

# Dentists' knowledge and practices about infective endocarditis antibiotics prophylaxis among children in southwestern Saudi Arabia

Ayed A Shati (✉ [shatiayed@gmail.com](mailto:shatiayed@gmail.com))

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Research article

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# Abstract

**Background** Infective endocarditis is a disease endangering the life of humans. Therefore, several prophylactic measures are needed to improve the protection of endocarditis-prone patients from bacteremia resulting from various dental actions. These measures range from developing the dental hygiene of endocarditis-prone individuals to trials of different antimicrobial agents. The objective of the study was to examine knowledge and practices of dentists in the Aseer Region, Saudi Arabia, regarding antibiotic prophylaxis against Infective endocarditis.

**Methods** A cross-sectional study design in Aseer Region. Interviews were carried out, and 182 individuals participated in the data collection process. The 182 participants were interviewed at their workplaces. The data collection sheet was constructed based on the guidelines of the American Heart Association /American College of Cardiology (AHA/ACC, 2017).

**Results** Dentists' mean knowledge score was  $17.5 \pm 3.7$  (out of 24). The least correct responses regarding dental procedures that require prophylactic antibiotics were "root canal treatment" (30.8%). Regarding cardiac conditions that require prophylactic antibiotics, dentists' least correct responses were "heart failure" (50%). Dentists' mean knowledge scores differed significantly according to their age groups ( $p=0.032$ ), nationality ( $p=0.002$ ), education/qualification ( $p=0.002$ ). Mean knowledge scores differed significantly according to dentists' years of operation ( $p=0.018$ ) and sources of information ( $p<0.001$ ). Amoxicillin was the most regularly recommended antibiotic (90.7%), while 86.8% correctly stated 30-60 minutes before the procedure as the time for prophylactic antibiotic administration.

**Conclusions** Knowledge of dentists in the Aseer Region regarding the use of preventive drugs for the control and prevention of I.E. is suboptimal. The inclusion of latest AHA guidelines into the dentistry curricula is highly recommended.

## Background

Infective endocarditis is also known as bacterial endocarditis by many health specialists. The disease is an infection of the cardiac valves. It is frequently related to congenital or acquired cardiac defects.<sup>1</sup> although infective endocarditis is quite rare; it is mostly associated with more than one cardiac valve hence leading to serious valvular inadequacy as well as heart failure. Moreover, it may develop to septic emboli, abscess formation, organ ischemia and stroke<sup>2</sup>. In attribution to this feature, the disease remains to be dangerous to human life despite the significant developments in its diagnosis, surgical methods, antimicrobial therapy, and supervision of linked problems.<sup>3</sup>

When a patient is infected with infective endocarditis, turbulent bloodstream is produced by certain acquired or congenital heart diseases (CHDs) which may cause physical injury to the endocardium, leading to accumulation of platelets and fibrin on the severely destroyed endocardium, thus resulting in the deposition of sterile vegetation, i.e., non-bacterial thrombotic endocarditis. Subsequently, micro-

organisms can invade the bloodstream and become attached to the damaged endocardium.<sup>4</sup> once connected; these microbes stimulate the deposition of platelets and fibrin on their surfaces. Uninhibited by host defenses, the germs become able to multiply rapidly.<sup>5</sup>

Rheumatic heart disease is a very common heart illness In Saudi Arabia.<sup>6</sup>There is insufficient data on the epidemiology of infective endocarditis because of the deficiency of countrywide epidemiological studies<sup>4</sup> since infective endocarditis is a life-threatening disease, several prophylactic measures continue to improve the protection of endocarditis-prone patients from bacteremia resulting from various dental actions. These preventive measures range from developing the dental hygiene of endocarditis-prone individuals to trials of different antimicrobial agents.<sup>7</sup>

In the previous years, all patients having any congenital heart disease were given antibiotics before undergoing dental precautions or operations on the throat and mouth. Antibiotics before dental processes is not a common medical practice since this procedure is only appropriate for patients suffering from the maximum danger of infective endocarditis, i.e., a prosthetic heart valve, past history of endocarditis, A heart replacement with unusual heart valve operation, certain congenital heart defects, (e.g., cyanotic CHD, and repaired CHD with residual errors).<sup>8</sup>

