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Dentistry Section

Knowledge, Attitude and Practices Regarding Antibiotic Usage and Resistance among Dental Postgraduate Students and Interns: A Cross-sectional Questionnaire-based Study

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ABSTRACT

Introduction: Antimicrobial Resistance (AMR) is a critical and escalating global health issue. Educating healthcare providers and the public is essential to mitigating this threat. Early integration of antimicrobial stewardship into medical, dental, pharmacy, and nursing curricula is key, and baseline assessments of knowledge and practices are necessary for effective training programs.

Aim: To evaluate the Knowledge, Attitudes, and Practices (KAP) related to antibiotic use and resistance among dental Postgraduate (PG) students and interns, with the goal of informing targeted educational interventions to promote responsible antibiotic usage and combat resistance.

Materials and Methods: This cross-sectional, questionnaire-based study surveyed dental Postgraduate (PG) students and interns at the Government Dental College (GDC) and Hospital, Raipur, Chhattisgarh, India, from March 2024 to April 2024. A Google Forms questionnaire, validated for content and construct, was used, with questions addressing knowledge of antibiotic indications, resistance mechanisms, attitudes towards stewardship, and prescribing practices. A total of 142 participants were invited, with 112 complete responses (78.8% response rate). Ethical clearance was obtained. Data were analysed using Statistical Packages of Social Sciences (SPSS) version 20.0 for descriptive and inferential statistics, including p-values where applicable.

Results: Out of 142 distributed questionnaires, 112 were completed (78.8% response rate), with 72 interns and 40 PG students responding; 72.3% were female. Overall, participants demonstrated acceptable knowledge of antibiotic use, with over 80% understanding factors contributing to resistance. Knowledge scores averaged 10.4±1.83 for interns and 11.3±1.31 for PG students. More than half expressed concerns about antibiotic safety and local misuse impacting global resistance. Most participants (89.93%) consulted a senior or specialist before taking antibiotics; though, 45.5% reported saving leftover antibiotics, and 27.7% had prescribed antibiotics to others without consultation. Statistical analysis revealed significant differences ($p<0.05$) in knowledge levels between interns and PG students.

Conclusion: The present study concludes that dental students show varied levels of knowledge and attitudes towards antibiotic use and resistance, with significant gaps in understanding appropriate prescribing practices, emphasising the need for enhanced educational interventions tailored to their training and clinical responsibilities.

Keywords: Drug resistance, Education, Health personnel, Medication

INTRODUCTION

In his 1945 Nobel lecture, Sir Alexander Fleming warned of the looming threat of antibiotic resistance, emphasising how easily microbes could develop resistance to penicillin. Today, his prescient warning is more relevant than ever, as antibiotic resistance has emerged as a significant global challenge, jeopardising ability to effectively combat bacterial infections [1].

In healthcare, antibiotics have been crucial for saving lives; however, their excessive use poses a significant global public health threat, leading to the rise and dissemination of antibiotic-resistant bacteria in hospitals, clinics, and communities. Antibiotic resistance, a consequence of overexposure to antibiotics, represents a severe risk to public health worldwide. Despite repeated calls for restraint in antibiotic prescriptions, their misuse persists unabated [1].

This misuse creates selective pressure, driving the evolution of resistant bacterial strains. The World Health Organisation recognises inappropriate antibiotic use as a key risk factor for AMR. Patient-related factors, including misperceptions, self-medication, advertising, promotion, and non compliance with dosage regimens, play a crucial role in driving inappropriate antimicrobial use. Collectively, these factors contribute to the escalating prevalence of AMR [2].

India holds the title of the world's largest consumer of antibiotics when measured in absolute volume. Study conducted in India reveal substandard prescription quality, including instances of unjustified use of broad-spectrum antibiotics without evidence of bacterial infection. This trend poses significant public health concerns, especially given India's high levels of antibiotic resistance in bacteria responsible for common infections [3]. Physicians often lack exposure to nonclinical factors contributing to antibiotic resistance, such as fundamental bacterial resistance mechanisms and the use of antibiotics in the livestock industry. Furthermore, there is a preference among physicians for broad-spectrum antibiotics, even when not indicated. Negative perceptions regarding the quality and efficacy of generic medicines may discourage their prescription, despite government efforts to promote them. Patient-related issues, such as self-medication, are common contributors to antibiotic resistance, driven by factors like low socio-economic status and the ease of purchasing antibiotics without prescriptions. Studies

indicate widespread antibiotic use for treating fever without proper diagnosis, particularly in developing countries [4-6].

