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Article

# Knowledge, Attitude and Practice of Antibiotic Prescription Among Dentists Practicing in Saudi Arabia-A Cross Sectional Survey

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**Abstract: Background/Objectives:** Prescription challenges in antibiotics contribute to the global prevalence of antimicrobial resistance (AMR). We are fast moving into an age of 'resistome', which has grave consequences. Dentists frequently prescribe antibiotics for intraoral infections and as prophylaxis, particularly for immunocompromised patients, though the clinical justification for these prescriptions remains a point of concern. This study aimed to evaluate the knowledge, attitudes, and practices of dental practitioners in Saudi Arabia regarding antibiotic prescription. **Methods:** A cross-sectional survey was conducted from October to November 2024, involving 252 dentists from various regions of Saudi Arabia. Data was gathered through social media. **Results:** The mean professional experience likely to agree prescribing antibiotics post-procedurally to be safe [OR 0.18, P=0.42, CI -0.94]. Contrastingly, knowledge of less experienced dentist [OR 9.60, P=0.03, CI 1.21-76.15] was updated regarding prescribing penicillin for women in third trimester of pregnancy than experienced dentist (>10 years). **Conclusions:** Though the knowledge level of practitioners in the public sector is reasonably good, there are concerns about antibiotic prescription practice among private dental practitioners.

**Keywords:** Dentist; Antibiotic; Dental Practitioner; Analgesics; Antimicrobial drug resistance; Saudi Arabia

## 1. Introduction

Antibiotic prescription in dental practice makes a small but significant contribution to the amount of antibiotics prescribed worldwide [1–5]. Dentists prescribe antibiotics to treat acute/chronic intraoral bacterial infections while antibiotic prophylaxis is considered before dental treatment for individuals in an immunocompromised state. Other medical professionals such as internists, family practitioners, cardiologists, surgeons, pediatricians, and others may also prescribe and advise prophylactic antibiotics for dental infections and procedures. Moreover, this suggests that antibiotic prophylaxis plays a significant role in the trending antibiotic prescription rates and their use when clinically indicated [6]. However, there is alarming concern that prophylactic antibiotics prescribed by dentists and the medical fraternity may contribute to the overall concern of antimicrobial resistance (AMR) [7].

Today, the concept of AMR is quickly moving to the concept of 'resistome'. The World Health Organization (WHO) has proposed various clinical guidelines for eliminating antibiotic prescription overuse [8].

According to the American Association of Endodontists (AAE), antibiotic prophylaxis in dentistry is crucial to prevent infective endocarditis (IE) and implant joint infection in immune-compromised patients [9]. The American Heart Association (AHA) has also developed revised guidelines for antibiotic use for prophylaxis based on scientific evidence. The guidelines have been accepted and published by the American Dental Association (ADA) [10].

Recent studies investigating antibiotic prescription trends for both prophylaxis and treatment showed high rates of clinically inappropriate use of antibiotics. A retrospective cohort study analyzed the prophylactic use of antibiotics among dentists in the U.S. by collecting insurance data, which reported that 80% of the prescriptions were unjustified clinically [11]. Despite the well-established guidelines stating specific indications for prescribing antibiotics for clinical scenarios or prophylactic conditions, it has been reported that dentists have a concerning trend of overusing antibiotics when it is clinically not indicated [12]. Overprescribing antibiotics affects the ecosystem at large. Astonishing data from the Centers for Disease Control and Prevention (CDC) reveals an annual mortality of 23,000 individuals in the United States because of AMR [7].

Kirchner et al.'s study in England revealed amoxicillin as the prescription of choice in 65% of overall antimicrobials prescribed by dentists the study also revealed that the number of amoxicillin-resistant *E. coli* bacteria increased after using amoxicillin, potentially indicating the development of resistance [13]. Today, health professionals agree that the overall prescribing of antibiotics should be reduced and reserved for life-threatening infections to minimize the emergence of bacterial resistance to available antibiotics [14]. Given the role dentists play in the high rates of antibiotic prescriptions, efforts should be made to identify the causes of this issue.

Previous literature on antimicrobial prescription patterns, and dentists' and general practitioners' knowledge and practice was restricted to specific regions of Saudi Arabia. None of the studies tried to analyze the knowledge and practice of antimicrobial prescription based on the health status of patients undergoing dental treatment [15].

The present study was undertaken to address the above lacunae. Hence, it included a nationwide survey of dental practitioners through social media platforms to get an in-depth perspective on knowledge, practice, and attitude of antimicrobial prescription in this region.

## 2. Materials and Methods

A cross-sectional study assessed the knowledge, attitude, and practice of dental practitioners in Saudi Arabia towards antibiotic prescription. The study was conducted from October 2024 to November 2024 (2 months), and the self-administered questionnaire was distributed through social media platforms Telegram and X (previously known as Twitter). Ethical approval was obtained from the Institutional Review Board (NRR/24/022/9) of King Abdullah International Medical Research Center (KAIMRC), Riyadh, KSA, to ensure adherence to ethical standards.