Several dental manipulations and procedures may lead to bacteremia among infective endocarditis patients. Therefore, it is necessary to use antimicrobial agents to reduce the size and the period of bacteremia among these patients.<sup>5</sup>Amoxicillin showed a substantial effect on decreasing the occurrence, level, and extent of bacteremia instigated by dental processes, however, it does not eradicate the bacteremia.<sup>9</sup>

The American Heart Association has published many journals to guide people ways to avoid infective endocarditis since ever since 1955.<sup>10</sup>However, since the publication of the 2007 version guidelines, the American Heart Association/American College of Cardiology (AHA/ACC) strategies have been updated several times, most recently in the 2017 AHA/ACC.<sup>11,12</sup>

Due to these repeated updates in guidelines, dental practitioners should always have up-to-date information about the latest procedures on the usage of antibiotics for the inhibition of ineffective endocarditis. Therefore, the current study is concerned with the assessment of the understanding and practices of dentists in the Aseer Region, Saudi Arabia, concerning antibiotic prophylaxis compared to infective endocarditis.

## Methods

The study of the research followed a cross-sectional design. The population of the study involved all dentists in Aseer Region (N=204). However, 182 dentists played a part in this study, who were personally interviewed at their workplaces by the researcher (response rate = 89.2%).

Based on the AHA/ACC 2017 Guidelines for infective endocarditis prophylaxis, a sheet for data collection was constructed by the researcher. It comprised the four parts below: <sup>13</sup>

- Personal characteristics of participant dentists: Age, gender, nationality, position, educational level (qualification), duration of experience in dental practice, sources of professional information.
- Knowledge regarding 14 dental practices that requires antibiotic prophylaxis
- Understanding of circumstances concerning the necessity of recommending antibiotics for ten diverse cardiac disorders
- Practices regarding medicines prophylaxis: Prescribed medicines and Time of administering antibiotics before the procedure.

For each knowledge statement, a rating of (1) was allocated for each "correct" response, while a rating of (0) was allocated for an "incorrect" response, or "do not know" response. The total knowledge scores were calculated for every participant dentist. Entire knowledge totals alternated from 0 to 24. Average knowledge scores were assessed for each participant dentist.

Informed consent was signed by all participant dentists. The ethical consent for conducting this research was attained from the Research Ethical Committee (REC# 2019-02-56) of College of Medicine, King Khalid University, Abha, Saudi Arabia.

The examination of the data gathered was done using the Statistical Package for Social Sciences (SPSS, version 25). The calculation of descriptive statistics was done (frequency & percentage for categorical data, standard deviation for quantitative data and mean were calculated. Independent variable t-test and analysis of variance (ANOVA) were applied to test the significance of variation in dentists' mean knowledge scores as per their personal characteristics. An output with P-values<0.05 was statistically significant.

## Results

Table (1) shows that the age of 53.8% of dentists was 25-35 years, while that of 30.2% was 36-45 years. Most dentists (73.1%) were males. Almost half of the participants (45.6%) were Saudi. About one-third of dentists (34.1% were general practitioners), 34.6% were specialists, 18.7% were residents, and 12.6% were consultants. Almost half of the dentists (45.1%) had a Bachelor's Degree, 37.4% had a Master's Degree, while 17.6 had a Ph.D. or Board. About one-third of participants (33%) had less than six years' experience in dental practice, 29.7% had an experience of 6-10 years, while 17% had an experience of 11-15 years. The sources of information for participants were textbooks (74.7%), scientific journals (47.8%), lectures (44.5%), internet (21.4%) and conferences (17%).

Table (2) shows that dentists' mean knowledge score was  $17.5 \pm 3.7$  (out of 24). The most correct responses regarding dental processes that need prophylactic antibiotics were those related to “

replacement of removable prosthodontic or orthodontic appliances” (92.9%), and “improvement of orthodontic devices” (91.8%), while the least correct responses were “root canal treatment” (30.8%) and “bleeding associated with oral mucosa or lips trauma to the lips ” (42.9%). Regarding cardiac conditions that require prophylactic antibiotics, dentists’ most correct responses were “previous infective endocarditis” (89%) and “prosthetic cardiac valves” (84.1), while the least correct responses were “heart failure” (50%) and “adjusted CHDs with no residual defects at the site” (51.1%).