Prescribers play a vital role in combating antibiotic resistance by ensuring safe and rational prescribing practices and actively promoting patient awareness and education on the responsible use of antibiotics within the community. Physicians often face challenges in creating awareness and educating patients about antibiotic usage, which are frequently attributed to insufficient training during their undergraduate and PG years. Integrating comprehensive training on antimicrobial chemotherapy into medical curricula is essential, given the frequency of antibiotic prescriptions and the growing concern about resistance. Similar training initiatives are proposed for pharmacy and nursing students to enhance responsible antibiotic prescribing, dispensing, and usage. Emphasising antibiotic resistance and appropriate prescribing during the undergraduate phase is crucial for young doctors, as their views and behaviours become deeply entrenched after qualification [7].

Antibiotics, commonly prescribed but frequently misused, contribute to the proliferation of antibiotic-resistant bacteria. Misguided prescribing behaviour among physicians, influenced by factors such as the fear of complications or patient expectations, is a key contributor. Patient habits and lack of knowledge also play a significant role in antibiotic misuse. Educational initiatives promoting proper antibiotic use are crucial for both the general population and healthcare professionals, with a particular focus on new generations entering the healthcare field [8].

Studies on medical students' knowledge, attitudes, and behaviours towards antibiotics, though often limited in sample size and response rates, reveal mixed results. While some provide promising insights, many highlight a lack of awareness regarding the importance of proper antibiotic use and prescription [9-11].

The present study seeks to fill the gap in the literature by assessing the baseline Knowledge, Attitudes, and Practices (KAP) of dental PG students and interns regarding antibiotic use and resistance. Previous research has primarily focused on physicians and medical students, with limited studies addressing dental students' knowledge and practices related to antibiotics [12-14]. Given the critical role dental professionals play in prescribing antibiotics-particularly for managing infections in the oral cavity-understanding their knowledge and attitudes is essential for effective intervention.

Understanding the KAP surrounding antibiotic usage and resistance among these students is paramount for devising effective interventions. By assessing the baseline KAP of interns and PG students at GDC, Raipur, Chhattisgarh, the present study aimed to identify knowledge gaps and attitudes that may inform targeted educational interventions. Ultimately, such efforts are vital in shaping the behaviour of future prescribers and mitigating the escalating threat of antibiotic resistance.

MATERIALS AND METHODS

A cross-sectional study was conducted at the Government Dental College in Raipur, Chhattisgarh, from March 2024 to April 2024. Ethical approval for the study was obtained from the Institutional Ethics Committee (IEC) of GDC Raipur (Approval Number: S.No./1839/GDC/Scientific Committee/2024).

Inclusion criteria: The study included all interns and postgraduate students (n=142) who were available and willing to participate.

Exclusion criteria: Exclusion criteria included students who were absent on the day of the survey, those unwilling to provide informed consent, students involved in the pilot study, and participants who submitted questionnaires with more than 20% incomplete responses.

Sample size: A total of 142 students were surveyed, of which 112 provided complete responses, yielding a response rate of 78.8%.

Study Procedure

A structured, pre-tested, and validated questionnaire, distributed online via Google Forms, was administered to participants during regular class sessions to collect data on their demographic details (age, gender, hometown, and educational status), as well as their KAP regarding antibiotic use and resistance. The questionnaire consisted of eight items on knowledge, six on attitudes, and five on practices, adapted from previously published studies [15,16]. Responses to knowledge and attitude items were measured on a three-point Likert scale (agree, disagree, do not know), while practice-related questions used a binary (yes/no) format. The online format provided ease of access but could potentially influence knowledge scores by allowing participants access to resources during the survey.