A total of 252 dentists actively involved in various dental fields, including general practitioners and specialists, participated in the study. The study adopted a convenient sampling technique since samples were recruited through social media. The participants were drawn from diverse regions across Saudi Arabia, ensuring that the findings reflect a broader perspective of knowledge, attitude, and practices within the dental community across the country. An estimated sample size of 240 was obtained based on correlation ( $r=0.20$ ) from previous literature [16]; sample size estimation was done using G power software (version 3.1.9.4). Informed consent was obtained from participants before they could respond further to the questionnaire.

The questionnaire was partially based on previous research [16], which allowed for previously validated questions, ensuring the assessment had a solid foundation in relevant scientific research. This questionnaire consisted of four distinct sections. Much of the questionnaire consisted of close-

ended questions, with only two open-ended questions to allow free responses such as age and years of experience [16].

The initial section of the questionnaire intended to collect the participants' demographic data (exploratory variables) such as gender, age, specialty, bachelor's degree, years of experience, and region of practice in Saudi Arabia. This section aimed to gain insight into the participants' professional backgrounds and experiences.

The second section included an assessment of knowledge about antibiotic prescription, designed to evaluate understanding and clinical decision-making regarding antibiotic prescriptions. This section was divided into two main parts: one focusing on prescription knowledge for healthy patients and the second on prescription knowledge for patients with systemic disease. The response to knowledge questions was based on a 3-point scale (yes/no/not sure) and the type of drug administered.

The third section primarily focused on the practice aspect of prescribing antibiotics, specifically addressing scenarios, as in the knowledge component, for healthy patients and patients with specific medical diseases.

The fourth and final component of the questionnaire assessed dentists' attitudes toward antibiotic prescribing practice using a 5-point Likert scale from "strongly agree" to "strongly disagree." This section presented seven attitude-related statements with scenarios, allowing respondents to express their agreement or disagreement with each statement.

The questionnaire's face validity was carried out using Lawshe's technique (1978) [17] with input from 5 subject experts on the importance of questions and responses. When assessed for reliability on a pilot sample of 12 (5%) dentists, the questionnaire elicited Cronbach's alpha value of 0.77, which is considered optimal. Those participants in the pilot survey were not part of the final analysis.

The data was transferred to Microsoft Excel (Microsoft Corp., New York, USA) initially for data cleaning and coding, later into Statistical Package for the Social Sciences (SPSS) statistical software (VERSION 20,2011; IBM Corp, Armonk, USA) for analysis, descriptive statistics were used to describe the demographic data based on frequency and percentage. Fisher's exact test was used to cross-tabulate the categorical variables and ascertain the significance. As a second step, multinomial logistic regression was applied to assess the significance of the exploratory variables found significant on the initial Fischer's exact test analysis.

### 3. Results

This section may be divided by subheadings. It should provide a concise and precise A total of 252 dentists responded to the questionnaire, of which 130 (51.6%) and 121 (48.4%) were female and male respondents, respectively. The mean age of the dentists was 31.5 ( $\pm 6.4$ ) years, and their mean professional experience was 5.6 ( $\pm 5$ ) years. Based on the data, general practitioners comprised 172 (68.3%) dentists who responded to the questionnaire. Conversely, oral radiology 01 (0.4%) was the least represented specialty. Other specialties represented were periodontics 9 (3.6%), pediatric dentistry 11 (4.4%), orthodontics 6 (2.4%), and prosthodontics 18 (7.1%), among others.

Of most dentists, 247 (98%) obtained their bachelor's degree from countries in the Gulf Cooperation Council (GCC) region, and most of these dentists, 118 (46.8%), practiced in the central geographic area. About 114 (46.6%) of the dentists practiced in public (academic/ hospital setting), 48 (19.1%) in private (academic/ hospital setting) and the remaining 90 (35.7%) were in private practice. [Table 1]

**Table 1.** Demographic details of the participating Dentists.

Demographic Variable	Sub-Division	Total (N)	Mean	Standard	Minimum	Maximum
				Deviation		
				( $\pm$ )		

