

## Original Research Article

# A questionnaire-based study to assess the knowledge, attitude, and practices of antimicrobial resistance among PharmD students

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### Abstract

**Purpose:** To evaluate the knowledge, attitude, and practices (KAP) regarding antibiotic use and antimicrobial resistance (AMR) among Doctor of Pharmacy (PharmD) students in selected institutions in India.

**Methods:** A cross-sectional study using a structured questionnaire was conducted among 292 fourth-, fifth-, and sixth-year PharmD students across various institutions.

**Results:** The findings revealed adequate knowledge (mean score  $5.87 \pm 1.34$ ) and a positive attitude (mean score  $7.05 \pm 1.20$ ) among participants, but practices were notably poor (mean score  $4.08 \pm 1.24$ ).

**Conclusion:** These results highlight the need for enhanced educational interventions and practical training for PharmD students to improve antibiotic stewardship and patient care outcomes.

**Keywords:** Antimicrobial resistance, Attitude, Doctor of Pharmacy, Knowledge, Practice

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## INTRODUCTION

Antibiotics have been a cornerstone of modern medicine, often referred to as "magic bullets" for their role in combating infectious diseases and saving lives [1]. However, the global misuse of antibiotics—including overuse, self-medication, and inappropriate prescribing—has led to the emergence of antimicrobial resistance (AMR) [2-4]. AMR, characterized by microorganisms' decreased sensitivity to antibiotics, has significant implications, including prolonged

hospital stays, increased healthcare costs, and elevated morbidity and mortality rates [5-6].

The World Health Organization (WHO) has identified AMR as a critical global health threat. Projections suggest that by 2050, AMR could result in approximately 10 million deaths annually, disproportionately affecting low- and middle-income countries. Addressing AMR requires robust diagnostic infrastructure, surveillance, stringent regulatory frameworks, and enhanced education among healthcare

professionals [7,8]. While KAP studies on AMR have been conducted among medical and nursing students, there are limited studies involving PharmD students, despite their critical role in antibiotic stewardship.

This study aims to evaluate the knowledge, attitude, and practices of PharmD students regarding antibiotic use and AMR to identify gaps and provide insights for targeted interventions.

## METHODS

### Study design and sites

The study was a questionnaire-based cross-sectional observational study conducted among fourth, fifth, and sixth-year PharmD students across multiple institutions. Each institution was treated as a cluster and students were randomly selected for participation.

### Sample size determination

Based on Yamane's sample size formula, the estimated sample size for the study was determined to be 292 respondents.

### Study Instrument

The study questionnaire was adapted with permission from a study conducted by Habib *et al* [8]. The questionnaire consisted of four sections: demographic information, knowledge, attitude and practices related to antibiotic use and AMR. The knowledge questions were about antibiotic use, knowledge of culture sensitivity testing, and treatment options. The attitude questions touched on intentions and thinking concerning AMR, while the practice questions asked about implementations and approaches related to AMR. Each section was composed of eight questions, scored from 0 to 8, with scores > 4 indicating adequate performance. The questionnaire was validated for face and content validity, with an internal consistency reliability score of 0.78.

### Ethical approval

The study was approved by the Institutional Ethical Committee of Santhiram Medical College, Nandyal (approval no. SRCP/IEC/2022/042).

### Data collection

A Google Forms link to the questionnaire was distributed to participants, and responses were collected within a designated timeframe. Each

site was allocated two days to complete data collection.

### Statistical analysis

Data were analyzed using GraphPad Prism 9.3.1. Descriptive statistics, including mean, standard deviation, and proportions, were used to evaluate KAP scores. Scores greater than 4 were considered adequate for each domain.

## RESULTS

### Demographics of participants

A total of 292 random responses were received from the various institutions, giving a 100 % response rate, the sample included 83 (28.42 %) responses from fourth-year, 108 (36.98 %) responses from fifth-year, and 101 (34.58 %) responses from sixth-year students. A summary of the descriptive statistics is shown in Table 1.

Table 2 shows the distribution of KAP scores and levels. The mean knowledge score was  $5.87 \pm 1.34$ . Of the 292 respondents 39 (13.35 %) scored  $\leq 4$ , 148 (50.68 %) respondents had a score of 5-6, and 105 (35.95 %) respondents had a score of 7-8. Overall, 253 (86.64 %) students scored above 4. A majority, 298 (98.97 %) of the respondents had heard about antibiotic resistance and 283 (96.91 %) believed that antibiotics can cure bacterial infections. However, common misconceptions by the respondents included the belief that antibiotics can cure viral infections 114 (39.04 %) and that their use for colds and cough accelerates recovery 176 (60.27 %) (Table 3).

