

Antibiotic prescribing practices of Filipino Dentists

Melchor A. Sarmiento¹, Mariano T. Maglutac Jr², Ma. Susan Yanga-Mabunga³

^{1,2}School of Dentistry, Emilio Aguinaldo College, Philippines

³Department of Health Policy and Administration, College of Public Health, University of the Philippines, Philippines

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ABSTRACT

There are reports that dentists overprescribe antibiotics which may contribute to antibiotic resistance. This is an exploratory study on antibiotic prescribing practices of Filipino dentists using an online platform to form a basis for antimicrobial stewardship policy for dentists. A link to an online questionnaire using Survey Monkey was posted in a Closed Group Facebook account of Filipino dentists. Two hundred thirty (230) dentists participated. Data was analyzed by Survey Monkey. Amoxicillin is the first choice of antibiotics (71.18%), and clindamycin is the second (57.27%). Most respondents follow the indications for antibiotic therapy, however, some will prescribe antibiotics for conditions without indications. For dental procedures, 88.99% will prescribe for periodontal surgery, 75.45% for endodontic surgery, 68.3% for extraction of a tooth with chronic infection, 87.17% for third molar surgery, 26.7% for routine endodontics, and 23.56% for periodontal treatment without surgery. Not all of the respondents would prescribe for medical conditions that require antibiotic prophylaxis, while 60.36% will prescribe when in doubt in diagnosis, under time pressure (25.68%), and 48.67% considers patient preference. Only 10.48% of the respondents are *very familiar* with antimicrobial stewardship, while majority (69.74%) have not attended a lecture for antimicrobial stewardship for dentists. There is inappropriate antibiotic prescribing of participants on certain dental diseases, procedures, and medical conditions. Most respondents are not *very familiar* and have not attended a lecture on antimicrobial stewardship for specifically for dentists.

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Corresponding Author:

Sarmiento, Melchor A,
Emilio Aguinaldo College, School of Dentistry,
Manila, Philippines,
Tel: +63-2-5212710 loc 5341.
Email: melchorasarmiento@gmail.com

1. INTRODUCTION

Most dental infections can be managed by operative procedures like creating drainage, or removal of the cause but, there are cases wherein antibiotics are needed especially for rapidly progressing infections, systemic involvement, or patients with decreased immune response. However, there are reports that dentists inappropriately prescribe antibiotics. Regulatory flaws in developing countries make patients take antibiotics even without prescription, based on recommendations from friends or relatives, or from previous experiences. This misuse and overuse of antibiotics contribute to antimicrobial resistance (AMR), which is now a worldwide public health problem. Health authorities are now devising strategies to fight antimicrobial resistance. The World Health Organization (WHO) developed policy package to combat antimicrobial resistance. Developed countries devised their own strategies. The US Centers for Disease Control and Prevention developed the Antibiotic Resistance (AR) Solutions Initiative to improve antibiotic use through antibiotic stewardship. The United Kingdom developed the UK Five Year Antimicrobial Resistance Strategy

to slow the development and spread of antimicrobial resistance, while Japan developed the National Action Plan on Antimicrobial Resistance.

In the Philippines, the Interagency Committee on Antimicrobial Resistance was created and launched the Win the WAR against AMR. The Department of Health also published the Antimicrobial Stewardship Program in Hospitals. Philippine Antibiotic Awareness Week (PAAW) is celebrated in the month of November.

Statement of the problem

There are no available published studies on antibiotic prescribing practices of Filipino dentists. The Philippines has no antimicrobial stewardship policy for dentists. The World Health Organization (WHO) is leading the way in taking actions against AMR. In dentistry, the World Dental Federation (FDI) is taking initiatives in participating in this efforts. Other national organizations like the American Dental Association, Canadian Dental Association, British Dental Association, and others are already doing their parts. The Philippine dental community needs to do its part because antimicrobial resistance does not recognize geographical boundaries.