Demographic Variable	-	Total	Mean	Standard Deviation (±)	Frequency (n)	Percentage (%)
Age of Dentists	-	252	31.5	6.4	25	47
Years of Experience	-	252	5.6	5.0	0.6	22
Specialty of Dentists	Advanced Education in General Dentistry (AEGD)	252			09	3.6
	Dental Public Health				02	0.8
	Endodontist				06	2.4
	Family Dentistry				03	1.2
	General practice				172	68.3
	Oral Medicine				04	1.6
	Oral Radiology				01	0.4
	Oral Surgery				03	1.2
	Orthodontics				06	2.4
	Pediatric Dentistry				11	4.4
	Periodontics				09	3.6
	Prosthodontic				18	7.1
	Restorative Dentistry				08	3.2
	Gender				Male	252
Female		130	51.6			
Dentist with degree obtained from	Africa	252			01	0.4
	Asia				02	0.8
	GCC countries (Saudi Arabia, Qatar, UAE, Kuwait, Bahrain, Oman)				247	98.0
	North America				02	0.8
Region of Dental Practice	Central	252			118	46.8
	Eastern				42	16.7
	Northern				20	7.9
	Southern				39	15.5
Dental Practice Setting	Western	252			30	13.1
	Academic/Hospital/Public				114	55.2
	Academic/Hospital/Private				48	19.1
	Private Practice				90	35.7

Knowledge about Antibiotic prescription among dentists for healthy individuals ascertained a significant difference in four of the five knowledge questions. The type of dental setting practice and specialty significantly ( $P=0.01$ ) influenced the response to the question "Is penicillin administered to a pregnant woman if it is required in the third trimester?"

Those from the public practice setup (academic/hospital) responded appropriately. Specialists in pediatric dentistry and general dentists responded that they were unsure of antibiotic prescriptions in the third trimester of pregnancy. [Table 2]

**Table 2.** Knowledge of dentists about antibiotic prescription in healthy individuals.

Knowledge	Dental Setting	n (%)	Total	df
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					Fishers exact test (P - Value)	
	Yes	No	Not Sure			
<b>Is penicillin administered to pregnant women if it is required in the third trimester?</b>	Academic/Hospital/Private	27 (10.7)	7 (2.8)	12 (4.8)	46 (18.3)	15 0.01*
	Academic/Hospital/Public	58 (23.0)	46 (18.3)	13 (5.2)	117 (46.4)	
	Private Practice	37 (14.7)	44 (17.5)	8 (3.2)	89 (35.3)	
	Total	122 (48.4)	97 (38.5)	33 (13.1)	252 (100.0)	
	Specialty	n (%)			Total	
	Advanced Education in General Dentistry (AEGD)	6 (5.1)	2 (0.8)	1 (0.4)	9 (3.6)	
	Endodontics	5 (2.0)	0 (0.0)	1 (0.4)	6 (2.4)	
	Pediatric Dentistry	2 (0.8)	0 (0.0)	9 (3.6)	11 (4.4)	
	Periodontics	4 (1.6)	2 (0.8)	3 (1.2)	9 (3.6)	
	Prosthodontics	12 (1.7)	3 (1.2)	3 (1.2)	18 (7.2)	
General Practitioner	66 (26.2)	82 (32.5)	24 (9.5)	172 (68.3)	24 0.01*	
Total	95 (37.6)	89 (35.3)	41 (16.2)	225 (89.2)		
<b>Is antibiotic prescribed for a patient with a visible sinus tract in the attached gingiva?</b>	Region of Practice	n (%)			Total	
	Central	25 (9.9)	84 (33.3)	9 (3.6)	118 (46.8)	
	Eastern	5 (2.0)	34 (11.1)	3 (1.1)	42 (16.7)	
	Western	1 (0.4)	28 (11.1)	4 (1.6)	33 (13.1)	
	Northern	8 (3.2)	11 (4.4)	1 (0.4)	20 (7.9)	
	Southern	2 (0.8)	30 (11.9)	7 (2.8)	39 (15.5)	20 0.00*
	Total	41 (16.3)	187 (74.2)	24 (9.5)	252 (100.0)	
	Degree based on country	n (%)			Total	
	GCC	36 (14.3)	187 (74.2)	24 (9.5)	7 (50.0)	
	Other	5 (2.0)	0 (0.0)	0 (0.0)	5 (2)	15 0.00*
Total	41 (16.3)	187 (74.2)	24 (9.5)	14 (100.0)		

Would you prescribe antibiotics for a surgically impacted third molar?	Degree based on country	n (%)			Total		
		Yes	No	Not Sure			
	GCC	63	165	19	247	15	0.00*
		(25)	(65.5)	(7.5)	(98.0)		
	Other#	4	1	0	05		
	Total	67	166	19	252		
		(26.6)	(65.9)	(4.0)	(100)		

  

Would you prescribe antibiotics for reversible pulpitis?	Degree based on Country	n (%)			Total		
		Yes	No	Not Sure			
	GCC	9	232	6	247	12	0.00*
		(3.6)	(92.1)	(2.4)	(98.0)		
	Other	2	3	0	05		
	Total	11	235	6	252		
		(4.3)	(93.3)	(2.4)	(100)		

\*Significance-P value (<0.05), Other- North America (02), Africa (01), Asia (02).

