Antimicrobial resistance - are future prescribers aware? A study among undergraduate medical students in Kumaon region

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ABSTRACT

Background: According to the WHO, antimicrobial resistance (AMR) occurs when bacteria, viruses, fungi, and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness, and death and is a global issue and measures to halt this is the need of the hour. **Aims and Objectives:** This study aims at identifying awareness as well as knowledge, attitude, perception, and practice regarding AMR and antibiotic use among medical undergraduate students, so to get insight and take appropriate actions to enhance their knowledge that will help in reducing AMR as they are the future prescribers. **Materials and Methods:** A descriptive cross-sectional study was conducted among 483 undergraduate medical students enrolled in government medical college, Haldwani. A pretested, semi structured questionnaire was designed to collect data from participants through Google forms regarding sociodemographic profile, and behavior of the participants regarding antibiotic use which comprises: Attitude, perceptions, and practice. **Results:** Majority of study participants have heard about AMR before (97%) of which most of them got information about antibiotic resistance by web/internet (35%). Majority of study participants were aware (>90%) of phenomenon of antibiotic resistance, 98.9% of them were correctly able to identify Amoxicillin and Penicillin as antibiotics, most of them had correct knowledge about role of antibiotics. Majority (83.6%) of participants take antibiotic only after the prescription of doctor, 78.9% of them reported use of antibiotics in the last year. **Conclusion:** A fair good amount of awareness, knowledge, attitude, perception, and practice regarding AMR and its use was found among study participants. Still, there is scope of improvement in it that can be addressed through giving more emphasis on this in undergraduate teaching curriculum.

Key words: Antimicrobial resistance; Knowledge; Attitude; Practice and awareness

INTRODUCTION

The discovery of antibiotics found to be one of the most significant medical achievements of the twentieth century. Antibiotics have saved millions of lives and enabled important medical procedures, including surgery and cancer chemotherapy.[1] Although it has reduced deaths from acute respiratory infections, diarrheal diseases, measles, AIDS, malaria, and tuberculosis account for more than 85% of the mortality from infection worldwide,[2] these days irrational use of antibiotics has been increased many folds that lead to antimicrobial resistance (AMR).[2]

AMR occurs when bacteria, viruses, fungi, and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk

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of disease spread, severe illness, and death as said by the WHO.[3]

Resistance increase the costs of treatment as it reduces the efficacy of earlier drug and have to switch to newer expensive drug or treatment, thus impact livelihoods and lives and threatens to undermine the effectiveness of health delivery programmes.[3] Furthermore, the pipeline of new drugs is running dry and the incentives to develop new antimicrobials to address the global problems of drug resistance are weak. So considering this as a major public health issue the World Health Assembly Resolution of 1998 urged Member States to develop measures to for appropriate use of antimicrobials, to prohibit the dispensing of antimicrobials without the prescription of a qualified health-care professional by formulating strict laws. For the same, world health day 2011 theme was antibiotic resistance: No action today, no cure tomorrow, along with this annually WHO held world antimicrobial awareness week since 2015, for which the slogan was "Antibiotics: Handle with Care" but that is changed to "Antimicrobials: Handle with Care" in 2020 to reflect the broadening scope of drug resistant infections.[4] In many studies, it has been shown that the medical students, future prescribers are not well aware of antibiotic resistance and not fully trained for safer antibiotic prescribtion.[5]

Aims and objectives

The study aimed at estimating awareness as well as knowledge, attitude, perception, and practice regarding AMR and antibiotic use among medical undergraduate students.