The questionnaire underwent a pre-testing phase to ensure content validity and reliability, with Cronbach's alpha showing an overall reliability score of 0.88, indicating acceptable internal consistency. A pilot study was conducted prior to the main survey to test the questionnaire's reliability and validity, ensuring that questions were clearly understood and relevant. A small sample from the target population (dental interns and PG students) participated, and the results helped refine the questionnaire items to improve clarity and relevance. Feedback obtained from this preliminary study led to minor adjustments in wording and question order, enhancing the tool's reliability. Grading for knowledge responses was done as follows: poor (≤50% correct responses), adequate (51-75% correct responses), and good (≥75% correct responses) [16].

STATISTICAL ANALYSIS

The collected data were entered into Microsoft Excel and analysed using SPSS version 20.0 for descriptive and inferential statistics. The t-test was employed to compare knowledge scores between interns and PG students, with p-values <0.05 considered statistically significant.

RESULTS

A total of 142 questionnaires were distributed among interns and postgraduate students, with 112 completed, yielding an overall response rate of 78.8%. The study comprised 72 interns and 40 PG students, as summarised in [Table/Fig-1].

Demographic variables	Category	n (%)
Age (years)	18-20	1 (0.008%)
	21-25	56 (50%)
	26-30	48 (42.8%)
	>30	7 (0.06%)
Gender	Male	31 (0.27%)
	Female	81 (72.3%)
Education	BDS	72 (64.2%)
	Pursuing postgraduation	40 (36%)
Area	Rural	24 (21.4%)
	Urban	88 (78.5%)

[Table/Fig-1]: Demographic details.
BDS: Bachelor of dental surgery

The majority of respondents were female 81 (72.3%) [Table/Fig-1]. Notably, most participants 109 (97.32%) demonstrated acceptable knowledge regarding the appropriate use of antibiotics in bacterial infections. Over 80% of respondents acknowledged that various factors contributing to antibiotic resistance includes incomplete antibiotic intake 93 (83%), inaccurate dosage 100 (89.3%), overprescription and overconsumption 104 (92.8%), nosocomial spread 77 (68.8%), and self-medication 96 (85.7%), highlighting the need for focused educational interventions, as shown in [Table/Fig-2].

Questions	Response	Interns n (%)	Postgraduates n (%)
Antibiotics are used to treat bacterial infections. (A)	Agree	72 (100%)	40 (100%)
	Disagree	0	0
	Don't know	0	0
Antibiotics are useful against all types of common cold	Agree	14 (19.4%)	14 (35%)
	Disagree	57 (79.1%)	26 (65%)
	Don't know	1 (1.3%)	0
Antibiotics resistance is important and serious global public health issue	Agree	66 (91.6%)	39 (97.5%)
	Disagree	3 (4.5%)	0
	Don't know	3 (4.5%)	1 (2.5%)
The efficacy is better if the antibiotics are newer and more costly	Agree	15 (20.8%)	6 (15%)
	Disagree	46 (64%)	31 (73.8%)
	Don't know	11 (15.2%)	3 (7.5%)
Antibiotics cause negative effects on the body's own bacterial flora	Agree	57 (79.1%)	37 (92.5%)
	Disagree	11 (15.2%)	2 (5%)
	Don't know	4 (5%)	1 (2.5%)
Following factors contribute to antibiotic resistance			
1. Incomplete antibiotic intake	Agree	55 (76.3%)	38 (95%)
	Disagree	17 (23.6%)	2 (5%)
	Don't know	0	0
2. Inaccurate antibiotic and inadequate dosage	Agree	60 (83.3%)	40 (100%)
	Disagree	12 (16.6%)	0
	Don't know	0	0
3. Overprescription and overconsumption	Agree	65 (90.2%)	39 (97.5%)
	Disagree	7 (9.7%)	1 (2.5%)
	Don't know	0	0
4. Nosocomial spread	Agree	51 (70.8%)	26 (65%)
	Disagree	21 (29.1%)	14 (35%)
	Don't know	0	0
5. Self-medication	Agree	61 (84.7%)	35 (87.5%)
	Disagree	11 (15.2%)	5 (12.5%)
	Don't know	0	0
Frequent use of same antibiotic will reduce the efficacy of the treatment	Agree	61 (84.7%)	32 (80%)
	Disagree	5 (6.9%)	7 (17.5%)
	Don't know	6 (8.3%)	1 (2.5%)
Unnecessary use of antibiotics can lead to antibiotic resistance	Agree	66 (91.6%)	38 (95%)
	Disagree	3 (4.1%)	1 (2.5%)
	Don't know	3 (4.1%)	1 (2.5%)
Antibiotics can cause secondary infections after killing good bacteria present in the body	Agree	56 (77.7%)	33 (82.5%)
	Disagree	9 (8.3%)	6 (15%)
	Don't know	7 (9.7%)	1 (2.5%)

