



Original article

Antibiotic Prescribing Regimen and Resistance Awareness Among Eastern Libyan Dentists

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ABSTRACT:

Background: The frequent use of antibiotics in dentistry for prophylaxis and treatment has contributed to a significant global public health issue: antibiotic resistance.

Aim: This research aims to evaluate the patterns in the prescription of antibiotics and their prophylactic usage in treating systemic conditions. Additionally, it investigates the awareness as well as adherence to guidelines for antibiotic prescription, as well as the awareness of antibiotic resistance among dentists with advanced degrees and postgraduate (AD) qualifications, and those with bachelor's Degrees (BD) in the eastern region of Libya.

Materials and Methods: This cross-sectional study employed a questionnaire to gather data from a representative sample of 130 Libyan dentists in the eastern region (including Benghazi, Almarj, Albayda, Derna and Tobruk cities).

Results: Most of the antibiotics prescribed by dentists were amoxicillin with clavulanic acid followed by amoxicillin alone, and both participant groups were adherent to the recommendations for prescribing antibiotics with statistically significant variation between the two groups.

Conclusion: This study revealed a tendency to overprescribe and utilize antibiotics for particular dental diseases. The majority of dentists were aware of resistance to antibiotics and adhering to the antibiotic prescription guidelines, the participants acknowledged the recommended use of antibiotics as a preventive strategy for systemic conditions.

Keywords: Antibiotics resistance, Dentists, Libya, Awareness, Adherence, Prescription, Prophylaxis, Guidelines

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INTRODUCTION

Since their discovery in the late 1920s, antibiotics have been among the medications that dentists administer the most frequently.^{1,2} In order to treat oral and dental infections, dentists frequently prescribe antibiotics for therapeutic or preventive purposes. 10% of all antibiotic prescriptions are considered to be associated with dental infections.³

Referring to the NICE guidelines, antibiotics are not recommended for healthy individuals at low risk when there is no evidence of infection spreading. For dentoalveolar infections, the primary options are Phenoxymethylpenicillin PO 500 mg every six hours, Amoxicillin PO 500 mg three times a day or Benzylpenicillin IV 1.2 g, they work effectively. If the

infection is severe, concurrent Metronidazole therapy should be addressed. In cases of a penicillin allergy, use 500 mg of Clarithromycin PO/IV every 12 hours along with the same kind of concurrent care as described above.^{4,5}

Global antibiotic consumption, expressed as defined daily doses, grew by 65% between 2000 and 2015.⁶ This rise in use was mostly evident in low- and middle-income nations, where utilization of antibiotics has been noticed to be significantly higher than in high-income countries. The correct administration of antibiotics in a wide range of medical circumstances has attracted greater attention in recent years from a variety of health groups.²⁻⁷

The ability of bacteria to resist an antimicrobial medication that was once successful in treating infections caused by them is known as antimicrobial resistance.⁸ Furthermore, because resistant genes are easily transferred through interpersonal connections and human or animal waste, antibiotic resistance affects not merely the individual using the medication but also everyone else.⁷

Despite there are many reasons for the increasing incidence of resistance, the most significant one is antibiotic abuse, even if prescribing antibiotics is still seen to be a relatively unimportant act. The world is rapidly approaching a post-antibiotic lifespan in which ordinary diseases and mild injuries that have been treated for decades could once again be fatal if immediate, coordinated action is not implemented.⁹⁻¹¹

Dentistry may have a significant impact on the issue of antibiotic resistance since antibiotic prescriptions by dentists are now routinely written for non-clinical reasons, such as pain management, irreversible pulpitis, and localized dentoalveolar abscess.¹²⁻¹⁵

Previous studies from Egypt showed that the participants demonstrated a considerably adequate understanding of the issue of bacterial resistance, however in their practices, they displayed varied degrees of adherence to antibiotic prescribing guidelines, mostly in overprescriptions for situations where antibiotics were unnecessary.¹⁶⁻¹⁹ Identically, Jordanian dental specialists and dentists of the National Health Service NHS in England tend to prescribe Amoxycillin and metronidazole.^{20,21} Moreover, dentists in Jordan tend to overprescribe antibiotics.²⁰

As a consequence of this, it is critical to use antibiotics sensibly in dental practice to both increase efficacy and decrease resistance and side effects.¹²⁻¹⁵

This emphasizes how crucial it is to understand how dentists prescribe antibiotics, including the duration, type of medication, frequency, and need to prescribe before, during, and after dental procedures.