MATERIALS AND METHODS

The study was a descriptive cross-sectional study conducted among undergraduate medical students of Govt. Medical College, Haldwani, during February–March 2021. The study instrument consisted of questionnaire containing questions related to socio- demographic profile, and behavior of the participants regarding antibiotic resistance and its use which comprises: Attitude, perceptions, and practice adopted from the previous studies.[5,6] Awareness and knowledge about role of drugs were assessed using 5-point Likert scale. Questionnaire was entered into Google forms and its link circulated to undergraduate students through WhatsApp class group. The nature of the study and its consequences along with free voluntariness to participate or not were explained during online lecture for each class. The ethical clearance was obtained from Institutional Ethics Committee, Govt. Medical College, Haldwani with 571/GMC/IEC/2020/Reg. No. 531/IEC/R-17-2-2020. Strict privacy confidentiality was

Table 1: Awareness of the study population (batchwise) towards antimicrobials resistance (n=483)

Awareness	Strongly agree (%)					Agree (%)					Neutral (%)					Disagree (%)					Strongly disagree (%)				
	I	II	III	Final	Total	I	II	III	Final	Total	I	II	III	Final	Total	I	II	III	Final	Total	I	II	III	Final	Total
Antibiotic resistance is a phenomenon for which a bacterium loses its sensitivity to an antibiotic.	66 (23.4)	78 (27.7)	82 (29.1)	56 (19.9)	282 (58.3)	43 (25)	46 (26.7)	49 (28.5)	34 (19.8)	172 (36)	06 (31.6)	01 (5.3)	02 (10.5)	10 (52.6)	19 (3.9)	04 (57.1)	00 (0)	00 (0)	03 (42.9)	7 (1.4)	00 (0)	00 (0)	02 (66.7)	01 (33.3)	3 (0.6)
Misuse of antibiotics can lead to a loss of sensitivity of an antibiotic to a specific pathogen.	47 (17.8)	74 (28)	84 (31.8)	59 (22.3)	264 (54.6)	58 (31.2)	44 (23.7)	46 (24.7)	38 (20.4)	186 (38.5)	10 (37)	06 (22.2)	05 (18.5)	06 (22.2)	27 (5.5)	04 (66.7)	01 (16.7)	00 (0)	01 (16.7)	06 (1.2)	00 (0)	00 (0)	00 (0)	00 (0)	00
If symptoms improve before it is completed the full course of antibiotic, you can stop taking it	00 (0)	02 (25)	03 (37.5)	03 (37.5)	08 (1.6)	10 (27)	08 (21.6)	11 (29.7)	08 (21.6)	37 (7.6)	14 (29.8)	17 (36.2)	05 (10.6)	11 (23.4)	47 (9.7)	38 (21.3)	54 (30.3)	46 (25.8)	40 (22.5)	178 (36.8)	57 (26.8)	44 (20.7)	70 (32.9)	42 (19.7)	213 (44)

assured. Simple descriptive statistics was used to generate frequencies, percentages, and proportions using MS Excel.

RESULTS

Majority of study participants have heard about AMR before (97%).

Most of study participants got information antibiotic resistance by web/internet (34.5%) whereas only 8.2% got this information through television (Figure 1).

Majority of study participants were aware (>90%) that "antibiotic resistance is a phenomenon for which a bacterium loses its sensitivity to an antibiotic," similarly most of them were aware (>90%) that "misuse of antibiotics can lead to a loss of sensitivity of an antibiotic to a specific pathogen" also most of them were aware (>80%) that "one should took full course of antibiotic even if symptoms improved." Furthermore, awareness regarding antibiotics was more among third and final year students in comparison to 1st and 2nd year students (Table 1).

Majority of study participants were correctly able to identify Amoxicillin and Penicillin as antibiotics (98.9%), while aspirin and paracetamol were incorrectly identified as antibiotics by 5.4% and 9.1% of study participants,
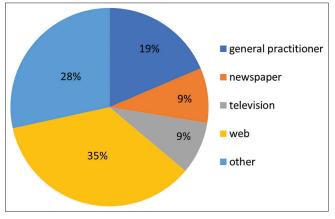

Figure 1: Sources of information about AMR (n=468)

respectively. Students in higher years were able to recognize antibiotics better than that of earlier years (Table 2).