[Table/Fig-2]: Knowledge on antibiotics use and its resistance.

The mean knowledge scores differed between interns (10.4±1.83) and PG students (11.3±1.31), with a significant difference noted (p=0.010*). This disparity was further delineated into categories of poor, moderate, and good knowledge, as illustrated in [Table/Fig-3].

Category	Poor n (%)	Moderate n (%)	Good n (%)	p-value
Interns (BDS)	3 (4.2%)	12 (16.7%)	57 (79.2%)	0.010*
Pursuing (MDS)	0	5 (12.5%)	35 (87.5%)	

[Table/Fig-3]: Grading of knowledge among interns and Postgraduate (PG) students (N=112).

Despite these findings, 73 (65.1 %) of participants expressed scepticism regarding the safety of antibiotics for common use. Furthermore, there was a noteworthy disagreement regarding the impact of local misuse or sporadic skipping of doses on global antibiotic resistance. However, a minority 18 (16%) expressed pessimism regarding the effectiveness of medical experts in addressing antibiotic resistance before it becomes a significant issue. Nevertheless, the vast majority 96 (85.7%) recognised antibiotic resistance as a paramount global concern, highlighting a cautious attitude towards antibiotic usage and a growing awareness of the urgent need to combat antibiotic resistance, as detailed in [Table/Fig-4].

Questions	Response	Interns n (%)	Postgraduates n (%)
Antibiotics are safe drugs; hence they can be used commonly.	Agree	26 (36.1%)	11 (27.5%)
	Disagree	45 (62.5%)	28 (7%)
	Don't know	1 (1.3%)	1 (2.5%)
Irrational antibiotic practice locally will not matter for global resistance.	Agree	10 (13.8%)	6 (15%)
	Disagree	54 (75%)	34 (85%)
	Don't know	8 (11.1%)	0
Skipping one or two doses does not contribute to development of antibiotics resistance.	Agree	26 (36.1%)	13 (32.5%)
	Disagree	36 (50%)	25 (62.5%)
	Don't know	10 (13.8%)	2 (5%)
Antibiotic resistance can be reduced using higher antibiotic inspite of lower antibiotics being sensitive.	Agree	21 (29.1%)	13 (32.5%)
	Disagree	44 (61.1%)	23 (57.5%)
	Don't know	7 (9.7%)	4 (10%)
Medical experts can solve the problem of antibiotic resistance before it becomes too serious.	Agree	58 (80.5%)	30 (75%)
	Disagree	10 (13.8%)	8 (20%)
	Don't know	15 (20.8%)	2 (5%)
Antibiotic resistance is one of the biggest problems the world faces.	Agree	58 (80.5%)	38 (95%)
	Disagree	6 (8.3%)	1 (2.5%)
	Don't know	8 (11.1%)	1 (2.5%)

[Table/Fig-4]: Attitude on antibiotics use and its resistance.

Interestingly, most participants 100 (89.2%) consulted a doctor before initiating antibiotic treatment for themselves. Among them, 98 (87.5%)-comprising 61 interns and 37 PGs-reported completing the full course of antibiotic treatment, reflecting positive adherence to medical advice. However, it is noteworthy that 53 (47.3%) of respondents admitted to saving leftover antibiotics for future use, while 26 (23.2%) acknowledged prescribing leftover antibiotics to relatives or friends for similar illnesses without consulting a doctor, as shown in [Table/Fig-5].