### Attitude

The mean attitude score was  $7.05 \pm 1.20$ , with 280 (95.89 %) participants scoring above 4 (Table 2). The respondents demonstrated strong awareness regarding the misuse of antibiotics (263 (90.06 %)) and agreed that measures should be put in place to minimize antibiotic resistance (264 (90.41 %)). They also agreed to the necessity of collaborative efforts among healthcare professionals to combat AMR (256 (87.67 %) (Table 3).

### Practices

The mean practice score was  $4.08 \pm 1.24$ , indicating poor practice. Only 100 (34.23 %) participants scored above 4, (Table 2) reflecting inadequate implementation of antibiotic stewardship principles. For example, 144 (49.31

%) of respondents incorrectly advised stopping antibiotics after symptom resolution, and 132 (45.20 %) believed antibiotics should always be given for infections regardless of the condition. Only 91 (31.16 %) of the respondents agreed that giving antibiotics in low doses can cause resistance Table 3.

## DISCUSSION

One of the most significant achievements in medicine is the discovery of antibiotics. Antibiotics have a considerable impact on the population, with physicians routinely prescribing them; however, overuse of antibiotics occurs around the world, particularly in low- and middle-income nations. Correct antibiotic use preserves the antibiotic effect, but improper use leads to AMR development, which is spreading over the world and becoming a serious public concern [3,9]. The current study focused on the doctor of pharmacy students, who will be the healthcare professionals responsible for providing effective pharmaceutical care to patients. Students will have Pharmacology, Microbiology, Clinical Pharmacy, Hospital Pharmacy, Community Pharmacy, and Pharmacotherapeutics in their curriculum and have a better grasp of antibiotics in various aspects.

This study evaluated the KAP of PharmD students, who are positioned to play a critical role in antibiotic stewardship and patient care. Students generally demonstrated good knowledge about antibiotics and AMR, with the majority scoring > 4. This is similar to the findings by Habib *et al* [8]. However, significant gaps were observed in areas such as antibiotic use for viral infections and misconceptions about antibiotics for colds and coughs [10].

The attitude of the students was overwhelmingly positive, with 95.89 % scoring > 4. This indicates a high level of awareness about AMR among

PharmD students, which aligns with similar studies [8]. However, attitude alone is insufficient without proper implementation in practice.

**Table 1:** Demographic details of respondents

Variable	Frequency (%)
<b>Gender</b>	
Male	80 (27.39)
Female	212 (72.60)
<b>Total</b>	<b>292 (100.00)</b>
<b>Year of Study</b>	
4 <sup>th</sup> year Pharm.D	83 (28.42)
5 <sup>th</sup> year Pharm.D	108 (36.98)
6 <sup>th</sup> year Pharm.D	101 (34.58)
<b>College</b>	
Annamacharya College of Pharmacy (KA)	33 (11.30)
Balaji College of Pharmacy (AN)	19 (6.50)
CES College of Pharmacy (KU)	36 (12.32)
Dr.K V Subba Reddy Institute of Pharmacy (KU)	42 (14.38)
GIET School of Pharmacy (EA)	31 (10.61)
JNTUA (AN)	1 (0.34)
Krishna Teja College of Pharmacy (CH)	16 (5.47)
P Rami Reddy Memorial College of Pharmacy (KA)	14 (4.79)
Raghavendra Institute of Pharmaceutical Sciences (AN)	18 (6.16)
Santhiram College of Pharmacy (KU)	26 (8.90)
Sri Padmavathi School of Pharmacy (CH)	34 (11.64)
Sree Vidyanikethan College of Pharmacy (CH)	18 (6.16)
Sri Venkateswara College of Pharmacy (CH)	4 (1.36)
<b>District</b>	
Kadapa (KA)	47 (16.09)
Anantapur (AN)	38 (13.01)
Kurnool (KU)	104 (35.61)
Chittoor (CH)	72 (24.65)
East Godavari (EA)	31 (10.61)
<b>Total</b>	<b>292 (100.00)</b>

**Table 2:** Proportions of KAP Scores (n=292)

Score & Level	Knowledge (%)	Attitude (%)	Practice (%)
0	1 (0.34)	0 (0)	0 (0)
1	1 (0.34)	1 (0.34)	5 (1.71)
2	2 (0.68)	0 (0)	24 (8.21)
3	6 (2.05)	3 (1.02)	58 (19.86)
4	29 (9.93)	8 (2.73)	105 (35.95)
<b>Poor</b>	<b>39 (13.35)</b>	<b>12 (4.10)</b>	<b>192 (65.75)</b>
5	77 (26.36)	21 (7.19)	63 (21.57)
6	71 (24.31)	42 (14.38)	30 (10.27)
<b>Average</b>	<b>148 (50.68)</b>	<b>63 (21.57)</b>	<b>93 (31.84)</b>
7	75 (25.68)	74 (25.34)	6 (2.05)
8	30 (10.27)	143 (48.97)	1 (0.34)
<b>Good</b>	<b>105 (35.95)</b>	<b>217 (74.31)</b>	<b>7 (2.39)</b>