Consequently, the objective of this study was to evaluate Libyan general practitioners' and specialists' prescribing patterns for antibiotics and whether they adhere to professional guidelines.

MATERIALS AND METHODS

This cross-sectional study employed a questionnaire to gather data from a sample of Libyan dentists at the eastern region, via an email containing an electronic link to the Google Forms-generated survey. The study conducted from February to June 2024, invited participation from 700 dentists who had been working in various basic and specialty dental clinics in the eastern region of Libya (Benghazi, Almarj, Albayda, Derna and Tobruk cities). The responses included 130 dentists who completed the questionnaire, yielding a

response rate of 18.5%. To increase the response rate, reminder emails and phone message notifications were sent to the participants

Bias

To reduce selection bias, all dental professionals who participated in the study were randomly chosen at random and requested to anonymously complete a self-administered questionnaire. To minimize information bias, the study's nature and aim were explained to each participant in the same way.

Participants:

Inclusion criteria

Libyan dentists from the eastern region in general practice who have completed a bachelor's degree in oral and dental medicine, a master's or doctoral degree in a specialization of dentistry.

Exclusion criteria

1. Any nationality outside of Libya.
2. Dental professionals who do not practice clinical dentistry, (dentists who only perform official duties and do not practice clinical dentistry or treat patients).

Sources of data and measurement methods

Data was collected using English validated self-administered questionnaire based on the earlier research by Konde *et al*²² and Mariam *et al*.¹⁷

The data collection technique involved using a specially designed form to gather essential general information and data on antibiotic prescription patterns. Closed-ended (Yes/No) and multiple choice questions composed the questionnaire. There were two sections on the questionnaire: The first part contained the participants' personal demographic and employment-related data, such as level of dental education achieved, work experience and workplace. and the second half included questions about dentists' awareness of and reactions related to the prescription of antibiotics for dental patients.

This observational research was reported in accordance with the STROBE guidelines. The Faculty of Medicine, University of Derna's Research Ethics Committee approved the current study.

Outcomes

This survey was created to evaluate:

- The prescribing behaviors for antibiotics in cases of pulpitis, localized intraoral swelling, draining sinus tract, dental trauma, acute swelling of the face, dry socket, periodontal diseases in pediatric, pericoronitis for partially erupted tooth, extraction by open wound, simple extraction, periapical infection, apical periodontitis, evidence of anaerobic infection.
- Antibiotic implement as a prophylaxis measure for systemic health issues, such as cardiovascular disorders, blood dyscrasias, diseases linked to viruses, respiratory disorders, juvenile diabetes.

- The knowledge of and compliance with the prescribing guidelines for antibiotics.
- The understanding of and adherence to antibiotic prophylactic protocols.
- The dentist's viewpoint on potential reasons why antibiotics are misused.
- dentists, both general practitioners and specialists, awareness of antibiotic resistance.

All statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 26.0. Descriptive statistics were employed to compute numbers, frequencies, and percentages for every category in the categorical data. To compare the prescription manner among general and specialty dentists, a Chi-square test was performed.

RESULTS

Out of the 700 questionnaires distributed, only 130 dental practitioners responded. Among them, 58 (44.6%) held a Bachelor of Dental Surgery, and 72 (55.4%) had advanced or postgraduate degrees. Table 1 presents the participants' practice information and demographic data, showing that 54.6% of participants were working in clinical practice, 8.5% were academics, and 36.9% were working in both. Approximately 14.6% of participants had less than two years of clinical experience, 11.5% had 2 to 5 years of experience, and 73.8% had more than 5 years of experience. Table 2 showed clinical situations for standard antibiotic prescriptions where there was a non-significant statistical difference in antibiotic prescriptions for both advanced and bachelor's degree dentists for various oral diseases, with the exception of pulpitis and localized intraoral swelling.

Table 3 highlights the patterns of antibiotic prescription among dentists with advanced degrees and those with

bachelor's degrees, where, as table 3 shows, amoxicillin with clavulanic acid (75% and 81.03%), was given more frequently than amoxicillin (20.83 % and 15.51%). Table 4 indicates that the majority of antibiotic prescriptions are for a period of 5-7 days.

