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Original Research Article

## Antibiotics usage, how well we know it? KAP survey among the dentist population in Mumbai

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### ABSTRACT

**Background:** There is a rising concern for antibiotic resistance worldwide, the primary cause of which is overuse and misuse. This study primarily aimed at assessing the knowledge of dental practitioners regarding the current guidelines on use of antibiotics and to identify the shortcomings if any.

**Methods:** Present study was a cross-sectional questionnaire-based study conducted amongst 450 dental practitioners across Mumbai with the help of a self-designed questionnaire. The data was entered into excel sheets and appropriate statistical analysis was done with chi-square test using SPSS version 20.

**Results:** The present study had a response rate of 95%. For the total percentage of patients examined each day that required systemic antibiotics, 36.9% (153) dentists answered 0-5%, followed by 25.3% (105) answered 10-15%. 76.1% (316) dentists came across patients who had self-prescribed antibiotics. 66% (274) dentists had never advised an antibiotic sensitivity/ culture test for their patients. 51.3% (213) dentists came across patients who did not respond to antibiotics. 87.2% (363) dentists were not aware about the 'AWaRe' classification of antibiotics given by WHO. 93.3% (383) dentists did not know about antimicrobial stewardship concept.

**Conclusions:** The present study reflected antibiotic overuse and misuse to a certain extent by dental practitioners across Mumbai. Most dentists were unaware about 'AWaRe' classification and antimicrobial stewardship. Patient education on ill effects of self-prescription of antibiotics, identification of traits of antibiotic resistance and antibiotic culture tests needs to be prioritized by dentists.

**Keywords:** Antimicrobial stewardship, Antibiotic resistance, Antibiotics survey, AWaRe, Dental practitioners

### INTRODUCTION

Antimicrobial resistant superbugs have become a reality of the present age and nosocomial infections by these organisms seem to indicate the alarming levels of antibiotic resistance that has run rampant in countries of all income levels. Thereby rendering common diseases untreatable and making life saving procedures riskier to perform. At-least 700,000 deaths have been reported globally as a result of drug resistance in a single year out of which 230,000 have resulted from multi-drug resistant

tuberculosis. A grim figure which can become even more grim considering a prediction of 10 million deaths globally per year by 2050, which definitely makes drug resistance the scourge of medical profession unless swift and sustained actions are not ensued upon.<sup>1</sup> Around 2.4 million people could die in high-income countries between 2015 and 2050 without a sustained effort to contain antimicrobial resistance.<sup>1</sup> Globally numerous strains of *Staphylococcus aureus* have started to exhibit resistance to all the medically important antibiotics which even include vancomycin and methicillin resistant

*Staphylococcus aureus* has become one of the most feared and frequent nosocomial pathogen.<sup>2</sup>

The use of systemic antibiotics has been a common part of the dental practice and has escalated to a great extent in the past two decades. The indiscriminate use of antibiotics runs the risk of producing superbugs which can render fatal infections when the patient is susceptible. The lacuna of solid scientific evidence stating the clinical situations that require systemic delivery of antibiotics tend to accentuate the constraint and limit the restraint on part of the dental practitioner to prescribe antibiotics. Clinical situations that require antibiotic therapy on an empirical basis are limited and include oral infection with evidence of systemic spread such as lymphadenopathy and trismus.<sup>3</sup> Endodontic conditions like reversible pulpitis, irreversible pulpitis with moderate/severe preoperative symptoms with/without apical periodontitis do not warrant antibiotic coverage. Despite these facts, there has been a tendency to prescribe antibiotics for this conditions.<sup>4</sup>

The World health assembly’s endorsement of the global action plan on antimicrobial resistance (AMR) in May 2015 and the political declaration of the high-level meeting of the general assembly on AMR in September 2017 have recognized AMR as a global threat to public health.<sup>5</sup>

**METHODS**

The present cross-sectional survey was conducted in February 2020, involving the dentists across Mumbai (Maharashtra, India). This study was conducted with the aim of assessing the knowledge, attitude and practice (KAP) of dental practitioners regarding the use of antibiotics. Inclusion criteria for the current study were dental practitioners having a minimum of bachelor of dental surgery degree. Practitioners who were unwilling to participate were excluded from the same.