**Table 3:** Knowledge, Attitude, and Practice towards AMR among the study respondents

QUESTION	YES (n; %)	No (n %)	Don't know (n; %)
<b>Knowledge</b>			
Have you ever heard of antibiotic resistance?	289 (98.97)	03 (1.02)	00 (0)
Do you agree that antibiotics can cure viral infections?	114 (39.04)	166 (56.84)	12 (4.10)
Do you believe that using antibiotics for colds and coughs will speed up the recovery?	176 (60.27)	105 (35.95)	11 (3.76)
Do you consider antibiotics can cure bacterial infections?	283 (96.91)	05 (1.71)	04 (1.36)
Do you know that using antibiotics frequently will decrease the efficacy of treatment?	243 (83.21)	36 (12.32)	13 (4.45)
Do you consider that newer and more costly antibiotics effect better?	113 (38.69)	137 (46.91)	42 (14.38)
Have you ever heard of a test to check antibiotic resistance?	231 (79.10)	42 (14.38)	19 (6.50)
Do you agree when antibiotics are administered for no specific reason, their efficacy can be decreased and they become more resistant?	257 (88.01)	26 (8.90)	09 (3.08)
<b>Attitude</b>			
Do you think there is a misuse of antibiotics at present?	263 (90.06)	22 (7.53)	07 (2.39)
Do you think antibiotic resistance has become a major challenge?	275 (88.01)	13 (4.45)	04 (1.36)
Do you think that measures should be taken to minimize antibiotic resistance?	264 (90.41)	15 (5.13)	13 (4.45)
Do you think involving all healthcare providers is a better option to minimize antibiotic resistance?	256 (87.67)	25 (8.56)	11 (3.76)
Do you consider sensitivity tests is good option for assessing antibiotic resistance?	253 (86.64)	16 (5.47)	23 (7.87)
Do you think misuse of antibiotics has become the main cause leading to bacterial resistance?	263 (90.06)	17 (5.82)	12 (4.10)
Can antibiotic resistance affect the overall health of your patient?	212 (72.60)	64 (21.91)	16 (5.47)
Do you consider studies about antibiotic resistance to be true?	266 (91.09)	04 (1.36)	22 (7.53)
<b>Practices</b>			
Do you consider a dose of antibiotics should be adjusted according to the condition?	280 (95.89)	12 (4.10)	00 (0)
Do you recommend patient ask physician about sensitivity test for assessing antibiotic resistance?	249 (85.27)	20 (6.84)	23 (7.87)
Using antibiotics in low doses can cause resistance.	91 (31.16)	171 (58.56)	30 (10.27)
Do you consider despite the condition of any infection antibiotics must be given?	132 (45.20)	142 (48.63)	18 (6.16)
Do you recommend stopping taking antibiotics after recovery from symptoms?	144 (49.31)	144 (49.31)	04 (1.36)
Have you ever suggested that patient should consult pharmacist about taking antibiotics?	235 (80.47)	51 (17.46)	06 (2.05)
Have you ever consulted the pharmacist about using antibiotics?	177 (60.61)	111 (38.01)	04 (1.36)
Would you advise the patient to consult a physician to take the same antibiotic that the other patient is using during the same condition?	179 (61.30)	104 (35.61)	09 (3.08)

The most worrisome finding was the students' poor practice in applying their knowledge, with more than half of them scoring  $\leq 4$  in the practice section. This mirrors findings from previous studies where healthcare students exhibited inadequate practical skills in antibiotic use and AMR management [1,10]. This gap between

knowledge and practice suggests the need for more hands-on training and practical exposure. When comparing these results to studies conducted among medical students, such as those by Shrestha *et al*, PharmD students demonstrated better attitudes but poorer practices. This discrepancy may be due to differences in clinical exposure and the focus of

their training [3]. The results of this study are consistent with those from other fields, where healthcare students exhibited good knowledge but lacked practical application skills [9,11].

### Study limitations

This study was based on self-reported data collected via an online questionnaire, and there is the potential for bias, as students may have used external sources to answer the questions. Future studies should consider direct observation of practices and incorporate more rigorous assessment methods.

### CONCLUSION

This study highlights that while PharmD students have adequate knowledge and a positive attitude toward antibiotics and AMR, their practical application of this knowledge remains poor. As future healthcare professionals, they must develop better practical skills to enhance patient outcomes. More practical training, workshops, and symposia should be incorporated into their curriculum to bridge this gap.

### DECLARATIONS

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#### Ethical approval

None provided.

#### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

#### Conflict of interest

No conflict of interest is associated with this work.

#### Contribution of authors

We declare that this work was done by the author(s) named in this article, and all liabilities pertaining to claims relating to the content of this article will be borne by the authors.

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