Numerous dentist specialists (73.61%) and bachelor's degrees (81.03%) recommend prophylactic antibiotics for the situation of cardiovascular diseases without statistical significance difference between both groups ($p=0.387$). Most dentists did not recommend antibiotics for several systemic conditions with no statistically significant difference observed between the two groups (Table 5).

Table (1): Demographic information and practice experience for the research population

variable	N	Percent %
Bachelor of dental surgery	58	44.6
Advanced degree and postgraduate training	72	55.4
Less than 2 years	19	14.6
from 2 to 5 years	15	11.5
More than 5 years	96	73.8
Clinical practice	71	54.6
Academics	11	8.5
Both	48	36.9

Table(2): Experimental circumstances for frequently antibiotics prescription among advanced and bachelor's degree dentists

	Advanced degree and postgraduate		Bachelor's degree		P- Value
	Yes/ No	N	Yes / No	N	
Pulpitis	Yes No	12 60	Yes No	17 41	0.059*
Draining sinus tract	Yes No	33 39	Yes No	30 28	0.508
Localized intraoral swelling	Yes No	31 41	Yes No	36 22	0.021*
Acute facial swelling	Yes No	65 7	Yes No	55 3	0.484
Dental trauma	Yes No	34 38	Yes No	26 32	0.787
Pediatric periodontal diseases	Yes No	20 52	Yes No	22 36	0.222
Pericoronitis	Yes No	45 27	Yes No	39 19	0.578
Simple extraction	Yes No	46 26	Yes No	2 56	0.441
Extraction by the open method	Yes No	43 29	Yes No	38 20	0.407
Periapical abscess	Yes No	46 26	Yes No	42 16	0.305
Apical periodontitis	Yes No	30 42	Yes No	28 30	0.459
Dry socket	Yes No	24 48	Yes No	21 37	0.631
Evidence of anaerobic infection	Yes No	60 12	Yes No	46 12	0.359

Table (3): The routinely prescribed antibiotic
Advanced degree and postgraduate(N=72) bachelor's degree(N=58)

	N	Percent	N	Percent
Amoxicillin	15	20.83	9	15.51
Amoxicillin with clavulanic acid	54	75	47	81.03
Ampicillin with Sulbactam	0	0	1	1.72
Amoxicillin with flucloxacillin	3	4.16	1	1.72
Total	72	100.0	58	100.00

Table (4): The prescription period of the antibiotic
Advanced degree and postgraduate(N=72) bachelor's degree(N=58)

	N	Percent	N	Percent
Less than 5 days	6	8.33	4	6.89
5 to 7 days	66	91.66	53	91.38
More than 7 days	0	0	1	1.72
Total	72	100.0	58	100.0

Table (5): prescribed antibiotic for systemic conditions

	Advanced degree and postgraduate(N=72)			Bachelor's degree(N=58)			P- Value
	Yes/ No	N	Percent %	Yes/ No	N	Percent %	
Cardiovascular diseases	Yes No	53 19	73.61	Yes No	47 11	81.03	0.387
Viral infections	Yes No	4 68	5.55	Yes No	3 55	5.17	0.970
Juvenile diabetes	Yes No	21 51	29.17	Yes No	20 38	34.48	0.339
Blood dyscrasias	Yes No	15 57	20.83	Yes No	10 48	17.24	0.458
Respiratory disorders	Yes No	14 58	19.44	Yes No	14 44	24.14	0.438

Regarding the awareness of the guidelines, 76.39% of specialists, and 91.38% of bachelor's degree dentists acknowledged the standards for prescribing antibiotics with a statistically significant difference between both groups ($p=0.000$). Additionally, 83.33 % of the advanced degree dentists and 91.38 % of the bachelor's degree dentists demonstrated awareness of the antibiotic prophylaxis rules, also with statistically significant difference between the two groups ($p=0.000$).

Concerning adherence to guidelines, 77.78% of advanced degree 84.48% of bachelor's degree dentists adhered to the antibiotic prescription guidelines with a statistical significance difference between the two groups ($p=0.000$) while 77.78 % of AD dentists and 81.03 % of BD dentists were adherents to the antibiotic prophylaxis guidelines with statistical significance difference between both groups ($p=0.000$) as displayed in Table 6

Table (6): Awareness of dental practitioners to the antibiotic prescription and prophylaxis recommendations, and antibiotic resistance

