

Awareness about Antimicrobial Resistance among Dental Practitioners in India- A Systematic Review.¹Dr. Rajkumar C, ²Iyyaparaj.P, ³Madankumar.P D.¹⁻³Ragas Dental College and Hospital, Uthandi, Chennai-600119.**Corresponding Author:** Dr. Rajkumar C, Ragas Dental College and Hospital, Uthandi, Chennai-600119.**Citation of this Article:** Dr. Rajkumar C, Iyyaparaj.P, Madankumar.P D., “Awareness about Antimicrobial Resistance among Dental Practitioners in India- A Systematic Review” IJDSIR- November - 2020, Vol. – 3, Issue - 6, P. No. 283 – 293.**Copyright:** © 2020, Dr. Rajkumar C, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.**Type of Publication:** Review Article**Conflicts of Interest:** Nil**Introduction**

Antimicrobial resistance is a serious threats to public health and economic burdens. India is one of the largest consumer of antimicrobial drugs worldwide, with overall 7-11% of dentists and 80% of physicians prescribing antimicrobial drugs^{1, 6}. In India approximately 2.4 million peoples get antimicrobial resistance infection which accounts for 50000 death/year [World Health Organization, 2019]. Recent report by Indian Council of Medical Research (2018) highlights that three health care specialties [Dentist, ENT, Skin specialty] highly over prescribe the antimicrobial drugs in India².

Although judicious use of antimicrobial agents is strongly encouraged, their overuse or misuse has become entrenched globally in various settings. In acute care hospitals, it is estimated that approximately 20%–50% of all antimicrobials prescribed are either unnecessary or inappropriately used. Some of the factors affecting this irrational use include socio-economic status, physicians’ knowledge and training, patient load, diagnostic ambiguity, availability of treatment guidelines and

pharmaceutical marketing². Further rampant antimicrobial use has contributed to adverse clinical outcomes, increasing healthcare costs and the emergence of multidrug-resistant organisms, which poses a significant threat to public health².

The basic step that can be taken towards building up antimicrobial resistance could be awareness. This also includes the knowledge about the right drug to be prescribed at the right time with the appropriate dosage. Many approaches are being made to control the spread. One of the approaches is to undertake various institutional and educational programs among the public sector, medical sectors about antimicrobial resistance, its complications and regarding the steps which can prevent its development and spread. World Health Assembly adopted a global action plan on antimicrobial resistance, which gives specific objectives [WHO global action plan for AMR 2015]. This objectives underscores the need for an effective “one health” approach involving coordination among numerous international sectors³.

Although awareness of the consequences of antimicrobial misuse is increasing, overprescribing remains widespread, driven largely by patients demand, time pressure on clinicians and dentists, and diagnostic uncertainty. Use of antimicrobial stewardship in combination with infection prevention and control efforts limits the emergence and transmission of antimicrobial-resistant pathogens⁴.

Literature evidence shows that dentists are prescribing more common antimicrobial drugs for many dental diseases¹. Exploration of the same revealed very limited studies in India assessing the antimicrobial prescription pattern among dentists⁷. As per the National Center for Disease Control and Prevention, approximately one-third of all outpatient antimicrobial prescriptions are unnecessary and increasing prescription of antimicrobials and bacterial resistance⁵. According to Indian Council of Medical Research, (2017), antimicrobial overprescribing is common in dentistry and is a major contributor to antimicrobial resistance⁵. Also lack of awareness observed emphasizes the need for developing national guidelines for antimicrobial use in dental conditions. Practicing such guidelines will go a long way in controlling antimicrobial resistance. Hence, this systematic review was proposed to review the existing evidence on awareness of antimicrobial resistance among Dental Practitioners in India.

Materials and Methods

A systematic review was undertaken using objective and transparent methods as per the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, to identify, evaluate and summarize all relevant research findings. The protocol for systematic Review was registered with PROSPERO (International prospective register of Systematic review, Acknowledgement ID: 155548)

Structured Question: What is the awareness about antimicrobial resistance among Indian Dental Practitioners?

Eligibility Criteria

The PECO analysis to the articles searched were set as shown below:

- **PECO Analysis**

- Population: Registered Dental Practitioners in India
- Exposure: Awareness about Antimicrobial Resistance.
- Outcome: Whether there was significant knowledge and awareness about Antimicrobial Resistance.

Types of Studies: Cross Sectional Studies.

Inclusion Criteria

1. Studies which included Registered Dental Practitioners in India.
2. Cross sectional study designs were included.
3. Studies which was written in English language were only included.
4. Studies published in the past 10 years (2009-2019) were included.