Questions	Response	Interns n (%)	Postgraduates n (%)
Do you consult a doctor before starting an antibiotic?	Yes	64 (88.8%)	36 (90%)
	No	8 (11.1%)	4 (10%)
Do you prescribe the same antibiotic for relatives/ friends for similar illness without consulting the doctor?	Yes	15 (20.8%)	11 (27.5%)
	No	57 (79.1%)	29 (72.5%)
The doctor prescribes a course of antibiotic for you, after taking for 2-3 doses you start feeling better, then			
1. Do you complete the full course of treatment?	Yes	61 (84.7%)	37 (92.5%)
	No	11 (15.2%)	3 (7.5%)
2. Do you save the remaining antibiotics for the next time you get sick?	Yes	44 (61.1%)	9 (22.5%)
	No	28 (38.8%)	31 (77.5%)
Do you check expiry date of the antibiotic before using it?	Yes	69 (95.8%)	40 (100%)
	No	3 (4.1%)	0
Do you prefer to take antibiotic when you have cough and sore throat?	Yes	40 (55.55%)	27 (67.5%)
	No	32 (44.4%)	13 (32.5%)

[Table/Fig-5]: Practice on antibiotics use and its resistance.

DISCUSSION

The present study provides valuable insights into the KAP regarding antibiotic use and resistance among interns and PG students at study Institute. The results indicate that while the majority of

S. No.	Author name and year	Place of study	Sample size	Parameters assessed	Conclusion
1	Bawankar S et al., [4]	Lucknow, India	390 students (300 BDS and 90 MDS students).	Knowledge, Attitude and Practices (KAP) regarding antibiotic use and resistance.	MDS students exhibited better knowledge and attitudes towards antibiotic use and resistance compared to BDS students, highlighting the need for improved education and awareness programs.
2	Lomi M et al., [21]	Puducherry, India	140 dental students.	KAP of antibiotic use and resistance.	Postgraduate (PG) students showed significantly higher knowledge, attitude, and practice scores regarding antibiotic use and resistance compared to interns and undergraduate students, indicating a need for further education on antibiotic misuse and resistance.
3	Emera NM et al., [22]	Egypt	1,250 final-year medical sector students.	KAP regarding antibiotic use and resistance.	The study identified significant knowledge gaps and misconceptions among students, particularly regarding antibiotic use for sore throats and self-medication. It highlighted the need for targeted educational interventions to improve rational antibiotic use and minimise resistance.
4	Indrapriyadharshini K et al., [23]	Tamil Nadu, India	294 dental students.	Knowledge and attitudes regarding antibiotic resistance.	The study revealed variable levels of understanding about antibiotic resistance, emphasising the need for enhanced education on appropriate antibiotic use among dental students.
5	Manikanta KN et al., [24]	Andhra Pradesh, India	326 students from MBBS, BDS, B.Pharma, and B.Sc (Nursing) programs.	KAP related to antibiotic use and resistance.	The study found a high awareness of antibiotic resistance among students, but their attitudes toward appropriate antibiotic use were often casual, highlighting a need for enhanced educational initiatives to address these gaps.
6	Mubarak A et al., [25]	Saudi Arabia	248 dental students and interns	Knowledge and attitudes toward antibiotic prescription guidelines and applications.	Senior dental students and interns have good knowledge and positive attitudes towards antibiotic prescriptions, while early clinical-year students show moderate-to-low knowledge. There is a need for educational campaigns to promote rational antibiotic use among these students.
7	Nandan S et al., [26]	Kanpur, India	135 dental students (59 final year BDS, 29 interns, 47 PG students)	KAP regarding antibiotic usage.	The study highlighted varying levels of knowledge and attitudes towards antibiotic usage among dental students, emphasising the need for improved education and awareness to promote rational antibiotic use
8.	Present study	Raipur, Chhattisgarh	112 dental students (72 interns, 40 PG)	KAP regarding antibiotic use and resistance.	Interns showed lower knowledge scores compared to PGs, highlighting the importance of targeted educational programs for improving KAP.