Interestingly, the region of practice ( $P=0.00$ ) and where one acquired their degree from ( $P=0.00$ ) also significantly varied in response to "Is antibiotic prescribed for visible sinus tract on attached gingiva?". Dentists from the central region and those who graduated from other countries positively affirmed a need for antibiotic prescription. Likewise, graduates from other countries are significantly ( $P=0.00$ ) more likely to prescribe an antibiotic in case of surgically impacted third molar and reversible pulpitis. [Table 2]

Knowledge of dentists about antibiotic prescription after extraction in patients with uncontrolled diabetes elicited a significant ( $P=0.00$ ) variation in response based on dentists' workplace setting; those in the public sector (academic/hospital) were more likely not to prescribe a drug than the dentists in the private dental setup. Similarly, general dentists were significantly ( $P=0.00$ ) unlikely to prescribe antibiotics in similar conditions compared to other dental specialists. No significance ( $P=0.35$ ) was observed considering the experience of dentists and their prescription pattern of antibiotics for patients with a history of IE undergoing extraction. [Table 3].

**Table 3.** Knowledge of dentists about antibiotic prescription for dental procedures in individuals with systemic disease.

Knowledge	Dental Setting	n (%)					Total	Fisher's exact test (P-Value)
		Amoxicilli Augmenti	Clindamyci	Metronidazol	No Drug Prescribed			
Which of the following drugs is prescribed	Academic/ Hospital/ Private	34 (13.5)	0 (0.0)	4 (1.6)	2 (0.8)	4 (1.6)	40.4 (17.6)	0.00*
	Academic/ Hospital/ Public	62 (24.8)	1 (0.4)	5 (2.0)	33 (13.1)	15 (6.0)	116 (46.4)	
	Private Practice	48 (16.3)	1 (0.4)	4 (1.6)	31 (12.3)	4 (0.4)	88 (35.2)	
	Total	144 (57.6)	2 (0.8)	13 (5.1)	66 (26.4)	23 (9.2)	248 (99.2)	
	Specialty	n (%)					Total	

for a patient with uncontrolled diabetes after extraction of the impacted third molar?	Amoxicillin		Metronidazole		No Drug Prescribed		Fisher's exact test (P-Value)
	n (%)	n (%)	n (%)	n (%)	Total	df	
AEGD	8 (3.2)	0 (0)	1 (0.4)	9 (3.6)	13	7	0.00*
Endodontics	4 (1.6)	0 (0)	2 (0.8)	6 (2.4)	7	2	
Restorative	5 (2.0)	0 (0)	2 (0.8%)	7 (2.8)	156	156	
Prosthetic	16 (6.3)	1 (0.4)	2 (0.8)	19 (7.6)	197	197	
General	87 (34.5)	63 (25)	6 (26.1)	156 (62.4)	197	197	
Total	120 (48)	64 (25.6)	13 (5.2)	197 (78.8)	197	197	

  

Which of the following drugs is prescribed for a patient with a history of Infective Endocarditis after simple extraction?	Years of Experience	n (%)				Total	df	Fisher's exact test (P-Value)
		Amoxicillin	Clindamycin	Metronidazole	No Drug Prescribed			
1 to 5	118 (46.8)	11 (4.4)	4 (1.6)	3 (1.2)	136 (54.4)	136	0.35	
6 to 10	71 (28.2)	1 (0.4)	1 (0.4)	3 (1.2)	76 (30.4)	76		
11 to 15	20 (7.9)	1 (0.4)	0 (0)	1 (0.4)	22 (8.8)	22		
16 to 22	14 (5.6)	0 (0)	0 (0)	2 (0.8)	16 (6.4)	16		
Total	223 (89.2)	13 (5.2)	5 (2)	9 (3.6)	250 (99.8)	250		

\*Significance-P value (<0.05).

Like knowledge-related questions, practice questions were divided into subcategories of antibiotic prescription in patients with and without systemic disease. A significantly (P= 0.00) high percentage (38.1%) of dentists in private (academic/hospital) setups responded with the practice of prescribing clindamycin. About (19.2%) were misled with the option of Augmentin, a combination of amoxicillin and clavulanic acid. Clindamycin was a significant (P=0.01) alternate drug of choice to amoxicillin among the practitioners in the country's central region. (Table 4)

**Table 4.** Practice of dentists about antibiotic prescription for dental procedures in individuals with no medical history.