	Advanced degree and postgraduate(N=72)			Bachelor's degree(N=58)			P- Value
	Yes/ No	N	Percent %	Yes/ No	N	Percent %	
Awareness of antibiotic prescription guidelines	Yes No	55 17	76.39	Yes No	53 5	91.38	0.000
Adherence to antibiotic prescription guidelines	Yes No	56 16	77.78	Yes No	49 9	84.48	0.000
Awareness of antibiotic prophylaxis guidelines	Yes No	60 12	83.33	Yes No	53 5	91.38	0.000
Adherence to antibiotic prophylaxis guidelines	Yes No	56 16	77.78	Yes No	47 11	81.03	0.000
Awareness of antibiotic resistance	Yes No	68 4	94.44	Yes No	55 3	94.83	0.051

Almost the entire AD and BD were knowledgeable of the issue of antibiotic resistance. The greater part of them were understanding that inappropriate antibiotic usage and self-medication contribute to increasing the incidence of resistance to antibiotics with no statistically significant difference throughout the two group (Table 6). Prior to prescribing the antibiotics, most of the respondents inquire if the patient has previously used antibiotics in the past week and emphasize the

importance of adhering to the prescribed dosage, (Table7). A small percentage of dentists prescribed antibiotics due to insistent parents or a crowded waiting area. Additionally, 11.11% of AD and 13.79% of BD dentists prescribed antibiotics to maintain the patient's condition until they could see a specialist, with no statistically significant difference between the two groups, as indicated in Table 7

Table (7): The potential factors of antibiotic misuse from the dentist’s perspective

	Advanced degree and postgraduate (N=72)			Bachelor’s degree(N=58)			P- Value
	Yes/ No	N	Percent %	Yes/ No	N	Percent %	
Self-medication.	Yes No	62 10	86.11	Yes No	48 10	82.75	0.602
Parents insist	Yes No	9 63	12.50	Yes No	8 50	13.79	0.830
Inquire from the patient about taking a course of antibiotics in the past 1 week before prescribing antibiotics	Yes No	65 7	90.27	Yes No	52 6	89.65	0.907
Advise the patient to adhere to the dosage regimen and inform the consequences of not doing so	Yes No	68 4	94.44	Yes No	53 5	91.37	0.498
Prescribe antibiotics to sustain the patient until the specialist treats the patient	Yes No	8 64	11.11	Yes No	8 50	13.79	0.647

DISCUSSION

Globally, antibiotic resistance is rising at an alarming rate, implementing the opportunity to treat common infectious diseases in dangerous circumstances. The misuse and overuse of antibiotics, in addition to inadequate infection prevention and control, all contribute to the development of antibiotic resistance.²³ Depending on the foundation of global regulations, observing the achievement of public health programs, and pinpointing new developments and risks improving all over the world antimicrobial resistance monitoring is fundamental.¹⁸ Consequently, this study aims to add to a wealth of knowledge about the misuse and usage of antibiotics, particularly with regard to the treatment of patients in the eastern region of Libya. The results of this study indicated a propensity for improper use and overuse of antibiotics for particular diseases, such as pulpitis and localized intraoral swelling. These results were consistent with several studies that suggest that the main causes may be insufficient knowledge about the disease, an inaccurate diagnosis, insufficient time, patient expectations,

parental pressure, and the rejection of surgical treatment.^{9,11,24,25} The antibiotic most commonly prescribed was amoxicillin with clavulanic acid, which was followed by Amoxicillin only. The reason behind this issue could be that Amoxicillin is effective against oral anaerobes and streptococci, which makes it suitable for treating odontogenic infections. Additionally, When amoxicillin is combined with clavulanic acid, it has the benefit of maintaining its effectiveness against beta-lactamases, which are often produced by microorganisms associated with odontogenic infectious diseases.^{26,30} Regarding the frequency of antibiotic recommendation, the majority of dental practitioners across both groups prescribed antibiotics for 5-7 days, which allowed for the elimination of symptoms and eliminated the possibility of a clinical or microbiological recurrence.²⁶⁻³¹ While dentists generally recommended antibiotics for systemic conditions such as cardiovascular diseases, the majority indicated they would not prescribe antibiotics for viral infections, juvenile diabetes, blood dyscrasias, or respiratory disorders.^{27,28}

Although it is possible for oral pathogens to spread and infect distant tissues during dental procedures, there is no direct evidence of this occurring. Therefore, it is uncertain when and under what circumstances systemic prophylactic antibiotics are truly necessary.^{27,28}

