

KNOWLEDGE, ATTITUDE AND PRACTICE REGARDING THE PROPER USE, RISKS
AND RESISTANCE OF ANTIBIOTICS AMONG UNDERGRADUATE LEVEL MEDICAL
AND HEALTH SCIENCES STUDENTS IN SANA'A, YEMENMaged Alwan Noman^{1,2}, Mahmoud Mahyoob Alburyhi^{1*}, Abdalwali Ahmed Saif¹¹Professor Dr. of Pharmaceutics and Industrial Pharmacy, Department of Pharmaceutics and Industrial Pharmacy,
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Faculty of Pharmacy, Sana'a University, Sana'a, Yemen. DOI: <https://doi.org/10.5281/zenodo.17813257>**How to cite this Article:** Maged Alwan Noman^{1,2}, Mahmoud Mahyoob Alburyhi^{1*} and Abdalwali Ahmed Saif¹ (2025).
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ABSTRACT

Background: Antibiotics (ABx) are chemical substances produced by living organisms, such as bacteria and fungi, or produced synthetically, and are used to inhibit the growth or kill bacteria. Antibiotic Resistance (ABR) occurs when bacteria change over time and no longer respond to medicines. **Objectives:** To Assess the Sociodemographic characteristics, Knowledge, Attitude and Practice levels among Medical and Health Sciences Students toward Proper use of ABx and the Risks of ABR in Sana'a, Yemen. **Methods:** The study is a descriptive cross-sectional survey of Medical and Health Sciences Students of Al-Saeeda University in Sana'a, Yemen. The sample size is 377 respondents, selected randomly from the site during seven weeks from the 11th of February 2025. Electrical self-administered questionnaire was used to collect Socio-demographic, Knowledge, Attitude and Practice-level data on proper use of ABx and the risks of ABR, with the results analyzed using SPSS program version 24. **Results:** Most of the Medical and Health Sciences of Al-Saeeda University, Sana'a, Yemen. have an 80.4% Knowledgeable, have high positive attitude 78.4% and Practice 79.3% towards proper use of ABx and the risks of ABR. Most of the students were female, with main age 19 years old, single, and have an intermediate-level family income. **Conclusion:** Majority of the respondent were knowledgeable, had positive attitude and practical towards proper use of ABx and risks of ABR.

KEYWORDS: Knowledge, Attitude, Practice, Antibiotic, Antibiotic resistance.**INTRODUCTION**

Prescribing medications is a challenging and essential practice that requires constant monitoring, evaluation, and adjustment. Additionally, it is based on the prescriber's expertise, knowledge of medications, and comprehension of clinical pharmacology concepts. ABx are drugs used to treat various local and systemic illnesses because they inhibit the growth of or destroy microbes. ABx have significantly lowered morbidity and death rates due to infectious diseases.^[1] The discovery of ABx was a major scientific revolution in the medical field that contributed to controlling and managing infectious diseases. The antibiotic's preventive and curable use helped improve patient health.^[2] However,

developing resistant microorganisms seriously reduces their effectiveness.^[3]

Antibiotics once coined as the 'magic bullet', are now rendered futile to fight bacterial infections as Antibiotic resistance (ABR) has emerged as a global threat to public health. Inappropriate and rampant use of such invaluable lifesaving drugs is among the key factors for the rapid development of superbugs and subsequent treatment failures with increased mortality rates.^[4] This phenomenon is nowadays affecting public health dramatically on the global level. It is estimated that at least every 10 min a patient dies in the USA or Europe

because of fatal infectious diseases caused by ABx resistant bacteria.^[4]

In 2019, approximately 1.27 million deaths globally were attributed to bacterial resistance, which is the main subset of ABR.^[5]

Antibiotics (ABx): Are chemical substances produced by living organisms, such as bacteria and fungi, or produced synthetically, and are used to inhibit the growth or kill bacteria.^[1]

Pharmaceutical Scientists and Importance of Antibiotics in Healthcare^[6-108]

Antibiotic Resistance (ABR): occurs when bacteria 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.^[1]

Antibiotics should be used according to a therapeutic regimen and well- thought -out plans in accordance with the user guide. For each antibiotic, the preformulation, formulation, stability, study of stability in the pharmaceutical market, method of preserving the drugs, and conditions for preserving the drug must be taken into consideration first. Antibiotic require pharmacokinetic parameters study to be linked during manufacturing, when prescribing the drugs and when dispensing the drug. antibiotics require community awareness and education regarding use.