Exclusion Criteria

1. Studies which included other healthcare professionals (general physician, nurse, pharmacist) and Dental Students.
2. Any other type of study designs, grey literatures and unpublished articles were excluded.

Search Strategy

The literature search covered the electronic databases: PubMed, Google scholar and Tripdatabase. In order to search databases, strings of search (MeSH) terms, consisting of relevant text words and Boolean links, were constructed. The references of all the full-text articles were searched to select the relevant articles. The search strategy included the combination of the following terms: awareness , anti-infective agents, antimicrobial resistance, dentists, knowledge, attitude, Practice, Over-prescription,

Antibiotic Prescription, Inappropriate Prescribing, Anti-Bacterial Agents , India, Antimicrobial resistance, Indian dental practitioners the search patterns of various database were given in table 1.

The remaining studies were sorted out on the basis of their title and abstract. Finally, those studies in which the

Data Collection and Analysis

The titles and abstracts were independently identified and screened by two reviewers and search and decided on the possible reports to be included. We obtained and examined full text reports of all potentially relevant studies, to decide whether the studies fulfilled the inclusion criteria. Any disagreement between the authors was resolved through discussion.

Data Extraction

Data extraction was completed independently by the two reviewers using a specifically designed data extraction form. Quality Assessment criteria to evaluate the studies were decided by two review authors in accordance with Modified New Castle Ottawa Guidelines. The following data was collected:

- ✓ Author and Year
- ✓ Study Population
- ✓ Objectives
- ✓ Exposure
- ✓ Outcome
- ✓ Results
- ✓ Conclusion

Quality Assessment

All the included studies were assessed by using Modified New Castle Ottawa Scale. The quality assessment of the included studies was undertaken independently by two reviewers. The domains evaluated were selection, outcome and risk of bias. In selection component(Representativeness of the sample, Sample

abstract fulfilled all the inclusion criteria were selected for full-text reading. In those cases in which a study met the eligibility criteria but the information in the abstract was insufficient, full texts of the articles were also obtained. Further literature search was performed based on the references of the selected articles.

size, Ascertainment of exposure, Non-respondents) Thus, the overall level of risk for each study was subsequently classified as “High Risk” [If it did not record a “YES” in more than three main and sub- categories], “Moderate Risk” of bias If four out of six categories did record a “YES”], “Low Risk” [all the categories recorded a “YES” or 5 out of six categories], “Unclear [unclear risk of bias for one or more domain].

Results

The search generated a total of 45 relevant articles identified (Pubmed=23, Google scholar=22, Trip Database=0). Seven articles were eliminated after reading the title. 38 articles were selected for the abstract reading. After the abstract reading twelve article was excluded and 26 were selected for full text reading. After full text reading 21 articles were excluded and 5 studies which met the inclusion criteria were taken for the present systematic review. (Table 1)

Outcome Measures

Knowledge & Awareness of Antimicrobial Resistance

All the included studies reported knowledge, attitude and practice about antimicrobial resistance among dental practitioners in India.

Regarding knowledge about anti-microbial resistance among dental practitioners, studies done by Karibasappa G.N et al., (2014) & Konde et al., (2016) & Ramachandran et al., (2019) stated that around 80% to 91% of Indian Dental practitioners were aware of the term “Antimicrobial Resistance”^{1,6,8}.

The study done by Puranik et al., (2018), stated that UG/PG training programs (95.0%) & scientific materials (91.7%) were the major sources of knowledge regarding antimicrobial resistance⁹.

Studies done by Karibasappa G.N et al., (2014), Konde et al., (2016) & Puranik et al., (2018), highlights that Injudicious prescription pattern among health professionals, self-prescription by patient (OR=1.06) and over-prescription by dentist (OR=1.10) were contributing to the emergence of antibiotic resistance. Also 50% of dentists have already encountered a cases of antibiotic resistance in their dental practice^{1,6,9}.

According to Karibasappa G.N et al., (2014), the first and foremost step taken by dentists to combat antimicrobial resistance was proper diagnosis (65.3%) and patient education (31.9%). Very few dentists used narrow-spectrum antibiotics (2.8%) and despite the awareness of antimicrobial resistance, they showed a lack of concern in curbing this grave problem¹.

Studies done by Gowri et al., (2015), Konde et al., (2016), Puranik et al., (2018) describe about prescription pattern for dental condition: high percentage of the Dentists were prescribing antibiotics for conditions such as simple dental extraction (30.8%) followed by Dental abscess (21.6%), Cellulitis & Ludwig's Angina and other Space Infection (12.5%), Periodontitis (7.5%), Pericoronitis (4.1%) and Tooth Fracture (56.7%)^{12,6,9}.