A self designed questionnaire survey was designed to assess the knowledge of dental practitioners regarding the guidelines for the use of antibiotics. The survey questionnaire was constructed after thorough review of literature<sup>3,5-9</sup>. The questions were customized as to fit into the criteria of the present study. The questionnaire was content and face validated and was also pilot surveyed. It contained two parts, i.e., part A had demographic details and part B had questionnaire proper with 14 questions and 5 sub questions which were presented as 6 multiple choice questions, 10 close and 3 open ended questions. A sample size of around 450 dental practitioners was surveyed across Mumbai. The questionnaire was hand delivered and collected after dual follow up. The data was entered into excel sheets and appropriate statistical analysis was done with chi-square test using SPSS version 20.

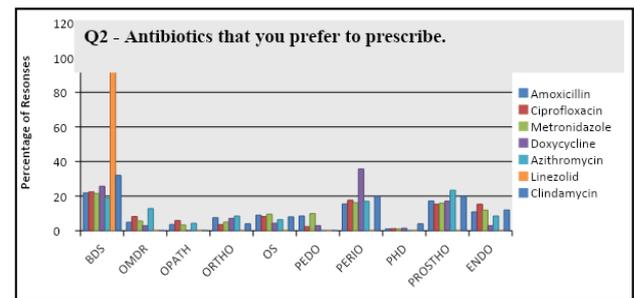
The above sample size of was determined using the estimates from the parent article and using a single proportion formula mentioned below;<sup>10</sup>

$$n = \frac{1.96^2 p(1 - p)(DEFF)}{d^2}$$

Where p=estimate of the expected proportion and d=desired level of absolute precision, assuming the current error prevalence/event rate to be atleast 50%.

**RESULTS**

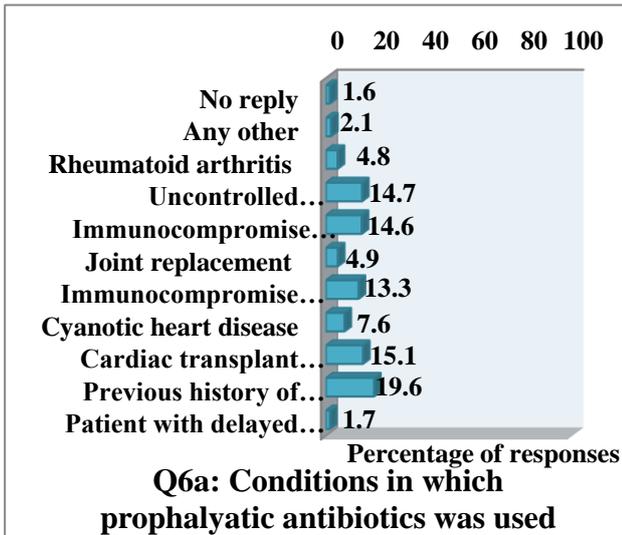
In the present study, out of the 450 questionnaires delivered to dental practitioners, 430 were returned back corresponding to response rate of 95%, which were then screened for missing data and 15 were excluded leading to a final count of 415. Among 415 dentists, 55.2% (229) were females. 56.1% (233) were aged between 20-29 years, followed by 30.1% (125) between 30-39 years. 79.3% (329) were post graduates in dental surgery (MDS). 88.9% (369) had their practice located in urban area. 57.3% (238) had institutional practice type followed by 26% (108) had mixed practice type (both private and institutional). 53.3% (221) of the dentists had an experience of 0-5 years and 48.4% (201) participated in CDE programs within the last one year (Table 1). For the total percentage of patients examined each day that required systemic antibiotics, 36.9% (153) dentists in this study answered 0-5%, followed by 25.3% (105) dentists who answered 10-15%, followed by 21.2% (88) dentists who answered 5-10%. 43.7% (412) dentists preferred to give amoxicillin followed by metronidazole 32.1% (302). A significant association was found for question 2 with specialization (p=0.001) (Figure 1).



**Figure 1: Percentage distribution of preference for prescription of antibiotics by the respondents.**

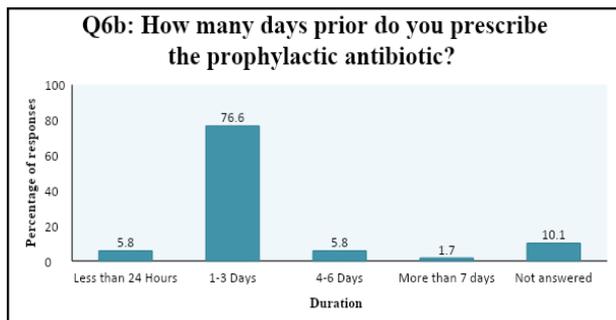
Maximum number of dentists preferred to prescribe antibiotics for facial swelling due to dental related causes 17.3% (400), followed by dentoalveolar abscess 13.9% (321), followed by facial cellulitis 12.9% (299), followed by replantation after avulsion 11.5% (265). When given a situation of a young permanent tooth which had irreversible pulpitis, maximum dentists 40.6% (288) preferred to prescribe antibiotics under the conditions of pain with swelling, fever and lymph node involvement.