Antibiotics are risks if they are used randomly and not according to the rules of use, safety, and effectiveness. Antibiotics may be resistance from microbes and thus will not provide therapeutic benefits, but rather increase the problem of treatment because patients do not benefit from treatment. Therefore, antibiotics require scientific knowledge among doctors, pharmacists, and the health care team regarding prescribing of use, indications for use, the risk of randomness, and the culture of dealing with antibiotic resistance. There must be a relationship between antibiotics and a study to test effectiveness by linking pharmacokinetic parameters and measure MIC in sensitivity test of microorganism to antibiotics.

Antibiotics or antibacterials from natural and synthetic sources should be treated in accordance with good pharmaceutical industry standards and good pharmacy practice to prevent any resistance to antibiotics or failure in useful in treatment of patients. There must be collaboration on antibiotic information between the healthcare team of doctors, pharmacists, medical laboratories, clinical pharmacists, therapeutic field and pharmaceutical care.

Antibiotics have the specifics of manufacturing, preserving, storage, marketing, prescribing and dispensing. So, they must have in academic programs a specific curriculum in which the academic vocabulary is defined and in which the outputs of medical faculties are

qualified in a way that serves society in preventing the risk of antibiotic resistance.

Justification

This study was done because there are no previous studies among Students of Al-Saeeda University. And very little is known about ABR in Yemen. Also, the Knowledge, Attitude and Practice towards the Proper use of ABx and the Risks of ABR can be improved simply by regular Health Education programs through lectures, Seminars Health exhibitions, Printed material, While the results of our study may be used by health planner and other medical or health sciences students.

Research Question

What is the Knowledge, Attitude and practice regarding the Proper use of ABx and the Risks of ABR among Pharmacy, Medical, Health Sciences and Dental Students of Al-Saeeda University, Sana'a, Yemen 2025?

OBJECTIVES

To Assess the Knowledge, Attitude and Practice of Health Sciences Students toward proper use of Antibiotics and the Risks of Antibiotic Resistance in Sana'a, Yemen.

METHODOLOGY

Descriptive Cross-sectional survey was in Al-Saeeda University that is Geographically located on the South-East region of Sana'a, Yemen. The Study population carried during the period from seven weeks period the second week of February 2025, The Study population was including all first, second, third, fourth- and fifth-years levels of Pharmacy, Medical, Medical laboratories, Midwifery, Nursing and Dental Students (N=3050), and exclusion non-medical specialties. Ethical approval and clearance were obtained from Al-Saeeda University Faculties of Health Sciences. Electronic consents were taken from each respondent, and data collection was based on confidence and privacy.

A total of 377 respondents were selected randomly, the sample size was calculated by using

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N} \right)} \quad Z = \text{z-score (1.96). } P = \text{prevalence (0.5). } e = \text{margin of error (5\%).}$$

N = Population size (3050), by substituting into the previous equation, the result was 342, 10% was added to the sample size case of non-respondents 342+35=377 respondents. The questionnaire was self-administrated and modified structured questionnaire^[109] which consist of four parts, (Socio-demographic characteristics, Knowledge level assessment questions, Attitude level assessment questions and barriers regarding ABx & ABR Knowlagent, Practical level assessment questions). Data was analyzed with (SPSS) Program Ver. 24, and the data was presented by using Tables.