Practice Question	Dental Setting	n (%)			Total	Fisher's exact test P-Value
		Augmentin	Clindamycin	Tetracycline		

<b>What alternative antibiotic do you commonly prescribe for penicillin-allergic patients?</b>	<b>Academic/Hospital/Private</b>	<b>3</b> (1.2)	<b>42</b> (38.1)	<b>1</b> (0.4)	<b>46</b> (18.3)	
	Academic/Hospital/Public	25 (9.9)	75 (29.8)	17 (6.7)	117 (46.4)	
	Private Practice	18 (7.1)	64 (25.4)	7 (2.8)	89 (35.3)	4 0.00*
	Total	46 (18.3)	181 (71.8)	25 (9.9)	252 (100.0)	
	Region of Practice	n (%)			Total	
	Central	13 (5.2)	96 (38.1)	9 (3.6)	118 (46.8)	
	Eastern	6 (2.4)	28 (11.1)	8 (3.2)	42 (16.7)	
	Western	11 (4.4)	18 (7.1)	4 (1.6)	33 (13.1)	
	Northern	7 (2.8)	12 (4.8)	1 (0.4)	20 (7.9)	8 0.01*
	Southern	9 (3.6)	27 (10.7)	3 (1.2)	39 (15.5)	
Total	46 (18.3)	181 (71.8)	25 (9.9)	252 (100.0)		
<b>What do you prescribe for a patient after a simple extraction?</b>	Specialty	n (%)				Total
	AEGD	Amoxicillin 4 (1.6)	Analgesic 0 (0)	Clindamycin 0 (0)	No Drug Prescribed 5 (50.0)	9 (3.6)
	Endodontics	3 (1.2)	1 (0.4)	0 (0)	2 (0.8)	6 (2.4)
	Restorative	4 (1.6)	0 (0)	0 (0)	4 (1.6)	8 (3.2)
	Prosthodontics	6 (2.4)	0 (0)	0 (0)	12 (4.8)	18 (7.1)
	General	31 (12.3)	1 (0.4)	4 (1.6)	136 (54)	172 (68.3)
	Total	48 (19.2)	2 (0.8)	4 (1.6)	159 (63.6)	213 (85.2)
Region of Practice	n (%)				Total	
Central	21 (8.3)	0 (0)	1 (0.4)	96 (38.1)	118 (46.8)	
Eastern	12 (4.8)	0 (0)	0 (0.0)	30 (11.9)	42 (16.3)	
					1 0.03* 2	

What antibiotic do you prescribe for a patient with chronic necrotic pulp?	Degree based on Country	n (%)				Total	Fisher's exact test P-Value
		Amoxicillin	Clindamycin	No Drug Prescribed	Total		
	Western	8 (3.2)	2 (0.8)	1 (0.4)	22 (8.7)	33 (13.1)	
	Northern	5 (2.0)	0 (0)	2 (0.8)	13 (5.2)	20 (7.9)	
	Southern	10 (4.0)	2 (0.8)	0 (0)	27 (10.7)	39 (15.5)	
	Total	56 (22.2)	4 (1.6)	4 (1.6)	188 (74.6)	252 (100)	
		n (%)					
	GCC	36 (14.3)	3 (1.2)	208 (83.3)	247 (98.0)		
	Other	2 (0.8)	1 (0.4)	2 (0.8)	5 (2)		
	Total	38 (15.1)	4 (1.6)	210 (83.3)	252 (100)		2 0.04*

\*Significance-P value (<0.05).

General dentists clearly and significantly ( $P=0.01$ ) indicated that they did not prescribe drugs after simple extraction compared to other specialty dentists. [Table 4]

A significant ( $P=0.03$ ) number of public (academic/hospital) dental practitioners, 97 (38.5%), mentioned the use of amoxicillin for patients with a history of heart valve replacement a year ago. Amoxicillin was significantly the drug of choice for dentists irrespective of the region ( $P=0.02$ ) or experience ( $P=0.00$ ) compared to higher broad-spectrum antibiotics such as augmentin or clindamycin. (Table 5)

**Table 5.** Practice of dentists about antibiotic prescription for dental procedures for individuals with relevant medical history.

Practice Question	Dental Practice Setting	n (%)				Total	Fisher's exact test P-Value
		Amoxicillin	Augmentin	Clindamycin	No Drug Prescribed		
	Academic/Hospital/Private	30 (11.9)	0 (0)	4 (1.6)	12 (4.8)	46 (18.3)	
	Academic/Hospital/Public	97 (38.5)	2 (0.8)	1 (0.4)	17 (6.7)	117 (46.4)	
	Private Practice	75 (29.8)	0 (0)	3 (1.2)	11 (4.4)	89 (35.3)	6 0.03*
	Total	46 (18.3)	2 (0.8)	8 (3.2)	40 (15.9)	252 (100)	
	Region of Practice	n (%)					

with valve replacement 1 year ago?	n (%)				Total	P-Value
	Amoxicillin	Augmentin	Clindamycin	No Drug Prescribed		
Central	87 (34.5)	2 (0.8)	3 (1.2)	26 (10.3)	118 (46.8)	0.02*
Eastern	38 (15.1)	0 (0)	1 (0.4)	3 (1.2)	42 (16.7)	
Western	26 (10.3)	0 (0)	0 (0)	7 (2.8)	33 (13.1)	
Northern	17 (6.7)	0 (0)	3 (1.2)	0 (0)	20 (7.9)	
Southern	34 (13.5)	0 (0)	1 (0.4)	4 (1.6)	39 (15.5)	
Total	202 (80.2)	2 (0.8)	8 (3.2)	40 (15.9)	252 (100)	