79.8% (331) dentists in this study believed in the use of prophylactic antibiotics before surgery. Majority of them preferred to prescribe prophylactic antibiotics for patients with previous history of infective endocarditis 19.6%, followed by cardiac transplant after valvular damage 15.1%, followed by uncontrolled diabetes mellitus 14.7%, followed by immunocompromised patients 14.6%. With question (6a) a significant association was found between age ( $p=0.001$ ) qualification ( $p=0.003$ ); specialization ( $p=0.001$ ) and years in profession ( $p=0.001$ ) (Figure 2).



**Figure 2: Percentage distribution of conditions in which the respondents prescribed prophylactic antibiotics.**

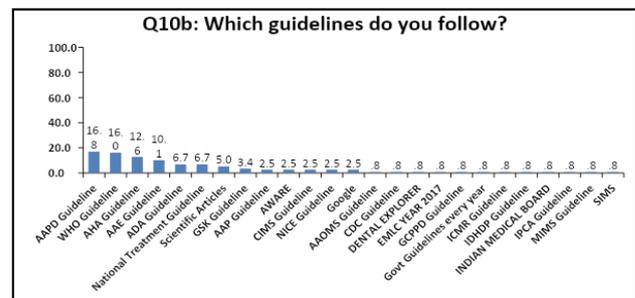
76.6% of the dentists believed in beginning the prophylactic antibiotic course 1-3 days prior. Question (6b) had significant association with qualification ( $p=0.002$ ); specialization ( $p=0.017$ ) and years in profession ( $p=0.033$ ) (Figure 3).



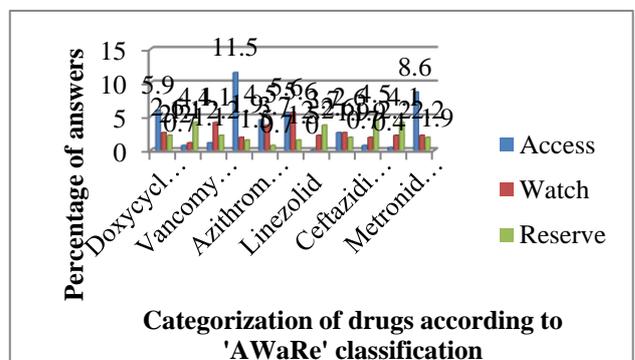
**Figure 3: Percentage distribution of number of days prior to which the respondents prescribed the prophylactic dose.**

76.1% (316) dentists in this study had come across patients who had self-prescribed antibiotics. 66% (274) dentists had never advised an antibiotic sensitivity/culture test for their patients. 51.3% (213) dentists came

across patients who did not respond to antibiotics (undergone resistance to that antibiotic). 58.6% (243) were doing a timely check for new guidelines or any updates on existing guidelines and a significant association was found for this question (question 10a) with qualification ( $p=0.001$ ). Out of the total respondents for this question who answered yes, 82.2% (207) were MDS and 14.8% (36) were BDS. Maximum dentists followed AAPD guidelines 16.8%, followed by WHO guidelines 16%, followed by AHA guidelines 12.6%, followed by AAE guidelines 10.1% (Figure 4). 87.2% (363) dentists in the present study were not aware about the 'AWaRe' (access, watch, reserve) classification of antibiotics given by WHO. Out of all the respondents for question 11b (categorizing the drugs according to 'AWaRe' classification by WHO) maximum dentists have categorized doxycycline as access 5.9%, polymyxin B as reserve 4.1%, vancomycin as watch 4.1%, amoxicillin as access 11.5%, azithromycin as access 4.5%, ciprofloxacin as access as well as watch 5.6%, linezolid as reserve 3.7%, clindamycin as both access and watch 2.6%, ceftazidime+avibactam as reserve 4.5%, meropenem as reserve 4.1% and metronidazole as access 8.6% (Figure 5). 93.3% (383) dentists in this study were unaware about the antimicrobial stewardship' concept introduced by WHO. 82.4% (342) dentists believed that the packet of antibiotics should include its susceptibility towards pathogens. 81.9% (340) dentists had not attended any CDE programs arranged for antibiotic abuse or antibiotic resistance recently (Table 2).