Most of study participants had knowledge that "antibiotics are useful for bacterial infections" (>95%), "antibiotics can cause allergic reactions" (>90%), approx. four- fifth of them had knowledge that "antibiotics can kill "good bacteria" present in our organism" (>80%), approx. three- fourth of them had knowledge that "antibiotics are not useful for viral infections and antibiotics can cause secondary infections after killing good bacteria present in our organism," approx. half of them had knowledge that "antibiotics are not indicated to reduce any kind of pain and inflammation." The knowledge regarding usefulness of antibiotics was more in those students that are in higher years (Table 3).

It is good to know that 80.7% participants do not take antibiotic for fever, 67.8% do not stop antibiotics when they feel better, a majority (83.6%) of participants take antibiotic only after the prescription of doctor, while only 21.7% believe in taking leftover antibiotics at home without consulting a doctor. There is a satisfactory number of participants (64.6%) who just do not take antibiotic therapy after a simple doctor call, without a proper medical examination. The use of antibiotics was seen more among students of 1st and 2nd year (Table 4).

Most of study participants reported use of antibiotics in the last year (78.9%), although 1–2 times approx. by two-third of them (65.6%), 23.9% of them used antibiotics 3–5 times and 10.5% of them used antibiotic >5 times in the previous year.

DISCUSSION

Our study provides useful information regarding the knowledge, attitudes, practices, and awareness of medical students with respect to antibiotic resistance and usage, which may be used to plan suitable educational interventions aiming at improving the antimicrobial

Table 2: Knowledge of study participants (batch wise) regarding antibiotics identification (n=483)														
Knowledge	Yes (%)					No (%)					Don't Know (%)				
	I	II	III	Final	Total	I	II	III	Final	Total	I	II	III	Final	Total
Penicillin or Amoxicillin are antibiotics	117 (24.4)	123 (25.7)	135 (28.3)	103 (21.6)	478 (98.9)	00 (0)	1 (100)	00 (0)	00 (0)	1 (0.2)	02 (50)	01 (25)	00 (0)	01 (25)	4 (.82)
Aspirin is an antibiotic	12 (46.2)	01 (3.8)	05 (19.3)	08 (30.7)	26 (5.4)	98 (22.5)	122 (28.2)	124 (28.5)	90 (20.8)	434 (89.8)	09 (39.1)	02 (8.7)	06 (26.1)	06 (26.1)	23 (4.76)
Paracetamol is an antibiotic	18 (40.9)	03 (6.8)	08 (18.2)	15 (34.1)	44 (9.1)	95 (22.3)	121 (28.3)	127 (29.7)	84 (19.7)	427 (88.4)	06 (50)	01 (8.3)	00 (0)	05 (41.7)	12 (2.4)

Table 3: Knowledge of study participants (batch wise) on antibiotics role and side effects (n=483)