RESULTS AND DISCUSSION

Results

The general levels of Knowledge, Attitude and Practice were shown by Scoring system that was calculated for each question as: two points will be scored for correct and complete answer, one point, will be scored for correct incomplete answer or don't know, zero point, will be scored for wrong answer. With a maximum obtainable correct score of 34 in the knowledge for each respondent, and categorized into two levels as following: Unknowledgeable ($< 70.0\%$ and it was in the study

19.6%), and Knowledgeable ($\geq 70.0\%$ and it was in the study 80.4%), With a maximum obtainable correct score of 22 in the attitude for each respondent, categorized into two levels as following: Negative ($< 65.0\%$ and it was in the study 21.6%) and Positive ($\geq 65.0\%$ and it was in the study 78.4%), With a maximum obtainable correct score of 24 in the practical for each respondent, categorized into two levels as following: (Un practical $< 70.0\%$ and it was in the study 20.7%) and practical ($\geq 70.0\%$ and it was in the study 79.3%).

Table 1: Frequency Distribution and Percentage of the Respondents by Socio-demographic Characteristics (n=377).

Questions	Frequency (NO.)	Percent (%)
Gender:		
Male	138	36.6
Female	239	63.4
Age: Mean (19) Std. Deviation (0.348).		
< 20 years old.	53	14.1
≥ 20 years old.	324	85.9
Marital Status:		
Single	327	86.8
Married	48	12.7
Other*	2	0.5
Place of birth:		
Urban	287	76.1
Rural	90	23.9
Habits:		
Cigarettes Smoking	28	7.4
Hookah Smoking	28	7.4
Khat chewing	92	24.4
Nonsmoker / non khat chewer	265	70.3
Family Income:		
High level	15	4
Intermediate level	245	65
Acceptable	89	23.6
Low level	28	7.4
Specialty:		
Pharmacy	148	39.3
Medicine and General Surgery	45	11.9
Medical Laboratory Sciences	71	18.8
Midwifery	30	8
Nursing	37	9.8
Dental	46	12.2
Academic level:		
1 st level	66	17.5
2 nd level	62	16.4
3 rd level	95	25.2
4 th level	79	21
5 th level	75	19.9

Table 1 shows most 239 (63.4%) of the respondent were female, 324 (85.9%) were over 20 years old, with mean age 19 years with a standard deviation of (0.348.), 327 (86.8%) were single, a majority, 287 (76.1%), were born in urban areas, 265 (70.3%) did not smoke or chew khat, 245 (65%) respondents report having an intermediate

income level, 148 (39.3%) respondents are studying Pharmacy, 95 (25.2%) respondents are in the third year.

Table 2: Frequency Distribution and Percentage of the Respondents by Knowledge about Proper Use of ABx and the Risks of ABR (n=377).

Questions	Frequency (NO.)	Percent (%)
ABx help you recover faster from common cold.		
Yes	236	62.6
No	125	33.2
I don't know	16	4.2
ABx often cause side effects such as diarrhea, stomach upset and intestinal disorder, or headaches.		
Yes	280	74.3
No	54	14.3
I don't know	43	11.4
overuse of ABx harm to normal flora of gut or skin.		
Yes	327	86.7
No	20	5.3
I don't know	30	8
ABR threat to human health.		
Yes	310	82.2
No	35	9.3
I don't know	32	8.5

Regarding whether ABx can help recover faster from the common cold, the majority of respondents, 236 (62.6%), answer 'yes', concerning the question about whether ABx often cause side effects such as diarrhea, stomach upset, intestinal disorders, or headaches, most respondents, 280 (74.3%), correctly state that ABx often

cause such side effects, regarding the harm caused by the overuse of ABx to the normal flora of the gut or skin, the majority 327 (86.7%) respondents correctly knowledge that overuse is harmful, as for ABR being a threat to human health, 310 (82.2%) respondents correctly recognize it as a serious threat, as shown in Table 2.

Table 3: Frequency Distribution and Percentage of the Respondents by Attitudes about ABx and ABR (n=377).