According to Ramachandran et al., (2019) 15% of Undergraduate practitioners knew the rules of antibiotic prescription when compared with 71% of Postgraduate practitioners⁸. Konde et al., (2016) stated that 17% of Undergraduate practitioners & 56% of Pediatric Dentists were awareness of the guidelines for antibiotic prescription⁶. According to Gowri et al., (2015), 63.3% of dental practitioners did not know about the recent antibiotic policy/guidelines¹².

Discussion

This systematic review was intended to assess awareness about antimicrobial resistance among Indian Dental Practitioners. This review has highlighted the lack of awareness about antimicrobial resistance among dentist. Further this research also reveals that reason behind antimicrobial resistance might be due to ununiformed prescription pattern, over prescription, antibiotics given for non-indicated clinical conditions by the dental health care professionals and improper use by the patients.

Dental diseases are predominantly because of local factors; mere removal of the local causative factors reduces the need for prescribing antibiotics considerably. Despite the awareness on antimicrobial resistance, dentists showed lack of concern with respect to this emerging problem. The need of the hour is to weigh the pros and cons of antibiotics before prescribing them to your patients. Public needs to be educated at mass level against self-medication with antimicrobial, which will help us in curbing antimicrobial resistance to a greater extent.

In the present review, the search based on PRISMA guidelines narrowed down on a set of five cross sectional studies which suggested that though dental practitioners showed positive attitude towards antimicrobial resistance. They lacked uniformity in knowledge of prophylactic and therapeutic prescription pattern of five studies considered for evaluation only the studies done by Karibasappa et al., (2014) & Puranik. P et al., (2018) have mentioned the age of the study population which was below 40 years old^{1,9}.

The study done by Karibasappa G.N et al., (2014), highlights some alarming findings among dental practitioners about the miss use of antimicrobial including systemic antimicrobial being increasingly used in the treatment of periodontal infection, routine endodontic treatments to prevent flare-ups. Although there was no significant difference based on educational qualification,

lack of prophylactic guidelines may have led the dentist to prescribe the antibiotics¹.

Ramachandran et al., (2019) stated that there was a significant difference seen in prescription pattern among undergraduate and post graduate dentists. Further though critical increments in the prescription of antimicrobials and knowledge about the antimicrobial resistance were also seen among dental practitioners, the awareness of guidelines for antimicrobial prescription was found to be low among undergraduate dental practitioners compare to postgraduate dental practitioners⁸.

Puranik. P et al., (2018), stated that dental practitioners with post graduate qualification believed that self-prescription by the patients (OR- 1.06, P=0.80) and over prescription by dentists (OR- 1.10, P=0.62) lead to antimicrobial resistance. UG/PG training, scientific material, Continuing Dental Education (CDE) programs were suggested as an important source of knowledge for dental practitioners to refresh or upgrade their clinical skills regarding the appropriate use of antimicrobials which in turn will affect their prescribing practices⁹.

Quality assessment of the studies showed that among five cross sectional studies, three studies had moderate risk of bias and two studies had low risk of bias. However there was difference in knowledge and prescription pattern which could affect the study results.

Some of the challenges faced in India to combat the issue of antibiotics are the lack of surveillance system and operating guidelines for antimicrobial prescription. Over-the-counter sale of antibiotics, lack of public awareness and commitment on the part of policymakers are other issues. At the level of policymakers, it is recommended to have a national action plan, improved surveillance system, regulation and promotion of guidelines and survey of the impact of information to follow-up whether the improvement is there or not¹⁶. At

the level of health-care workers, promotion of hand instrument and environmental sanitation to avoid development of infection in the first place, antimicrobial prescription only when needed, right drug, dose and duration while prescribing and test to confirm when in doubt is recommended. For the general public or the patients, it is required that they use antimicrobials only when prescribed by health care professionals, take full prescription, discard leftover, not to share their prescription with friends or family and prevent infection by maintaining hygiene¹⁶. From the dental perspective, it is, therefore, suggested that antimicrobials should be used as an adjunct and not a substitute for a definite treatment. Frequent updating and reinforcement programs have to be conducted focusing on the prescription of antimicrobial, over usage and educate the practitioners on the harmful effects of antimicrobial resistance.