**Figure 4: Percentage distribution of guidelines which respondents follow.**



**Figure 5: Percentage distribution of categorization of the drugs according to 'AWaRe' classification by the respondents.**

**Table 1: Frequency distribution of demographic variables of respondents.**

Variable	Respondents, N (%)
<b>Gender</b>	
Male	186 (44.8)
Female	229 (55.2)
<b>Age (years)</b>	
20-29	233 (56.1)
30-39	125 (30.1)
40-49	44 (10.6)
50-59	12 (2.9)
60 and above	1 (0.2)
<b>Qualification</b>	
BDS	86 (20.7)
MDS	329 (79.3)
<b>Specialization</b>	
Orthodontics	34 (8.2)
Endodontics	45 (10.8)
Oral pathology	15 (3.6)
Oral medicine and radiology	21 (5.1)
Oral surgery	38 (9.2)
Pediatric dentistry	37 (8.9)
Periodontology	65 (15.7)
Prosthodontics	70 (16.9)
Public health dentistry	4 (1.0)
<b>Practice location</b>	
Urban	369 (88.9)
Semi urban	41 (9.9)
Rural	5 (1.2)
<b>Practice Type</b>	
Private	67 (16.1)
Institutional	238 (57.3)
Public	2 (0.5)
Mixed	108 (26.0)
<b>Years of experience in the profession</b>	
0-5	221 (53.3)
6-10	99 (23.9)
11-15	51 (12.3)
Above 15	44 (10.6)
<b>Continuing dental education</b>	
Within last 1 year	201 (48.4)
Past 2-5 years	97 (23.4)
More than 5 years	117 (28.2)

## DISCUSSION

The present study had a response rate was 95% which was much higher compared to study conducted by Kaul et al (38.33%), Mohan et al (87.3%), Kumar et al

(87.8%), the better response rate could be attributed to personal distribution and collection of the survey responses.<sup>4,10,11</sup> 7-11% of all the antibiotics prescribed in the World originate from dental prescriptions, which although is a small percentage when compared to the same prescribed by medical practitioners, it does significantly contribute to the global consumption of antibiotics<sup>12</sup>. The present study found that although maximum number of respondents 36.9% (153) found the need to prescribe antibiotics to only about 0-5% of the patients examined daily, there were also 25.3% (105) who prescribed antibiotics to 10-30% and 12.8% (53) who prescribed antibiotics to 30-50% of their patients daily which does contribute to antibiotic over prescription to a certain extent. James et al from their systematic review inferred that antibiotics were not useful whenever used for irreversible pulpitis especially when prescribed with the motto of pain relief.<sup>12,13</sup> In accordance with this the present study found misuse of antibiotics to a certain extent in the form of prescription for irreversible pulpitis 5.1% (118), reversible pulpitis 1.6% (38) and also for pain relief 1.9% (44). The American dental association guidelines suggests usage of antibiotics for dental conditions should be limited to situations when there is systemic involvement due to dental causes and prescribes to perform immediate definitive and conservative dental treatment for all cases.<sup>14</sup> With regards to this the present study found a positive outcome wherein maximum number of dentists 40.6% (288) preferred to give antibiotics for a tooth with irreversible pulpitis with pain only if there is swelling, fever and lymph node involvement. Patients who are medically compromised tend to require a prophylactic dose of antibiotics even for minor surgical procedures which run the risk of producing bacteraemia. The American academy of pediatric dentistry (AAPD) provides a set of guidelines, which intends to help the dental practitioners to make decisions regarding patients at risk with respect to antibiotic prophylaxis. This becomes essential in clinical decision making owing to the unpredictability of a susceptible patient developing an infection hence minimizing their risk of developing bacteraemia.<sup>12</sup> With respect to this the present study found major prophylactic antibiotic prescriptions for patients with previous history of infective endocarditis, cardiac transplant after valvular damage, uncontrolled diabetes mellitus and immune-compromised patients. Patients who have undergone joint replacements in the past do not require prophylactic antibiotics prior to dental procedures.<sup>15,16</sup> In spite of this the present study found some prescriptions for joint replacement patients and also some who prescribed for healthy patients with delayed appointment. The 2007 AHA guidelines state that an antibiotic for prophylaxis should be administered in a single dose before the procedure.<sup>15</sup> The present study found that maximum respondents begin prophylactic prescriptions 1-3 days prior thereby contributing to over-prescription. Previous studies have shown that there was very high prevalence of self-prescription of antibiotics in rural as well as urban population in India.<sup>17</sup>