Questions	Frequency (NO.)	Percent (%)
Leftover ABx can be saved for future use or to give to someone else.		
Agree	58	15.4
Disagree	270	71.6
Neutral	49	13
Believe it's acceptable to use the same ABx for the same person or someone with similar symptoms without consulting a doctor.		
Agree	49	13
Disagree	288	76.4
Neutral	40	10.6
It's okay to get ABx from a doctor over the phone without a clinical examination.		
Agree	115	30.5
Disagree	186	49.3
Neutral	76	20.2
Believe you can take ABx based on a pharmacist's recommendation.		
Agree	195	51.7
Disagree	116	30.8
Neutral	66	17.5

As shown in Table 3 the majority of respondents 270 (71.6%) believe that leftover ABx should not be saved for future use or given to someone else. Furthermore, 288 (76.4%) respondents disagree with the idea of using the same ABx for oneself or another person with similar symptoms without consulting a doctor. When they were asked whether it is acceptable to obtain ABx from a doctor over the phone without a clinical examination, 186 (49.3%) respondents disagree. In Additionally, most

of the respondents 195 (51.7%) agree that it is acceptable to take ABx based on a pharmacist's recommendation.

Table 4: Frequency Distribution and Percentage of the Respondents by Practice about Proper Use of ABx and the Risks of ABR (n=377).

Questions	Frequency (NO.)	Percent (%)
Always follow the instructions for taking ABx.		
Yes	258	68.4
No	58	15.4
I can't remember	61	16.2
Take ABx according to the medical prescription.		
Yes	260	69
No	32	8.5
Sometimes	85	22.5
Follow all the doctor's instructions and guidelines for taking ABx.		
Yes	260	69
No	14	3.7
Rarely follow them	45	11.9
Rarely break them	58	15.4
How do respondents handle medical prescription for ABx.		
They stop taking the ABx when they feel better.	46	12.1
They change the ABx if they don't feel better right away	32	8.5
They take ABx as prescribed by the doctor or the pharmacist.	292	77.5
They repeat the prescription without going back to the doctor.	7	1.9

Table 4 show that most of respondents 258 (68.4%) report that they always follow instructions when taking ABx. In Additionally, 260 (69%) respondents say they take ABx based on a medical prescription. Regarding adherence to the doctor's instructions and guidelines for

ABx use, 260 (69%) respondents report full compliance. When they were asked how they handle medical prescriptions for ABx, 292 (77.5%) respondents said they take the ABx as prescribed by a doctor or pharmacist.

Table 5: Frequency and Percentage of the Respondents Among What is the Barrier That Prevent Respondents from Accessing Adequate Information about ABx and ABR (n=377).

Questions	Frequency (NO.)	Percent (%)
What is the barrier that prevent respondents from accessing adequate information about ABs and AMR.		
Lack in basic knowledge about microbiology.	146	38.7
Difficulty to understanding the mechanism of action of antibiotics.	136	36.1
Lack of knowledge about bacterial resistance.	131	34.7
Lack of educational resources.	111	29.4
Lack of practical training.	132	35
Unfamiliar language and lack of linguistic knowledge.	71	18.8
Not having enough time to read and study.	163	43.2
Other*	26	6.9

The survey results highlight several key barriers that hinder respondents' access to adequate information about ABx and ABR, with respondents allowed to choose more than one option. The most common barrier, reported by 163 (43.2%) respondents, is a lack of time to read and study. Additionally, 146 (38.7%) respondents cite a lack of basic knowledge in microbiology as a major challenge. Difficulty understanding the mechanism of action of ABx is also a significant issue for 136 (36.1%) respondents. Furthermore, 132 (35%) respondents report that a lack of practical training presents a notable barrier, while 131 (34.7%) respondents identify limited knowledge of ABR as a concern. A lack of educational resources is noted by 111 (29.4%) respondents as a challenge. In addition, 71 (18.8%) respondents point to unfamiliar language and insufficient linguistic knowledge as significant barriers. A smaller group of

respondents, 26 (6.9%) report other miscellaneous factors as barriers to accessing proper information on ABx and ABR. As shown in Table 5.