  

Years of Experience	n (%)				Total	P-Value
	Amoxicillin	Augmentin	Clindamycin	No Drug Prescribed		
1 to 5	96 (38.1)	1 (0.4)	7 (2.8)	34 (13.5)	138 (54.8)	0.00*
6 to 10	77 (30.6)	0 (0)	1 (0.4)	5 (2.0)	83 (32.9)	
11 to 15	13 (5.2)	1 (0.4)	0 (0)	1 (0.4)	15 (6.0)	
16 to 22	16 (6.3)	0 (0)	0 (0)	0 (0)	16 (6.3)	
Total	202 (80.2)	2 (0.8)	8 (3.2)	40 (15.9)	252 (100)	

  

Region of Practice	n (%)			Total	Fisher's exact test P-Value
	Amoxicillin	Clindamycin	No Drug Prescribed		
Central	22 (8.7)	6 (2.4)	90 (35.7)	118 (46.8)	0.03*
Eastern	10 (4)	0 (0)	32 (12.7)	42 (16.7)	
Western	3 (1.2)	1 (0.4)	29 (11.5)	33 (13.1)	
Northern	9 (3.6)	0 (0)	11 (4.4)	20 (7.9)	

What antibiotic do you prescribe for patients with hypertension after gingivectomy?

Southern	5 (2)	4 (1.6)	30 (11.9)	39 (15.5)	
Total	49 (19.4)	11 (4.4)	192 (76.2)	252 (100)	
Years of Experience	Amoxicillin	Clindamycin -cin	No Drug Prescribed	Total	
1 to 5	27 (10.7)	10 (4.0)	101 (40.1)	138 (54.8)	
6 to 10	9 (3.6)	1 (0.4)	73 (29)	83 (32.9)	
11 to 15	10 (4)	0 (0)	5 (2)	15 (6)	6 0.00*
16 to 22	3 (6.1)	0 (0)	13 (6.8)	16 (6.3)	
Total	41 (19.4)	11 (4.4)	192 (76.2)	252 (100)	

\*Significance-P value (<0.05).

Prescribing no drug over antibiotics was significantly the choice of dental practitioners for patients after gingivectomy and with a medical history of hypertension, irrespective of region (P=0.00) or years of experience (P=0.01). [Table 5]

Dental Practitioners had a significant (P=0.00) and favorable attitude of agreeing with a need for antibiotic prophylaxis in patients with a relevant medical history. However, through Fisher's exact test, it cannot be indeed established if private (academic/hospital) dental practitioners disagree with antibiotic prophylaxis for the same. [Table 6]

**Table 6.** Dentists' attitudes regarding antibiotic prescription for dental procedures.

Attitude Questions	Dental Setting	n (%)					Total	df	Fishers exact test (P - Value)
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree			
I ask patients if they have any medical conditions typically requiring antimicrobial prophylaxis against IE before performing dental procedure?	Academic/ Hospital/ Private	15 (6.0)	3 (1.2)	1 (0.4)	27 (10.7)	0 (0)	46 (18.3)	8	0.00*
	Academic/ Hospital/ Public	60 (23.8)	0 (0)	10 (4.0)	47 (18.7)	0 (0)	117 (46.4)		
	Private Practice	50 (19.8)	0 (0)	7 (2.8%)	31 (12.3)	1 (0.4)	89 (35.3%)		
	Total	125 (49.6)	3 (1.2)	18 (7.1)	105 (41.7)	1 (0.4)	252 (100)		
		n (%)							
	Specialty	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total		

<b>I continue to prescribe anti-microbials post-procedurally just to be safe</b>	AEGD	0 (0)	1 (0.4)	1 (0.4)	4 (1.6)	3 (1.2)	9 (3.6)	48	0.00*
	Endodontics	2 (0.8)	1 (0.4)	0 (0)	1 (0.4)	2 (0.8)	6 (2.4)		
	Restorative	0 (0)	2 (0.8)	2 (0.8)	4 (1.6)	0 (0)	8 (7.1)		
	Prosthodontics	0 (0)	3 (1.2)	4 (1.6)	10 (4)	1 (0.4)	18 (5.1)		
	General Practitioner	21 (8.3)	55 (21.8)	28 (12.3)	31 (12.3)	37 (14.7)	172 (68.3)		
	Total	23 (9.2)	60 (24)	35 (14)	50 (20)	43 (17.2)	186 (74.4)		
		n (%)							
Years of Experience	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	12	0.00*	
1 to 5	11 (4.4)	23 (9.1)	31 (12.3)	33 (13.1)	40 (15.9)	138 (54.8)			
6 to 10	13 (5.2)	37 (14.7)	3 (1.2)	23 (9.1)	7 (2.8)	83 (32.9)			
11 to 15	2 (0.8)	3 (1.2)	3 (1.2)	3 (1.2)	4 (1.6)	15 (6.0)			
16 to 22	0 (0)	4 (1.6)	7 (0.4)	1 (0.4)	4 (1.6)	16 (6.3)			
Total	26 (10.3)	67 (26.6)	44 (17.5)	60 (23.8)	55 (21.8)	252 (100)			

\*Significance-P value (<0.05).