Table (3) shows that dentists aged 25-35 years had the least mean knowledge score regarding antibiotics prophylaxis against infective endocarditis ( $16.9 \pm 3.3$ ). Dentists’ mean knowledge scores differed significantly according to their age groups ( $p=0.032$ ). Non-Saudi dentists had a significantly higher mean knowledge score than that of Saudi dentists ( $18.3 \pm 3.5$  and  $16.6 \pm 3.7$ , respectively,  $p=0.002$ ). Dentists with Bachelor's Degree had the least mean knowledge score ( $16.6 \pm 3.6$ ). Dentists’ mean knowledge scores differed significantly according to their education/qualification ( $p=0.002$ ). Dentists with less than 11 years’ experience in dental practice had the least mean knowledge scores. Mean knowledge scores differed significantly according to dentists’ years of experience ( $p=0.018$ ). Dentists whose scientific journals were their source of information about infective endocarditis had the highest mean knowledge score ( $18.0 \pm 3.6$ ), followed by dentists whose source of information was textbooks ( $17.8 \pm 3.5$ ), while dentists whose internet was their source of information had the least mean knowledge score ( $16.3 \pm 4.1$ ). Differences in dentists’ mean knowledge scores according to their sources of information were statistically significant ( $p<0.001$ ). However, dentists’ mean knowledge score regarding antibiotics prophylaxis against infective endocarditis did not differ significantly according to their gender or position.

Table (4) shows that Amoxicillin was the most commonly prescribed antibiotics by dentists for prophylaxis against infective endocarditis (90.7%), followed by Augmentin (37.4%). Regarding the time of administering prophylactic antibiotics, 86.8% of dentists correctly stated 30-60 minutes before the procedure.

## Discussion

The Ministry of Health in Saudi Arabia and the Saudi Commission for Health Specialties follow the American Heart Association procedures for prophylaxis compared to infective endocarditis. Therefore, dentists in Saudi Arabia should have up-to-date knowledge regarding guidelines about their patients’ standards of care, for which antibiotic prophylaxis against infective endocarditis is among the essential recommendations.<sup>4</sup>

Findings of the present study revealed that dentists’ knowledge about antibiotic prophylaxis against infective endocarditis was suboptimal. Out of 24, their mean knowledge score was  $17.5 \pm 3$ . This result is in line with that reported in Saudi Arabia, which stated that the average knowledge result for infective

endocarditis prophylaxis was  $8.6 \pm 3.2$  (out of 14).<sup>14</sup> However, a lower knowledge level was found in Saudi Arabia, which reported that dentists' total knowledge level regarding the prevention of infective endocarditis was 52.5%.<sup>4</sup>

In Jerusalem, the percentage of 81.3% correct responses for cardiac conditions necessitating prophylactic antibiotics, while, about 41% total knowledge level among dentists in Nigeria.<sup>15,16</sup> In our study, the highest percentages of correct responses regarding dental procedures necessitating prophylactic antibiotics were those related to the placement of removable prosthodontic or orthodontic appliances, and improvement of orthodontic appliances, while the minimum percentages of accurate replies were connected to root canal treatment and bleeding from trauma to the lips or oral mucosa. On the other hand, regarding cardiac conditions necessitating prophylactic antibiotics, the highest percentages of accurate replies were connected to previous infective endocarditis and prosthetic cardiac valves, and the minimum rates of accurate answers were connected to heart failure and fixed congenital heart illness with no residual limitations at the site.

The highest percentages of dentists' correct responses in the study were related to prescribing prophylactic antibiotics to patients with prosthetic cardiac valves and previous infective endocarditis (92.6% and 87.5%, respectively).<sup>4</sup> In Nigeria, it found that 94% of participant dentists would suggest prophylactic antibiotics for patients suffering from prosthetic cardiac valves, while 75% of dentists would recommend prophylactic antibiotics for those with previous infective endocarditis.<sup>16</sup> Better knowledge among dentists was reported, which found that 95% of participant dentists would recommend prophylactic antibiotics for those with prosthetic cardiac valves while 90% would prescribe prophylactic antibiotics for those with previous infective endocarditis.<sup>15</sup> In Saudi Arabia, it was reported that nearly all dentists correctly stated that invasive dental processes (e.g. tooth extraction, periodontal surgery, or scaling) would induce bacteremia.<sup>4</sup> About one-third of participant dentists incorrectly recommended prophylactic antibiotics for patients undergoing local anesthetic infiltration. Our findings indicate that some of our dentists are not familiar with the latest guidelines for antibiotic prophylaxis against infective endocarditis, and there are several points of insufficient knowledge that need to be recovered.