The American Heart Association (AHA) suggests that patients with cardiovascular diseases need to receive antibiotic prophylaxis because they have the greatest risk of adverse effects.^{29,30}

In this study, a large number of advanced degree dentists (73.61%) and bachelor's degree (81.03%) prescribed prophylactic antibiotics for cardiovascular patients with no statistically significant difference between both groups. Several studies have linked endodontic infections to systemic diseases, including cardiovascular conditions.³¹ This connection has raised concerns about dental management for patients scheduled for cardiovascular surgery. The practice of dental screening and management of oral infections, such as caries, endodontic infections and periodontal infections before any invasive cardiovascular procedure remains controversial due to the lack of detailed information in existing guidelines.³²

In our study, participants demonstrated awareness of the antibiotic prescription guidelines, with a statistically significant difference between the two groups. They also showed awareness of the antibiotic prophylaxis recommendations, again with a statistically significant difference between the groups. These results in disagreement with the finding of Al-Johani. *et al*, who reported that 65.9% of the dentists did not follow any specific guidelines.¹⁸ Comparable results have been observed in other studies conducted in the USA.^{13,33}

The American Dental Association released guidelines on the use of antibiotics for emergency management of pulpal and periapical dental pain and oral swelling. They concluded that antibiotics are not recommended for healthy adults diagnosed with symptomatic irreversible pulpitis, with or without symptomatic apical periodontitis, or pulp necrosis and symptomatic apical periodontitis. Instead, these patients should be referred for definitive dental treatment. However, if dental treatment is not possible and symptoms worsen, a delayed prescription of amoxicillin or penicillin V potassium is recommended for patients with pulp necrosis and symptomatic apical periodontitis. Conversely, the expert panel recommended prescribing antibiotics along with urgent dental treatment for immunocompromised patients diagnosed with pulp necrosis and acute apical abscesses with systemic involvement.³⁴

The results revealed that nearly all AD and BD were attentive of antibiotic resistance and understood that self-medication and improper usage of antibiotics contribute to its development, with no statistically

significant difference between the two groups. These findings are consistent with a survey conducted in Derna (eastern region of Libya) by Rabee *et al*, which found that 6.7% of participants used antibiotics through self-medication.³⁵

Antimicrobial resistance is driven by various aspects, such as improper antibiotic prescriptions, overuse or misuse of antibiotics, and inappropriate patient compliance with antimicrobial medication, often not following treatment recommendations.³⁶ Recently, there has been a growing trend in the inappropriate utilization of antibiotics throughout Europe. In its entirety, 7–10% of antibiotic administrations occur in outpatient settings, with dentistry contributing a comparatively higher proportion of these prescriptions. Numerous studies have shown that dentists frequently do not follow antibiotic prescription guidelines, particularly for prophylactic purposes in dentoalveolar surgery.^{37,38}

The results of the current investigation indicated that the majority of the participant dentists followed the antibiotic prescription guidelines, with statistically significant variations between the two groups. Similarly, adherence to the antibiotic prophylaxis guidelines also showed statistical significance between the groups. According to an updated global survey, non-adherence to antibiotic therapy, which highlights improper usage and potentially increases the risk of treatment failure, reinfection, and antimicrobial resistance, was estimated to be around 22.3%, varying between 9% and 44% among different countries.³⁹ The findings of this study contradict those of a study conducted among dentists in Jeddah, which revealed a lack of adherence to antibiotic prescription guidelines.¹⁸

STUDY LIMITATIONS

The data was collected using participants' self-reported information and did not involve reviewing patient records to verify the accuracy of prescriptions. Moreover, it is concerning that reporting bias may exist since dentists' answers might not accurately represent their real practices. Furthermore, an additional possible issue with self-administered questionnaire research is non-response bias. The responses from participants could have differed positively or negatively compared to those of non-respondents, making it challenging to determine the likely direction of the non-respondents' answers.

CONCLUSION

Conclusions of this study indicated that participants had greater inclination to overprescribe and overuse antibiotics for particular dental diseases. Nearly all AD and BD were aware of antibiotic resistance and adhering to the guidelines for antibiotics prescription, the participants were aware of the guidelines for the

prescription and prophylactic use of antibiotics for systemic conditions.