Contradicting the usual antibiotic use norms and with a focus on antibiotic resistance, it was interesting to note that a significantly high number of dental practitioners in the experience bracket of less than 10 years felt the need to prescribe antibiotics post-procedurally to be safe. [Table 6]

Dental Practitioners with less than 10 years, 1 to 5 years (OR 2.26, P=0.03, CI 1.21-76.15) and 6-10 years (OR 3.32, P=0.02, CI-3.4-84.5) of experience had better knowledge of administrating penicillin in the third trimester of pregnancy compared to fellow dentists with more than 10 years of experience. Dentist practicing in the central region (OR-0.50, P=0.28, CI 0.23-1.53) are less likely to prescribe antibiotics after a simple extraction compared to practitioners from other regions of the country. Contrasting to their knowledge response, while dentists with less than 10 years (OR 0.55, P=0.46, CI 0.39-7.62) are more likely to prescribe antibiotics post procedurally than practitioners with more than 10 years of experience. [Table 7]

**Table 7.** Multinomial regression analysis of important dependent variables found significant with Fisher's exact test.

Variable	Independent Variable	B	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
						Lower Bound	Upper Bound
<b>Is penicillin administered to pregnant women if it is required in the third trimester?</b>	<b>Years of Experience</b>	<b>Response: No#a</b>					
	1 to 5	2.26	1	0.03*	9.60	1.21	76.15
	6 to 10	3.32	1	0.02*	27.8	3.4	84.5
	11 to 15	1.59	1	0.19	4.93	0.44	55.4

<b>(Knowledge Component)</b>							
<b>What antibiotic would you prescribe for a patient who had valve replacement 1 year ago? (Knowledge Component)</b>	Dental Setting	Response: No Drug Prescribed#b					
	Academic/Hospital/Private	1.00	1	0.03*	2.72	1.08	6.85
<b>What do you prescribe for a patient after simple extraction? (Practice Component)</b>	Academic/Hospital/Public	0.17	1	0.66	1.19	0.52	2.70
	Region of Practice	Response: Amoxicillin#c					
<b>I continue to prescribe anti-microbials post-procedurally just to be safe (Attitude Component)</b>	Central	-0.50	1	0.28	0.60	0.23	1.53
	Eastern	0.09	1	0.85	1.10	0.38	3.14
	Northern	0.05	1	0.93	1.05	0.28	3.92
	Southern	0.01	1	0.97	1.01	0.34	3.02
<b>I continue to prescribe anti-microbials post-procedurally just to be safe (Attitude Component)</b>	Years of Experience	Response: Strongly Disagree#d					
	1 to 5	0.55	1	0.46	1.73	0.39	7.62
	6 to 10	-1.66	1	0.42	0.18	0.38	0.94
	11 to 15	0.28	1	0.78	1.33	0.17	10.25

Reference category: a-16-22 (last), b-Private Practice (last), c- No drug Prescribed (last), d- Strongly Agree (first).

\*Significance-P value (<0.05).

#### 4. Discussion

The present study received 252 responses from dentists across different regions in Saudi Arabia, so a broad national representation was achieved within the sample. Inappropriate antibiotic use has been considered a public health concern and a contributing factor to the rise in antimicrobial resistance (AMR) [7,8].

Though there is similar research among dentists in KSA, the present study tries to address the shortcomings of previous literature, such as low sample size and studies which did not assess the practice based on dental setting [18]. In certain similar studies, the students and academicians were considered for the final sample; this study comprehensively considered all the factors and addressed the above lacunae [19]. The study included practitioners associated with public (hospitals/colleges), private (hospitals/colleges) and private practitioners. This study also assessed the knowledge and practice of these practitioners regarding antibiotic usage among healthy patients and patients with compromised systemic health undergoing dental treatment.

The present study revealed significant uncertainty among practitioners, particularly general dentists, regarding using antibiotics like penicillin during pregnancy, especially in the third trimester, for healthy individuals. Meanwhile, public sector practitioners had better antibiotic prescription knowledge than private practitioners about penicillin administration during pregnancy [20]. Our study revealed uncertainty among pediatric dental specialists and inadequate knowledge among general dentists regarding penicillin use during the third trimester of pregnancy [21]. To address this, the American Dental Association Council on Scientific Affairs recommends advising patients on antibiotic interactions with oral contraceptives, suggesting nonhormonal alternatives, and ensuring compliance. While penicillin is generally safe during pregnancy, tetracyclines are contraindicated due to the risk of dental discoloration [22].