**Table 2: Participants responses to various questions when compared with qualification.**

Question	Responses	BDS N (%)	MDS N (%)	Total N (%)	P value
<b>Q. 1 Percentage of patients examined each day, that require be given systemic antibiotics?</b>	0-5%	21 (13.7)	132 (86.3)	153 (36.9)	0.001*
	5-10%	16 (18.2)	72 (81.8)	88 (21.2)	
	10-30%	37 (35.2)	68 (64.8)	105 (25.3)	
	30-50%	12 (22.6)	41 (77.4)	53 (12.8)	
	50-80%	5 (31.2)	11 (68.8)	16 (3.9)	
<b>Q. 2 What antibiotics you prefer to prescribe?</b>	Amoxicillin	90 (21.8)	322 (44)	412 (43.7)	0.511
	Ciprofloxacin	19 (22.4)	66 (77.6)	85 (9)	
	Metronidazole	65 (21.5)	237 (78.5)	302 (32.1)	
	Doxycycline	18 (25.7)	52 (74.3)	70 (7.4)	
	Azithromycin	9 (19.1)	38 (80.9)	47 (5)	
	Linezolid	1 (100)	0 (0)	1 (0.1)	
	Meropenem	0 (0)	0 (0)	0 (0)	
Clindamycin	8 (32)	17 (68)	25 (2.7)		
<b>Q. 3 Conditions for which you prefer to give antibiotics?</b>	Facial swelling due to dental related causes	89 (22.2)	311 (77.8)	400 (17.3)	0.436
	Pain relief	14 (31.8)	30 (68.2)	44 (1.9)	
	Implant	33 (17.6)	155 (82.4)	188 (8.1)	
	Periodontal surgeries	52 (23.7)	167 (76.3)	219 (9.5)	
	Endodontic flare up	35 (16)	184 (84)	219 (9.5)	
	Reversible pulpitis	6 (15.8)	32 (84.2)	38 (1.6)	
	Irreversible pulpitis	27 (22.9)	91 (77.1)	118 (5.1)	
	Dent alveolar abscess	70 (21.8)	251 (78.2)	321 (13.9)	
	Facial cellulitis	59 (19.7)	240 (80.3)	299 (12.9)	
	Replantation after avulsion	47 (17.7)	218 (82.3)	265 (11.5)	
	Intrusion	12 (21.1)	45 (78.9)	57 (2.5)	
	Extrusion	14 (22.2)	49 (77.8)	63 (2.7)	
	Luxation/subluxation	16 (20)	64 (80)	80 (3.5)	
<b>Q. 4 Tooth no. 16 has irreversible pulpitis with vital pulp confirmed by the standard tests, under which conditions do you prefer to give antibiotics?</b>	Pain	5 (45.5)	6 (54.5)	11 (1.5)	0.013*
	Pain and swelling	54 (27.7)	141 (72.3)	195 (27.5)	
	Pain, swelling and fever	44 (22.3)	153 (77.7)	197 (27.7)	
	With pain, swelling, fever and lymph node involvement	47 (16.3)	241 (83.7)	288 (40.6)	
<b>Q. 5 Do you believe in use of prophylactic antibiotics before surgery?</b>	Yes	72 (21.8)	259 (78.2)	331 (79.8)	0.484
	No	19 (22.6)	65 (77.4)	84 (20.2)	
<b>Q. 7 Have you ever come across patients who have self-prescribed antibiotics?</b>	Yes	68 (21.5)	248 (78.5)	316 (76.1)	0.719
	No	23 (23.2)	76 (76.8)	99 (23.9)	
<b>Q. 8 Have you ever advised an antibiotic sensitivity/ culture test for your patients?</b>	Yes	29 (20.6)	112 (79.4)	141(34)	0.631
	No	62 (22.6)	212 (77.4)	274 (66)	
<b>Q. 9 Have you come across patients who did not respond to antibiotics? (undergone resistance to antibiotics)</b>	Yes	44 (20.7)	169 (79.3)	213 (51.3)	0.521
	No	47 (23.3)	155 (76.7)	202 (48.7)	

Continued.