References

1. Karibasappa GN, Sujatha A. Antibiotic resistance—A concern for dentists? IOSR J Dent Med Sci 2014;13:112-8.
2. Himika Wasan, Pooja Gupta, Apoorva Mathur¹, Ekta Mutneja, Vijay Prakash Mathur², Yogendra Kumar Gupta Journal of Natural Science, Influence of Qualification and Practice Settings of Dental Practitioners on Antimicrobial Prescribing in Delhi and National Capital Region, India | Published by Wolters Kluwer – Medknow, 2017
3. WHO Library Cataloguing-in-Publication Data Global Action Plan on Antimicrobial Resistance. I.World Health Organization. ISBN 978 92 4 1509763, 2015
4. Kopal Sharma, Pushpawati Jain, Amit Sharma, Knowledge, attitude and perception of medical and dental undergraduates about antimicrobial stewardship August 6, 2019.

5. Dar Odeh NS, Abu Hammad OA, Al Omiri MK, Khraisat AS, Shehabi AA. Antibiotic prescribing practices by dentists: A review. Ther Clin Risk Manag 2010;6:301
6. Konde S, Jairam LS, Peethambar P, Noojady SR, Kumar NC Antibiotic overusage and resistance: A cross-sectional survey among pediatric dentists. J Indian Soc Pedod Prev Dent 2016;34:145-51.
7. Oberoi SS, Dhingra C, Sharma G, Sardana D. Antibiotics in dental practice: How justified are we. Int Dent J 2015;65: 4-10.
8. Punithavathy Ramachandran, Narendra Kumar Rachuri¹, Satyam Martha, Rekha Shakthivel², Anusha Gundala³, Thilak Sravan Battu. Implications of Overprescription of Antibiotics: A Cross-Sectional Study 2019.
9. Manjunath P. Puranik, Bhavna Sabbarwal, Sreekanth Bose. Dental Practitioner's Knowledge and Practices Regarding Antibiotic Prescription and Development of Resistance: A Cross sectional Study, Journal of Indian Association of Public Health Dentistry | Volume 16 | Issue 2 | 2018
10. Abukaraky AE, Afifeh KA, Khatib AA, Khdairi NO, Habarneh HM, Ahmad WK, et al. Antibiotics prescribing practices in oral implantology among Jordanian dentists. A cross sectional, observational study. BMC Res Notes 2011;4:266.
11. Halboub E, Alzaili A, Ali Quadri MF, Al-Haroni M, Al-Obaida MI, Al-hebshi NN. Antibiotic prescription knowledge of dentists in Kingdom of Saudi Arabia: An online, country-wide survey. J Contemp Dent Pract. 2016;17(3):198-204.
12. Sivaramakrishnan Gowri, Deeksha Mehta, Sridharan Kannan¹ Antibiotic use in dentistry: A cross-sectional survey from a developing country, Journal of Orofacial Sciences 90 Vol. 7• Issue 2, 2015.

Legends Table and figure

Table 1 : Data Extraction

Author Name & Year	Study Population	Objectives	Exposure	Outcome And Results	Conclusion
Dr. Karibasappa G.N et al., 2014	Registered Dental practitioners	The present survey was carried to assess the antibiotic prescription pattern, awareness on antibiotic resistance and measures taken to combat antibiotic resistance among dentists at Dhule city of	To assess the antibiotic prescription pattern, awareness on antibiotic resistance and measures taken to combat antibiotic resistance among dentists	Around 90% of dentists were aware of the term “Antibiotic resistance” and knew that injudicious prescription pattern among health professionals and self-medication with antibiotics inappropriately were contributing to the emergence of antibiotic resistance. Exactly 50%	Dental diseases are predominantly because of local factors; Antibiotics should be used only as adjuncts even when there is a real need; never the first line of treatment modality. Public needs to be educated at mass level against self-medication with antibiotics, which w

		Maharashtra.		of dentists have already encountered few cases of antibiotic resistance in their dental practice. The first and foremost step taken by dentists to combat antibiotic resistance is proper diagnosis (65.3%) and patient education (31.9%). A very few dentists feel use of narrow-spectrum antibiotics (2.8%) may also help in combating antibiotic resistance.	help us in curbing antibiotic resistance to a greater extent.
Sivaramakrishnan Gowri et al., 2015	Dental practitioners	The aim was to assess the knowledge, attitude, and practice (KAP) of antimicrobial drug use among dental fraternity in a tertiary care teaching dental college and hospital.	To assess the antibiotic prescription pattern, awareness on antibiotic resistance	The most common dental indication of antibiotics among dentists was post dental extraction, attributing to 30.8% (37/120), followed by dental abscess 21.6% (26/120) and 60% (72/120) prescribed antibiotics after most minor surgical procedures. Surprisingly, 37.5% (45/120) of the participants opined that they use antibiotics against viral infection. Regarding the spectrum of antibiotic usage, 74.1% (89/120) preferred broad	We found poor KAP regarding antimicrobial use in dentistry thereby conferring increasing potential for the development of more serious antimicrobial resistance. Immediate constitution of hospital antibiotic committee and scrutinizing the prescription of antibiotics is mandatory in dental hospitals as well.

