.24)	3 (1.76)	0 (0)	1 (0)
Viral infection with fever should be treated with antibiotics	75 (43.85)	91 (53.22)	5 (2.93)	1 (1)
Multiple antibiotics should be co-administered for the faster resolution of the infection.	52 (30.40)	96 (56.14)	23 (13.46)	1 (1)
Newer antibiotics are better compared to old antibiotics	88 (51.46)	45 (26.31)	38 (22.23)	1 (1)
Unnecessary use of antibiotics is dangerous for health	146 (85.38)	21 (12.28)	4 (2.34)	1 (0)
Antibiotics can cause secondary infections after killing good bacteria in our body	120 (70.17)	39 (22.80)	12 (7.03)	1 (1)
Antibiotics are safer drugs they do not cause any side effects?	44 (25.73)	124 (72.52)	3 (1.75)	1 (1)
Antibiotic resistance is a phenomenon in which a bacterium loses its sensitivity to an antibiotic	143 (83.63)	17 (9.94)	11 (6.43)	1 (0)
Improper use of antibiotics can cause antibiotic resistance	163 (95.34)	4 (2.33)	4 (2.33)	1 (0)
If bacteria are resistant to antibiotic, it can be very difficult to treat the infection they cause	160 (93.56)	6 (3.51)	5 (2.93)	1 (0)

**Table 6. Attitude of Nursing students about antibiotics resistance (N = 171)**

Question	SA N (%)	A N (%)	N N (%)	D N (%)	SD N (%)	Median (IQR)
Do you think antibiotic resistance is a public health problem and potential threat to mankind?	66 (38.60)	88 (51.46)	11 (6.43)	1 (0.59)	5 (2.94)	4 (1)
Do you think overuse of antibiotics results in antibiotic resistance?	117 (68.43)	44 (25.73)	6 (3.50)	4 (2.34)	0 (0)	5 (1)
Do you think skipping one or two doses does not contribute to the development of antibiotic resistance?	27 (15.80)	39 (22.80)	23 (13.45)	66 (38.59)	16 (9.36)	3 (2)
Do you agree antibiotics should be prescribed for all type of infections?	5 (2.92)	39 (22.80)	14 (8.18)	72 (42.11)	41 (23.99)	4 (2)
Do you think antibiotic use without a doctor's prescription is safe?	12 (7.01)	37 (21.64)	10 (5.85)	57 (33.33)	55 (32.17)	4 (3)
Do you think that taking fewer antibiotics than prescribed is more beneficial?	23 (13.45)	17 (9.95)	16 (9.35)	66 (38.60)	49 (28.65)	4 (2)
Do you think taking many antibiotics produce the better result than one antibiotic?	11 (6.43)	28 (16.37)	14 (8.18)	60 (35.09)	58 (33.93)	4 (2)
Do you think the effectiveness of treatment would be reduced if a full course of antibiotics was not completed?	75 (43.85)	61 (35.68)	6 (3.51)	22 (12.86)	7 (4.10)	4 (1)
Do you think it is better to stop taking antibiotic when symptoms are improved?	10 (5.85)	15 (8.77)	15 (8.77)	84 (49.13)	47 (27.48)	4 (1)
Do you think the leftover antibiotics can be saved and used for the similar symptoms without consulting the physician?	3 (1.76)	8 (4.68)	7 (4.09)	80 (46.78)	73 (42.69)	4 (1)

SA: strongly agree, A: agree, N: neutral, D: disagree, SD: strongly disagree

**Table 8. Odds ratios (ORs) of knowledge, attitudes and practices of MBBS students in relation to antibiotic resistance**

Variables	Knowledge level		Attitudes level		Practices level	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Sex						
Female	.994 (.647-1.527)	.978	1.132 (1.021-1.254)	.018*	1.137 (.995-1.300)	.060
Male	1		1		1	
Age group (yrs.)						
17-20	.613 (.209-1.796)	.372	.941 (.736-1.205)	.632	1.099 (.798-1.514)	.563
21-23	1.133 (.391-3.287)	.818	1.013 (.795-1.291)	.918	1.012 (.739-1.388)	.939
≥ 24	1		1		1	
Academic Year						
First	.524 (.294-.935)	.029*	.980 (.855-1.124)	.776	1.128 (.944-1.348)	.185
Second	.321 (.172-.600)	.000**	.842 (.729-.974)	.020*	1.104 (.915-1.333)	.302
Third	.714 (.384-1.328)	.288	.813 (.705-.938)	.004*	1.057 (.879-1.273)	.554
Fourth	1		1		1	

OR: Odds ratio, \*p-value <0.05, \*\*p-value <0.01

**Table 9. Correlation between knowledge score, attitude score, and practice score in MBBS students**

Variables	Correlation coefficient	p-value
Knowledge - Attitudes	.347	.000**
Knowledge - Practices	.123	.023*
Attitudes - Practices	.295	.000**

\*p-value <0.05, \*\*p-value <0.01

**Table 10. Odds ratios (ORs) of knowledge, attitudes and practices of nursing students in relation to antibiotic resistance**

Variables	Knowledge level		Attitudes level		Practices level	
	OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p-value
<b>Age group (yrs.)</b>						
17-20	1.716 (.551-5.346)	.351	2.734 (.876-8.530)	.083	.935 (.280-3.122)	.914
21-23	2.006 (.663-6.068)	.217	3.061 (1.025-9.139)	.045*	.884 (.278-2.811)	.834
≥ 24	1		1		1	
<b>Academic Year</b>						
First	.219 (.090-.534)	.001**	1.930 (.911-4.086)	.086	.134 (.054-.336)	.000**
Second	.185 (.068-.503)	.001**	2.652 (1.180-5.959)	.018*	.101 (.038-.270)	.000**
Third	.224 (.081-.618)	.004**	3.211 (1.339-7.701)	.009**	.106 (.038-.298)	.000**
Fourth	1		1		1	

OR: Odds ratio, \*p-value <0.05, \*\*p-value <0.01

**Table 11. Correlation analysis between knowledge score, attitude score, and practice score in Nursing students**

Variables	Correlation coefficient	p-value
Knowledge - Attitudes	.127	.099
Knowledge - Practices	.324	.000**
Attitudes - Practices	.201	.008**

\*p-value <0.05, \*\*p-value <0.0