REFERENCES

- Esposito S.; Castellazzi L.; Tagliabue C.; Principi N. Allergy to antibiotics in children: An overestimated problem. *Int J Antimicrob Agents*. 2016, 48, 361–366. <https://doi.org/10.1016/j.ijantimicag.2016.08.001> PMID: 27554439.
- Klein EY, Van Boeckel TP, Martinez EM, Pant S, Gandra S, Levin SA, et al. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. *Proc Natl Acad Sci U S A*. 2018 Apr 10; 115(15):E3463 <https://doi.org/10.1073/pnas.1717295115> PMID: 29581252.
- Malik AZ, Qasim A. Surgical Site Infections after Elective Surgery in Pakistan: SURGIPAK Study. *J Rawalpindi Med Coll*. 2015; 19(3):209–14.
- NICE. Antimicrobials stewardship. Available at: <https://www.nice.org.uk/about/what-we-do/our-programs/nice-guidance/antimicrobial-prescribing-guidelines> (accessed September 2022)
- Palmer N O (ed). *Antimicrobial prescribing in dentistry: Good Practice Guidelines*. 3rd ed. London: Faculty of General Dental Practice (UK) and faculty of Dental Surgery, 2020. Available at: <https://cgdent.uk/wp-content/uploads/2021/08/Antimicrobial-Prescribing-in-Dentistry-2020-online-version.pdf> (accessed September 2022).
- Malik ZI, Nawaz T, Abdullah MT, Waqar SH, Zahid MA. Surgical site infections in general surgical wards at a tertiary care hospital. *Pak J Med Res*. 2013; 52(4).
- Saleem Z, Hassali MA, Godman B, Hashmi FK, Saleem F. A multicenter point prevalence survey of healthcare-associated infections in Pakistan: findings and implications. *Am J Infect Control*. 2019; 47(4):421–4. <https://doi.org/10.1016/j.ajic.2018.09.025> PMID: 30471976.
- Montero-Aguilar M. Antimicrobial Resistance: What Should Dentists be Doing? *Odovtos-Int J Dent Sci*. 2017 Jan 15; 18(1E):10–4.
- Patrick A, Kandiah T. Resistance to change: how much longer will our antibiotics work? *Fac Dent J*. 2018;9(3):103–11.
- Carlet J. The world alliance against antibiotic resistance: consensus for a declaration. *Clin Infect Dis*. 2015;60(12):1837–41.
- Liaquat A, Fatima Jaffery M, Usman M, Faraz Tayyab T, Saeed T, Naheed A. Are dentists prescribing the antibiotics in justified conditions? An exploratory study. *J Pak Dent Assoc*. 2020;29(03):120–3.
- 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; 21:301–6.
- Cherry WR, Lee JY, Shugars DA, White RP, Vann WF. Antibiotic use for treating dental infections in children: a survey of dentists' prescribing practices. *J Am Dent Assoc*. 2012;143(1):31–8.
- Pallasch TJ. Global antibiotic resistance and its impact on the dental community. *J Calif Dent Assoc*. 2000;28:215–33.
- Ahsan S, Hydrie MZI, Naqvi SMZH, Shaikh MA, Shah MZ, Jafry SIA. Antibiotic prescription patterns for treating dental infections in children among general and pediatric dentists in teaching institutions of Karachi, Pakistan. *PLoS ONE*. 2020;15(7 July):1–11.
- Mariam M, A, and Marwa, A.E. The prescription pattern and awareness about antibiotic prophylaxis and resistance among a group of Egyptian pediatric and general dentists: a cross sectional study. *BMC Oral Health*. 2021; 21(1):322
- El-Geleel A, Gamal B, Wahba N. Assessment of the knowledge, attitude, and practice of antibiotic prescription among a group of dentists in Egypt: a cross-sectional survey. *Egyptian Dental Journal*. 2021 Oct 1;67(4):2893–904.
- K Al-Johani, S G Reddy, A S Almushyt, A El-Housseiny. Pattern of prescription of antibiotics among dental practitioners in Jeddah, KSA: A cross-sectional survey. *Niger J Clin Pract*. 2017 Jul;20(7):804–810.
- A Mainjot, W D'hoore, A Vanheusden, J-P Van Nieuwenhuysen. Antibiotic prescribing in dental practice in Belgium. 2009 dec;42(12):1112–7.
- Dar-Odeh NS, Abu-Hammad OA, Khraisat AS, El Maaytah MA, Shehabi A. An analysis of therapeutic, adult antibiotic prescriptions issued by dental practitioners in Jordan. *Chemotherapy*. 2007 Dec 3;54(1):17–22.
- Martin H Thornhill, Mark J Dayer, Michael J Durkin, Peter B Lockhart, Larry M Baddour. Oral antibiotic prescribing by NHS dentists in England 2010– 2017. *Br Dent J*. 2019 December ; 227(12): 1044–1050.
- Konde S, Jairam LS, Peethambar P, Noojady SR, Kumar NC. Antibiotic cover-usage and resistance: a cross-sectional survey among pediatric dentists. *J Indian Soc Pedod Prev Dent*. 2016;34(2):145–51.
- World Health Organization. Antibiotic resistance: multi-country public awareness survey. WHO Press. 2015; pp. 1–51.
- Baudet A, Kichenbrand C, Pulcini C, et al. Antibiotic use and resistance: a nationwide questionnaire survey among French dentists. *Eur J Clin Microbiol Infect Dis*. 2020;39(7):1295–303.