The findings of the present study showed that sources of dentists' information about infective endocarditis were mainly textbooks, scientific journals, and lectures. In Iran, it was reported that participants' sources of information about infective endocarditis were textbooks (70.9%), journal articles (13.5%), and conferences (15.6%).<sup>17</sup> In Nigeria, it was reported that participants' sources of information about infective endocarditis were lectures (54.5%), internet (34.6%), and textbooks (2.2%).<sup>18</sup>

Amoxicillin was the most commonly prescribed antibiotics by dentists in our study for prophylaxis against infective endocarditis (90.7%), followed by Augmentin (37.4%), while the timing of administering prophylactic antibiotics was stated to be 30-60 minutes before the procedure by the majority of participant dentists (86.8%). Other study noted that antibiotic prophylaxis is recommended for invasive dental processes that comprise the operation of gingival tissue or periapical section or perforation of the

mucosa when implemented on high-risk persons.<sup>19</sup> Amoxicillin was also the first-choice prophylactic antibiotic prescribed by dentists for avoidance of infective endocarditis in Saudi Arabia, e.g., in Riyadh City 98.6% and 63.9%, and in other countries, e.g. 57.5% 89%.<sup>4,7,16,20</sup> The administering prophylactic antibiotics at the correct time during the preoperative period for dental procedures that produce significant bacteremia. She emphasized that it is essential that prophylactic antibiotics should be administered shortly before the dental procedure.<sup>21</sup>

Results of our study revealed significant differences between dentists' mean knowledge scores about antibiotics prophylaxis against infective endocarditis according to their age, educational level (qualification), years of experience in dental practice, and sources of information. However, their knowledge did not differ significantly according to their gender or position.

These findings are as per those of in Iran, who found significant differences among dentists' knowledge about antibiotics prophylaxis against infective endocarditis according to their age groups ( $p=0.007$ ), work experience ( $p=0.001$ ), and sources of information ( $p=0.005$ ), but not according to their gender.<sup>17</sup> Moreover, in Nigeria, they reported differences in dentists' knowledge on infective endocarditis according to their age ( $p=0.035$ ), educational level ( $p=0.023$ ), but not according to their gender.<sup>18</sup>

## Conclusion

Knowledge of dentists in the Aseer Region regarding the application of prophylactic antibiotics for the avoidance of infective endocarditis needs to be improved. The inclusion of the latest AHA guidelines into undergraduate and postgraduate curricula of dentistry is highly recommended. Continuous education of dentists should cover these guidelines. Moreover, the AHA guidelines should be distributed to dentists at their clinics.

## Abbreviations

AHA/ACC = American Heart Association /American College of Cardiology

CHD = Congenital Heart Defects

ANOVA = Analysis of variance

SPSS = Statistical Package for Social Sciences

## Declarations

**Ethics approval and consent to participate:** Research Ethical Committee (REC# 2019-02-56) of College of Medicine, King Khalid University, Abha, Saudi Arabia.

**Consent for publication:** Not applicable

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# Tables

Table (1): Personal characteristics of participant dentists

Personal characteristics	No.	%
Age groups in years		
· Between 25 to 35	98	53.8
· Between 36 to 45	55	30.2
· Between 46 to 55	24	13.2
· Above 55	5	2.7
Sex		
· Male	133	73.1
· Female	49	26.9
Nationality		
· Saudi	83	45.6
· Non-Saudi	99	54.4
Position		
· Resident	34	18.7
· General practitioners	62	34.1
· Specialist	63	34.6
· Consultant	23	12.6
Educational level (Qualification)		
· Bachelor	82	45.1
· Master	68	37.4
· Ph.D./Board	32	17.6
Years of experience in dentistry		
· Less than 6 years	60	33.0
· Between 6 to 10 years	54	29.7
· Between 11 to 15 years	31	17.0
· Between 16 to 20 years	20	11.0
· Above 20 years	17	9.3
Sources of information		
· Textbooks	136	74.7
· Scientific journals	87	47.8
· Lectures	81	44.5
· Internet	39	21.4
· Conferences	31	17.0

**Table (2): Dentists' responses toward knowledge statements about dental procedures and cardiac conditions that necessitate antibiotic prophylaxis against infective endocarditis**