In our study, the majority responded "No" to prescribing antibiotics for patients with visible sinus tract for healthy individuals, aligning with findings from a study conducted in Riyadh by

Baskaradoss et al. [20]. Conversely, a study evaluating dental students' knowledge and attitudes towards antibiotics by AboAlsamh et al. revealed that most participants favored prescribing antibiotics for their patients [19].

The prescription of antibiotics is not indicated for the surgical extraction of impacted third molars unless there is systemic involvement or a preexisting local infection, as noted in the guideline [23]. The frequency of dentists refraining from prescribing antibiotics after the surgical extraction of a third molar is significantly higher compared to findings from the study by Baskaradoss et al. [20]. This study examined the antibiotic prescription pattern among dentists in Riyadh, Saudi Arabia, recommending stringent guidelines to minimize unnecessary antibiotic use. Their findings support the principle that antibiotics should not be routinely prescribed as a preventive measure for third-molar extractions. Instead, they are reserved for specific cases involving high-risk patients or severe infections, ensuring a more targeted and evidence-based approach to antibiotic use [20].

Based on the findings from our study, a significant number of participants answered 'no' to the prescription of antibiotics for reversible pulpitis in healthy individuals, in comparison to the study by AboAlSamh et al. (2018), which examined dental students' knowledge and attitudes towards antibiotic prescribing guidelines in Riyadh, Saudi Arabia. Their study highlighted discrepancies in antibiotic prescription practices among dental students, with many indicating uncertainty about when antibiotics should be prescribed [19].

Our findings show that knowledge of dentists, irrespective of dental setting and specialty, prefer prescribing amoxicillin as a drug of choice in patients with uncontrolled diabetes and those who have undergone invasive dental procedures such as extraction of impacted third molar, which is in line with the guidelines given in the study by Oberoi et al. [24]. Amoxicillin was also the drug of choice for dentists when their knowledge was assessed for patients with a history of infective endocarditis undergoing simple extraction; this makes evident that the knowledge was fairly good among the responding dentists in our study [8,9].

Amoxicillin is the most prescribed antibiotic for dental treatments worldwide [1], including for individuals with systemic disorders, while clindamycin is used as an alternative for patients with confirmed penicillin allergies [25]. Similarly, a high frequency of dentists claimed to prescribe clindamycin as an alternative AB in the present study, with one of its significant drawbacks being the risk of inducing *Clostridioides difficile* infections. A 2020 study from Colombia revealed that more than half of surveyed dentists preferred amoxicillin as the first-line antibiotic, with clindamycin being the second choice [26].

Our study found that most general dentists do not prescribe antibiotics for healthy patients undergoing simple extractions, which aligns with the Oral and Maxillofacial Surgery guidelines. These guidelines suggest that antibiotics are unnecessary unless there is a risk factor for infective endocarditis (IE) [23].

Amoxicillin was the drug of choice among practicing dentists, regardless of dental practice setting, region of practice, or years of experience, for patients who underwent valve replacement a year ago [1–5,23].

Dentists unanimously responded that 'no' antibiotic should be prescribed for patients with hypertension undergoing gingivectomy, as this aligns with current guidelines emphasizing that antibiotic prophylaxis is unnecessary unless systemic risk factors or active infections are present [27]. The dentists in the public sector were more likely to ask the patients about their medical condition to avoid postoperative IE compared to the dentists in the private sector. A study from Jeddah also reported similar results [28]. Additionally, research from Kuwait showed that dentists with more professional experience had a better understanding of how antibiotics are appropriately used, which aligns with our findings [29]. Less experienced dentists (<10 years) are more likely to prescribe antibiotics post-procedurally to 'be safe,' raising concerns about antibiotic overuse and antimicrobial resistance [28].

## 5. Conclusions

The study highlights variations in knowledge, attitude, and practice of antibiotic prescription among dental practitioners working at various sectors in Saudi Arabia. Dentists practicing in public (academic/hospital) had better knowledge compared to their private counterparts. The younger dentists exhibit better knowledge in prescription, which may be due to updated knowledge as part of fresh graduation or because of the continuing professional dental education being attended by this group. Interestingly, the senior practitioner (<10 years) of experience exhibited more significant knowledge in practice questions. The main limitation of the study was insufficient responses from specialized dentists, and dentists who graduated from other regions of the world who are presently practicing in Saudi Arabia. Future research should be undertaken ensuring large samples with overcoming lacunae of our study. Antibiotic awareness is at a crossroads and requires to be addressed among all dental practitioners throughout the country.

**Supplementary Materials:** The following supporting information can be downloaded at the website of this paper posted on Preprints.org.

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