Knowledge	Strongly agree (%)					Agree (%)					Neutral (%)					Disagree (%)					Strongly disagree (%)				
	I	II	III	Final	Total	I	II	III	Final	Total	I	II	III	Final	Total	I	II	III	Final	Total	I	II	III	Final	Total
Antibiotics are useful for bacterial infections (e.g. Tuberculosis)	68 (21.9)	83 (26.7)	89 (28.6)	71 (22.8)	311 (64.3)	43 (27.9)	39 (25.3)	45 (29.2)	27 (17.5)	154 (31.8)	03 (33.3)	03 (33.3)	00 (0)	03 (33.3)	9 (1.86)	03 (42.9)	00 (0)	01 (14.3)	03 (42.9)	7 (1.44)	02 (100)	00 (0)	00 (0)	00 (0)	2 (0.41)
Antibiotics are useful for viral infections (e.g. flu).	03 (10.7)	15 (53.6)	06 (21.4)	04 (14.3)	28 (5.79)	11 (25)	16 (36.4)	13 (29.5)	04 (9.1)	44 (0.91)	11 (22.9)	14 (29.2)	11 (22.9)	12 (25)	48 (9.93)	27 (18.2)	39 (26.4)	45 (30.4)	37 (25)	148 (30.6)	67 (31.2)	41 (19.1)	60 (27.9)	47 (21.9)	215 (44.5)
Antibiotics are indicated to reduce any kind of pain and inflammation.	06 (37.5)	01 (6.3)	03 (18.8)	06 (37.5)	16 (3.31)	34 (35.1)	19 (19.6)	16 (16.5)	28 (28.9)	97 (20.08)	28 (30.1)	30 (32.3)	19 (20.4)	16 (17.2)	93 (19.3)	30 (19.4)	44 (28.4)	51 (32.9)	30 (19.4)	155 (32.09)	21 (17.2)	31 (25.4)	46 (37.7)	24 (19.7)	122 (25.3)
Antibiotics can kill "good bacteria" present in our organism.	33 (20.5)	43 (26.7)	48 (29.8)	37 (23)	161 (33.3)	55 (21.8)	71 (28.2)	72 (28.6)	54 (21.4)	252 (52.1)	19 (43.2)	09 (20.5)	09 (20.5)	07 (15.9)	44 (9.1)	10 (47.6)	02 (9.5)	04 (19)	05 (23.8)	21 (4.34)	02 (40)	00 (0)	02 (40)	01 (20)	05 (1.03)
Antibiotics can cause secondary infections after killing good bacteria present in our organism	18 (14)	40 (31)	39 (30.2)	32 (24.8)	129 (26.7)	50 (21.6)	63 (27.3)	76 (32.9)	42 (18.2)	231 (47.8)	32 (40.5)	16 (20.3)	12 (15.2)	19 (24.1)	79 (16.3)	18 (47.4)	05 (13.2)	06 (15.8)	09 (23.7)	38 (7.86)	01 (16.7)	01 (16.7)	02 (33.3)	02 (33.3)	06 (1.24)
Antibiotics can cause allergic reactions.	31 (19)	44 (27)	50 (30.7)	38 (23.3)	163 (33.7)	72 (25.8)	74 (26.5)	79 (28.3)	54 (19.4)	279 (57.7)	14 (37.8)	07 (18.9)	05 (13.5)	11 (29.7)	37 (7.6)	1 (50)	00 (0)	01 (50)	00 (0)	02 (0.41)	1 (50)	00 (0)	00 (0)	01 (50)	02 (0.41)

Table 4: Attitudes and perceptions of study participants (batch wise) toward antibiotics resistance (n=483)

Attitudes and perceptions	Yes (%)					No (%)				
	I	II	III	Final	Total	I	II	III	Final	Total
Do you usually take antibiotic for cold or sore throat	26 (26.8)	21 (21.6)	32 (33)	18 (18.6)	97 (19.1)	93 (24.1)	104 (26.9)	103 (26.7)	86 (22.3)	386 (79.9)
Do you take antibiotic for fever?	34 (36.6)	16 (17.2)	23 (24.7)	20 (21.5)	93 (19.3)	85 (21.8)	109 (27.9)	112 (28.7)	84 (21.5)	390 (80.7)
Do you usually stop taking antibiotic when you start feeling better	46 (29.5)	43 (27.6)	33 (21.2)	34 (21.8)	156 (32.2)	73 (22.3)	82 (25.1)	102 (31.2)	70 (21.4)	327 (67.8)
Do you take antibiotic only when prescribed by the doctor?	100 (24.8)	105 (26)	111 (27.5)	88 (21.8)	404 (83.6)	19 (24.1)	20 (25.3)	24 (30.4)	16 (20.3)	79 (16.4)
Do you keep leftover antibiotics at home because they might be useful in the future?	61 (23)	65 (24.5)	83 (31.3)	56 (21.1)	265 (54.8)	58 (26.6)	60 (27.5)	52 (23.9)	48 (22)	218 (45.2)
Do you use leftover antibiotics when you have cold, sore throat or flu without consulting your doctor?	23 (21.9)	26 (24.8)	33 (31.4)	23 (21.9)	105 (21.7)	96 (25.4)	99 (26.2)	102 (27)	81 (21.4)	378 (78.3)
Can you buy antibiotics without a medical prescription?	38 (23.3)	41 (25.2)	48 (29.4)	36 (22.1)	163 (33.7)	81 (25.3)	84 (26.3)	87 (27.2)	68 (21.3)	320 (66.3)
Have you ever started an antibiotic therapy after a simple doctor call, without a proper medical examination?	35 (20.5)	46 (26.9)	57 (33.3)	33 (19.3)	171 (35.4)	84 (26.9)	79 (25.3)	78 (25)	71 (22.8)	312 (64.6)