[Table/Fig-6]: Shows comparative summary of studies on KAP regarding antibiotic resistance among dental students [4,21-26].
MDS: Master of dental surgery

participants demonstrated an acceptable level of knowledge about the appropriate use of antibiotics, significant gaps and misconceptions still exist.

Antibiotics, though among the most frequently prescribed medications, are susceptible to misuse, contributing to the alarming rise in antibiotic resistance globally-a paramount healthcare challenge. Proper antibiotic utilisation hinges on responsible practices by patients, healthcare providers, and retailers. However, dental students, much like their peers in other healthcare fields, often face barriers to rational antibiotic use, including limited training on antimicrobial stewardship, inadequate knowledge about rational prescribing, and patient pressure for quick relief. This can result in unnecessary prescriptions, incorrect dosages, or even the use of antibiotics for non bacterial oral infections. Compounding these issues are patient behaviours, such as self-medicating, sharing antibiotics, not completing prescribed courses, and retaining antibiotics for future use [15].

For dental students, who will soon be prescribers, addressing these practices through focused education and awareness programs is critical to fostering a responsible approach to antibiotic use and combating the broader threat of resistance.

Majority (93.8%) of the students in present study were well aware of the global problem of Antimicrobial Resistance (AMR). The finding was similar to the study done in Congo in medical students and practicing medical doctors, in which 85.4% of participants said antibiotics resistance is important global problem [17]. A 100% of students in present study were aware of the fact that antibiotics are useful for bacterial infection which was similar to the study done in Lucknow, which suggested that 95.2% of MDS and 88.6% of BDS students were aware that antibiotics are useful for treatment of bacterial infections, by Kumar A and Anuradha P [18].

Majority of the participants disagreed that “antibiotics are useful against all types of common cold.” Similar perception was also observed among participants of the studies conducted by Chandan NG and Nagabushan H [19]. In response to survey question, “antibiotics are safe drugs; hence they can be used commonly,” 60% disagreed. The response was similar to Indian study in which 78.4% of students disagreed to the same question [20]. However, certain areas of concern emerged, such as the misconception that skipping doses does not contribute to antibiotic resistance. This belief parallels findings from a study conducted in Pondicherry, India, where similar misunderstandings were identified [21].

In response to self-medication questions related to antibiotics, 89.3% students said they always consulted doctors before taking antibiotics, which was similar to the study carried out in Karnataka, India, which reported 92% of medical students and interns consulted doctors before taking antibiotics [16]. Majority (87.5%) of the students completed the full course of antibiotics, which was similar to the study done in Nepal which showed that 78.9% of medical students completed the full course [15]. Comparative summary of studies on KAPs regarding antibiotic resistance among dental students has been depicted in [Table/Fig-6] [4,21-26].

Limitation(s)

The present study had several limitations. It only represents opinions of interns and PG students from GDC Raipur, limiting generalisability to all dental students. Response honesty of responses may have been compromised due to discussions among participants while filling out the questionnaire. Additionally, the online format could have led to inflated knowledge scores. Lastly, the questionnaire’s design may not fully capture the nuances of students’ KAPs regarding antibiotic usage.

CONCLUSION(S)

The present study has provided valuable insights into the KAP regarding antibiotic use and resistance among dental PG students and interns. While the participants demonstrated a solid

understanding of antibiotic use, there were notable gaps in their practices, such as storing leftover antibiotics and sharing them without medical consultation. These risky behaviours highlight the need for targeted educational interventions to address misconceptions and reinforce responsible antibiotic use. The key takeaway from present study is the importance of continuous education and awareness, particularly in fostering better prescribing habits among future healthcare professionals. Strengthening the curriculum to include focused training on antimicrobial stewardship is essential in shaping the attitudes and practices of young dental professionals. By addressing these gaps, authors can contribute meaningfully to the global fight against antibiotic resistance, ultimately safeguarding public health.

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