DISCUSSION

Study of knowledge, attitude and practice toward the proper use of ABx and the Risks of ABR among 377 Pharmacy, Medical, Laboratories, Midwifery, Nursing and Dental Students, at Al-Saeeda University, Sana'a, Yemen, were carried out. The study found that the majority of the respondents were generally highly knowledgeable, with a highly positive attitude and practice towards proper use of ABx and the risks of ABR. and this was line with many studies such as study carried out to assess the levels of knowledge, attitudes and practices pertaining to antibiotics use and resistance among the healthcare professional students (MBBS,

BDS, B.Pharm and B.Sc (Nursing) students of Andhra Pradesh, India show that majority of the students are aware of the antimicrobial resistance and its consequences. However, the students were found to have very casual attitude towards the use of antibiotics.^[110] Also study carried to assess knowledge, attitudes, and practices regarding antimicrobial use and resistance among a group of final-year pharmacy students and medical students at universities in Baghdad, Iraq show that, the students' level of knowledge was more than sufficient, but they need more education to improve their practice. Significant work still needs to be done to focus on improvements.^[111]

Across sectional study was carried in United Arabs Emirates aims to investigate medical students' knowledge, attitude and practice in relation to antibiotic use by controlling with non-medical students.^[112]

Study in Bangladesh also show moderate knowledge, moderate attitude and poor practice, with a substantial amount of knowledge and attitude gap about and non-compliance to the proper use of antibiotics among the university students.^[113]

Study at Thamar Universities and Institutes, Yemen, showed that medical students have an overall positive attitude and very good awareness, knowledge, and practice regarding antibiotic usage.^[114]

Study on medical students in India show that, knowledge level of medical students regarding antibiotics and its resistance was quite satisfactory. As far as attitude and practices are concerned, there is a significant need for improvements.^[115]

Study among the Medical Students of a Southern Indian Teaching Hospital, show that educational interventions are necessary to improve their understanding and perceptions on antibiotic resistance, as well as their attitude towards antibiotic use.^[116]

Also, study assess knowledge, attitudes, and practices about antibiotic resistance among medical students in India show that knowledge level of medical students was quite satisfactory. As far as attitude and practices are concerned.^[117]

Cross-sectional study was conducted among the pre-final medical students in a sub-Himalayan state show that, knowledge and attitude of the respondents were not up to the desired levels. The practices regarding use of antibiotics were more or less adequate^[118] and in Aden Yemen.^[119]

In our study found that most of the respondents were female and had a mean age around 19 years old, most of them were single, had no special habits such as smoking or khat chewing, were born in urban areas, had an

intermediate level of income, and were studying pharmacy in their third academic year.

This may be explained by the fact that most of the respondents were young, which justifies single status, and their mean age being 19 years old reflected their university level. The intermediate income level may be attributed to Al-Saeeda University being a private institution, which is more accessible to those with middle or high income. The high proportion of third-year students could be due to dropouts, changes in specialization, or academic failure occurring frequently after this stage.

CONCLUSION

In conclusion, through the study on the knowledge attitude and precise of Pharmacy, Medical, Medical laboratories, Midwifery, Nursing and Dental Students towards the proper use of ABx and Antibiotic Resistance in Sana'a, Yemen. The majority of the respondents were knowledgeable, had positive attitude and practical towards the proper use of ABx and ABR. And through the study, it was found that most of the respondents were female, over 20 years old with a mean age of 19 years old, Single, have no special habits like Smoking or Khat chewing, born in urban areas, have Intermediate level of income, studying pharmacy, third level. The study has provided valuable insights into the perceptions and beliefs of these students regarding the proper use of ABx and ABR.

RECOMMENDATIONS

Based on the findings of this study regarding the knowledge, attitudes, and practices of Pharmacy, Medical, Medical laboratories, Midwifery, Nursing and Dental Students at Al-Saeeda University towards the proper use of ABx and the risks of Antibiotic resistance, the following recommendations are proposed: Add antibiotic resistance modules and awareness programs, follow clinical guidelines and support related research and enforce prescription laws and engage communities in awareness.

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