				<p>spectrum instead of narrow spectrum</p> <p>25.8% (31/120). Furthermore, (76/120) 63.3% did not know about the recent antibiotic policy/guidelines from the Government of India. However, 85% (102/120) felt that the frequent use of antibiotics decreased the efficacy of treatment on reuse of the same antibiotic. Interestingly, 4.1% (5/120) did not know the existence of antibiotic resistance.</p>	
Sapna Konde et al., 2016	Registered Dental practitioners	The objective of this survey is to compare the antibiotic prescription pattern and the awareness of antibiotic resistance among Bachelor of Dental Surgery (BDS) practitioners and pediatric dentists.		<p>Around 88% BDS practitioners and 99% pediatric dentists were aware of “antibiotic resistance” and a majority of them knew that self-medication and injudicious use of antibiotics were contributing to the development of antibiotic resistance.</p>	Practitioners should prescribe antibiotics in accordance with the guidelines to curb antibiotic resistance, an emerging public health problem.
Manjunath P. Puranik et al., 2018	Registered Dental practitioners	To assess knowledge and practice regarding antibiotic	Antimicrobial resistance	A majority of participants were postgraduates (59.5%). UG/PG training (95.0%) and scientific	Knowledge related to antibiotic prescription was low. Although the majority of participants

		prescription and development of resistance among dental practitioners		materials (91.7%) were the major sources of knowledge. A high percentage of the study participants were prescribing antibiotics for conditions such as tooth fracture (56.7%), dental caries (53%), and simple extraction (54.5%). Dental practitioners with postgraduate qualification believed that self-prescription by patient (odds ratio [OR] = 1.06, [P = 0.80]) and over prescription by dentist (OR = 1.10, [P = 0.62]) may lead to the development of antibiotic resistance.	were aware of the antibiotic resistance, still indiscriminate prescription of antibiotics was found indicating a need for updating regarding appropriate antibiotic use through Continuing Dental Education programs.
Punithavathy Ramachandran et al., 2019	Registered Dental practitioners	The objective of this study was to compare the awareness of antibiotic prescription and resistance among BDS and MDS practitioners.	Antimicrobial resistance,	Around 85% BDS and 94% MDS dental practitioners knew about “antibiotic resistance” and a majority of the participants (90% BDS and 96% MDS) were aware about the prophylactic antibiotic prescription with a P = 0.39.	Antibiotic prescription should be given with care to prevent its resistance, an upcoming iatrogenic health hazard.

Table 2: Quality Assessment of Cross-Sectional Studies Included

Author & year	Selection 1)a/b=1c/d=0	Selection 2)a=1b=0	Selection 3)a/b=1 c=0	Selection 4)a=1b/c=0	Exposure 1)a/b=1c/d=0	Exposure 2)a=1b=0	Score
Dr. Karibasappa G.N et al., 2014	A	a	b	a	c	a	5
Sivaramakrishnan Gowri et al., 2015	A	b	a	a	c	a	4
Sapna Konde et al., 2016	A	b	b	a	c	a	4
Manjunath P. Puranik et al., 2018	A	a	b	a	c	a	5
Punithavathy Ramachandran et al., 2019	B	b	b	a	c	a	4

Table 3: Bias Table

High risk of bias (Low evidence)	Moderate risk of bias (Moderate evidence)	Low risk of bias (High evidence)
If it did not record a “YES” in more than three main and sub- categories	If four out of six categories did record a “YES”	If all the categories recorded a “YES” or 5 out of six categories
No Studies	Three Studies	Two Studies
	<p>1- Antibiotic use in dentistry: A cross-sectional survey from a developing country Sivaramakrishnan Gowri et al., 2015.</p> <p>2- Antibiotic overusage and resistance: A cross-sectional Survey among pediatric dentists, Sapna Konde et al., 2016.</p> <p>3- Implications of Over prescription of Antibiotics: A Cross-Sectional Study, Punithavathy Ramachandran et al., 2019.</p>	<p>1- Antibiotic Resistance – A Concern for Dentists? , Dr. Karibasappa G.N et al., 2014.</p> <p>2- Dental Practitioners knowledge and practices regarding antibiotic prescription and development of resistance, Manjunath P. Puranik et al., 2018.</p>

Flowchart 1