Question	Responses	BDS N (%)	MDS N (%)	Total N (%)	P value
<b>Q. 10a) Do you timely check for any new guidelines or for any updates on existing ones?</b>	Yes	36 (14.8)	207 (82.2)	243 (58.6)	0.001*
	No	55 (32)	117 (68)	172 (41.4)	
<b>Q. 11a) Are you aware about the 'AWaRe' classification by WHO?</b>	Yes	10 (19.2)	42 (80.2)	52 (12.5)	0.214
	No	81 (23.2)	282 (76.8)	363 (87.2)	
<b>Q. 12a) Are you aware about the Antimicrobial Stewardship concept introduced by WHO?</b>	Yes	7 (25)	21 (75)	28 (6.7)	0.684
	No	84 (21.3)	303 (78.3)	387 (93.3)	
<b>Q.12b) Do you believe in implementing the Antimicrobial Stewardship concept in India?</b>	Yes	29 (24.4)	90 (75.6)	119(28.7)	0.544
	No	16 (26.2)	46 (14.2)	62 (14.7)	
<b>Q. 13 Do you believe that the packet of antibiotics should include its susceptibility towards pathogens?</b>	Yes	73 (21.3)	269 (78.7)	342 (82.4)	0.535
	No	18 (24.7)	55 (75.3)	73 (17.6)	
<b>Q. 14 Have you recently attended any CDE programs arranged for antibiotic abuse or antibiotic resistance?</b>	Yes	16 (21.3)	59 (78.7)	75 (18.1)	0.891
	No	75 (22.1)	265(77.9)	340 (81.9)	

Similarly, the present study also found a significant number of dentists who came across patients who self-prescribed antibiotics 76.1% (316) and also a significant number who came across patients who did not respond to antibiotics 51.3% (213) which hints that we need to focus on antibiotic sensitivity/culture tests. Rarely the dentist faces the challenge of combating a resistant strain of bacteria which would not relent to prescription of routine antibiotics, such situations demand the use of antibiotic sensitivity test to identify and single out exactly which antibiotic is suitable for that particular strain of bacteria. Antibiotic sensitivity test requires a sample to be obtained from the lesion which could be the exudates or purulent material or an excised granuloma or cyst sent to the diagnostic lab where the histopathology can also be done for the lesion.<sup>18</sup> A study conducted by Singh et al found that less than 40% of the dentists advised culture sensitivity test, which is very similar to the results found in the present study 34% (141).<sup>19</sup>

The WHO has introduced the concept of antimicrobial stewardship (AMS) to make sure that the health sector as a whole starts taking responsibility for the health and well being of the population and also guides the health systems first nationally and eventually globally. AMS is one of the three pillars which are aimed at strengthening the health systems at large. Infection prevention and control (IPC) and medicine and patient safety are the other two pillars of the tripod. AMS helps in controlling the antimicrobial resistance when applied in conjunction with antibiotic use surveillance, the WHO essential

medicines list (EML) and AWaRe classification (access, watch, reserve).<sup>5</sup> The present study clearly reflected that 93.3% (387) dentists were unaware about the antimicrobial stewardship concept. This study also found that 87.2% (363) dentists were not aware about this classification which led to very few dentists who could correctly categorize the drugs in the question that followed. One of the reasons for the above situation could be that maximum number of dentists in this study 81.9% (340) had not attended any continuing education programs or events specifically for antimicrobial resistance which was found to be more than that observed by Naveen et al (64%).<sup>12</sup> India's National action plan (NAP) for antimicrobial resistance (AMR) was released in April 2017 by the union ministry of health and family welfare.<sup>20</sup> Antimicrobial stewardship can be started at hospital/clinical level to curb the overuse of antibiotics and outpatient antibiotic stewardship can be established.<sup>21-23</sup>

## CONCLUSION

There is a rising concern for antibiotic resistance worldwide, the primary cause of which is overuse and misuse, both of which are clearly evidenced in the present study to a certain extent. Hence, there is an urgent need to focus on building guidelines that specify all the possible dental conditions which require antibiotic prescription in accordance with the WHO essential medicine list (EML), AWaRe classification in order to completely curb antibiotic over prescription by dentists. Outpatient

Antimicrobial Stewardship can be established and dental practitioners should be trained for the same. Dental practitioners should be updated on recent guidelines for the use of antibiotics with the help of Continuing Education programs. Moreover, on coming across patients who self-prescribe antibiotics, dentists should warn them about its ill effects and at the same time focus on identifying traits of antibiotic resistance among their patients and advice sensitivity/culture tests for the same.

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