Knowledge statements	Correct		Incorrect		Do not know	
	No.	%	No.	%	No.	%
<b>Dental procedures:</b>						
· Supra-gingival scaling	139	76.4	43	23.6	0	0.0
· Class II fillings	138	75.8	40	22.0	4	2.2
· Crown preparation	113	62.1	59	32.4	10	5.5
· Root canal treatment	56	30.8	118	64.8	8	4.4
· Repetitive anesthetic injections via a non-infected tissue	135	74.2	42	23.1	5	2.7
· Dental radiography	164	90.1	16	8.8	2	1.1
· Placement of removable prosthodontic or orthodontic appliances	169	92.9	9	4.9	4	2.2
· Modification of orthodontic appliances	167	91.8	11	6.0	4	2.2
· Placement of orthodontic brackets	164	90.1	15	8.2	3	1.6
· Shedding of deciduous teeth	131	72.0	39	21.4	12	6.6
· Bleeding from trauma to the lips or oral mucosa	78	42.9	95	52.2	9	4.9
· Implant placement	154	84.6	26	14.3	2	1.1
· Sub-gingival scaling	149	81.9	28	15.4	5	2.7
· Surgical extractions	166	91.2	13	7.1	3	1.6
<b>Cardiac conditions:</b>						
· Prosthetic cardiac valves	153	84.1	24	13.2	5	2.7
· Previous infective endocarditis	162	89.0	15	8.2	5	2.7
· Entirely repaired CHDs with prosthetic resources or devices during the initial six months after the process	151	83.0	22	12.1	9	4.9
· Residual defects after repair of CHDs	125	68.7	34	18.7	23	12.6
· Untreated cyanotic congenital heart disease	95	52.2	55	30.2	32	17.6
· Use of prosthetic materials for cardiac valve repair	129	70.9	43	23.6	10	5.5
· Cardiac transplantation recipients who develop cardiac valvulopathy	141	77.5	22	12.1	19	10.4
· Repaired CHDs with no residual defects at the site	93	51.1	93	51.1	29	15.9
· Heart murmurs	122	67.0	28	15.4	32	17.6
· Heart failure	91	50.0	70	38.5	21	11.5
<b>Total knowledge score (Mean±SD out of 24)</b>	<b>17.5±3.7</b>					

**Table (3): Dentists' knowledge scores (Mean±SD) regarding antibiotics prophylaxis against infective endocarditis according to their personal characteristics**

Personal characteristics	No.	Mean	SD	P-value
Age groups in years				
· 25-35	98	16.9	3.3	
· 36-45	55	18.4	4.3	
· 46-55	24	18.4	3.2	
· >55	5	15.6	4.0	0.032
Sex				
· Male	133	17.7	3.9	
· Female	49	16.9	3.0	0.214
Nationality				
· Saudi	83	16.6	3.7	
· Non-Saudi	99	18.3	3.5	0.002
Position				
· General practitioner	62	17.3	3.2	
· Resident	34	17.5	2.7	
· Specialist	63	17.6	4.5	
· Consultant	23	17.6	4.0	0.974
Educational level (Qualification)				
· Bachelor	82	16.6	3.6	
· Master	68	18.6	3.6	
· Ph.D./Board	32	17.5	3.7	0.002
Years of experience in dentistry				
· <6	60	17.2	3.3	
· 6-10	54	16.4	4.1	
· 11-15	31	18.7	3.8	
· 16-20	20	18.6	4.0	
· >20	17	18.5	2.1	0.018
Sources of information				
· Textbooks	136	17.8	3.5	
· Scientific journals	87	18.0	3.6	
· Lectures	81	17.2	3.9	
· Internet	39	16.3	4.1	
· Conferences	31	17.3	4.5	<0.001

Table (4): Dentists' practices regarding antibiotics prophylaxis for infective endocarditis

Practices regarding antibiotics prophylaxis	No.	%
Prescribed antibiotic:		
· Amoxicillin	165	90.7
· Augmentin	68	37.4
· Ampicillin	29	15.9
· Erythromycin/Clarithromycin	50	27.5
· Azithromycin	25	13.7
· Cephalexin	28	15.4
· Cefazolin	7	3.8
· Ceftriaxone (IV only)	4	2.2
· Others	2	1.1
Time of administering antibiotic:		
· Immediately before procedure	3	1.6
· Shortly (30-60 minutes) before the procedure	158	86.8
· 6 hours before the procedure	4	2.2
· 12 hours prior to the procedure	7	3.8
· 24 hours prior to the procedure	10	5.5