25. Vasudavan S, Grunes B, Mcgeachie J, Sonis A. Antibiotic prescribing patterns among dental professionals in Massachusetts. *Pediatr Dent*. 2019;41(1):25–30.
26. Peedikayil F. Antibiotics: use and misuse in pediatric dentistry. *J Indian SocPedodPrev Dent*. 2011;29(4):282.
27. American Academy of Pediatric Dentistry. Use of antibiotic therapy for pediatric dental patients. *Pediatr Dent*. 2018;40(6):383–5.
28. Oberoi SS, Dhingra C, Sharma G, Sardana D. Antibiotics in dental practice: how justified are we. *Int Dent J*. 2015;65(1):4–10.
29. American Academy of Pediatric Dentistry. Antibiotic prophylaxis for dental patients at risk for infection. *Pediatr Dent*. 2020:447–452.
30. Wilson W, Taubert KA, Gewitz M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association. *Circulation*. 2007;116(15):1736–54.
31. Aminoshariae A, Kulild JC, Fouad AF. The impact of endodontic infections on the pathogenesis of cardiovascular disease (s): a systematic review with meta-analysis using GRADE. *Journal of endodontics*. 2018 Sep 1;44(9):1361-6.
32. Habib G, Lancellotti P, Antunes MJ, Bongiorni MG, Casalta JP, Del Zotti F, Dulgheru R, El Khoury G, Erba PA, Iung B, Miro JM. 2015 ESC guidelines for the management of infective endocarditis: the task force for the management of infective endocarditis of the European Society of Cardiology (ESC) endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European Association of Nuclear Medicine (EANM). *European heart journal*. 2015 Nov 21;36(44):3075-128..
33. Sivaraman SS, Hassan M, Pearson JM. A national survey of Pediatric dentists on antibiotic use in children. *Pediatr Dent* 2013;35:546-9
34. Lockhart, P.B.; Tampi, M.P.; Abt, E.; Aminoshariae, A.; Durkin, M.J.; Fouad, A.F.; Gopal, P.; Hatten, B.W.; Kennedy, E.; Lang, M.S.; et al. Evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling: A report from the American Dental Association. *J. Am. Dent. Assoc.* 2019, 150, 906–921.e12.
35. Rabee AA; Elzahaf RA;. Mansour YS; Ibrahim N A. Knowledge, Attitude and Practices of Self-Medication Among Community Pharmacy Consumers' Perspectives in Derna City, Libya. *PBJ*. 2021; 9(1):11-21.
36. Loeffler C, Boehmer F. The effect of interventions aiming to optimise the prescription of antibiotics in dental care—A systematic review. *PloS one*. 2017 Nov 14;12(11):e0188061.
37. Preus H.R., Fredriksen K.W., Vogsland A.E., Sandvik L., Grytten J.I. Antibiotic-prescribing habits among Norwegian dentists: A survey over 25 years (1990–2015) *Eur. J. Oral Sci*. 2017;125:280–287.
38. Busa A., Parrini S., Chisci G., Pozzi T., Burgassi S., Capuano A. Local versus systemic antibiotics effectiveness: A comparative study of postoperative oral disability in lower third molar surgery. *J. Craniofac. Surg*. 2014;25:708–709.
39. Pechère JC, Hughes D, Kardas P, Cornaglia G. Non-compliance with antibiotic therapy for acute community infections: a global survey. *International journal of antimicrobial agents*. 2007 Mar 1;29(3):245-53.