prescription and use. In our study, high rate of respondents (89.8%) correctly identify that aspirin is not an antibiotic which is in line with previous studies Nisabwe et al.,[7] and Scaioli et al.[8] In accordance with knowledge regarding antibiotic usage, good knowledge 75% participants know that antibiotics are not useful for viral infections (e.g. flu) which is similar to previous studies Huang et al., Nisabwe et al., Scaioli et al., Khan et al., Sharma et al., and Padmanabha et al.,[6,7-11] in a study conducted by Ganesh et al., (2014)[12] to assess knowledge of final year students in comparison to paramedical students and non-medical students found good knowledge among final year students. In Gupta et al.,[13] found that 2nd year students more aware about antibiotic resistance than 1st year that is similar to present study that also showed more awareness among students belong to 3rd and final year while other pervious study reported different results that more than 60% of their participants believed that antibiotics should be prescribed for viral illnesses.[14] Regarding source of information, majority of the participants (83%) heard about antibiotic resistance during the course of degree and by web platform (34.5%) which is less than previous study by Nisabwe et al., (2020),[7] and majority of them (94.3%) aware about antibiotic resistance and what will occur if miss use of antibiotic happen which is in line with Scaioli et al., (2015).[8] In the view of attitude toward antibiotic resistance 66.3% believe to take medical practitioner's consultation before taking antibiotics which is relatively less than previous studies as in Padmanabha et al.,[11] it was 70.29%, in Sharma et al.,[10] it was 84%, it shows 90% in Khan et al.,[9] in Scaioli et al.,[8] it was 83%, 71% in Suaifan et al.,[15] while in Nisabwe et al.,[7] depict lesser interest (51.1%) of participants for consulting medical practitioner, in Ganesh et al., (2014)[12] showed good attitude of final year

students regarding antibiotics resistance in comparison to paramedical students. On taking antibiotics during fever, our study shows more than three-fourth (80%) respondents agree that antibiotics should be taken in fever, which is different from the previous studies as in Nisabwe et al.,[7] it was only 15% participants and in Scaioli et al.,[8] only 19% participants believe the same while in Khan et al.,[9] shows that 60% of participants has similar believes. In a study done by Gupta et al.,[5] showed use of antibiotics more frequent by first and 2nd year students than that of final year students. On leftover medication to be used in future, in our study around 54% participants believe so which is in line with previous studies as in Nisabwe et al.,[7] it was 46%, 37% found in Scaioli et al.,[8] while not similar with previous studies as in Padmanabha et al.,[11] showed that only 10% participants believe so, it was found to be 18% in Sharma et al.[10]

CONCLUSION

Our study gives insight about knowledge, attitude, practice, and awareness regarding antibiotic resistance among medical students of medical institution of Kumaon region. A fair good amount of awareness, knowledge, attitude, perception, and practice regarding AMR and its use was found among study participants. Still, there is scope of improvement in it that can be addressed through giving more emphasis on this in undergraduate teaching curriculum.

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