Significance of the study

The study aims to establish baseline data on prescribing practices of Filipino dentists and will be used as part of the basis to create policy on antimicrobial stewardship or antibiotic prescribing guidelines for general dental practitioners in the Philippines.

Review of literature

Antimicrobial resistance is a global public health problem that it now poses a threat to the achievements of modern medicine in dealing with infections. World Health Organization (WHO) defines antimicrobial resistance (AMR) as the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarials) from working against it, making standard antimicrobial therapy ineffective. WHO further stated that “both overuse and misuse of antimicrobial medicines accelerate the emergence of resistant microorganisms. Misuse can be due to poor prescribing practice, incorrect choice or dosage; self-medication; failure to finish a course of antimicrobial medicines or taking them for too long; lack of regulations or standards for health care workers.” [1]. The WHO antimicrobial resistance global report on surveillance provided a view of the magnitude and state of surveillance in the world. It reported that resistance of common bacteria in some parts of the world has reached alarming level making antibiotic therapy ineffective. It also reported that surveillance is neither coordinated nor harmonized. The WHO published the Antimicrobial resistance in the Asia Pacific region: a development agenda that provides in-depth technical discussions in areas that have direct implications to the containment of AMR and in the context of Sustainable Development Goals [1].

Researches in different parts of the world suggest that there are inappropriate antibiotic prescribing practices of dentists. This is believed to be a factor in the increase of antimicrobial resistance. Studies in the United Kingdom revealed that 65.6% of the respondents prescribed antibiotics in situations where there was no evidence of spreading infection, 70.6% were used without operative intervention, and only 19.0% of antibiotics were prescribed in indicated situations [2], and insufficient knowledge of general dental practitioners in antibiotics use [3]. In line with this, the Faculty of General Dental Practice (UK) produce the evidenced-based guidance Antimicrobial Prescribing for General Dental Practitioners and endorses the Scottish Dental Clinical Effectiveness Programme’s implementation advise on the prophylactic use of antibiotics against infective endocarditis. The FGDP (UK) and the British Dental Association co-developed the Antimicrobial Prescribing Self-Audit Tool, and is being endorsed by Public Health England. This is designed to be used alongside the Antibiotic Prescribing guidance, while the British Association of Oral Surgeons developed the Antimicrobial Stewardship e-Learning Modules [4].

A retrospective cross-sectional analysis of dental care provider specialties in the United States concluded that “dentists frequently prescribe antibiotics for prolonged periods and often use broad-spectrum antibiotics” [5]. In British Columbia Canada, a study revealed that the overall antibiotic use has declined including prescribing by physicians, but increased for dental prescribing of 62.2% [6], while another study concluded that “dentists and physicians are not always aware of the most current clinical guidelines regarding antibiotic prophylaxis” [7]. To address these issues, the American Dental Association issued the Report on Combating Antibiotic Resistance through its Council on Scientific Affairs addressing the association between overuse of antibiotics and the development of resistant bacteria and presented recommendations for dentists when prescribing antibacterial drugs [8], while the US Centers for Disease Control and Prevention developed the Antibiotic Resistance (AR) Solutions Initiative to improve antibiotic use through antibiotic stewardship [9]. Canada developed Tackling Antimicrobial Resistance and Antibiotic Resistance and

Antimicrobial Use: A Pan-Canadian Framework for Action as part of the global efforts to combat AMR, while the Canadian Roundtable on Antimicrobial Stewardship is being developed as part of a larger national action plan [10].

A study in Australia regarding current prescribing trends of antibiotics by dentists from 2013 to 2016 suggest that some antibiotics are prescribed inappropriately and there is preference to moderate-to-broad spectrum agents, and the current Pharmaceutical Benefits Scheme (PBS) dental schedule is inconsistent with prescribing guidelines and may contribute to inappropriate prescribing [11]. Similar studies also suggest reliance to moderate and broad spectrum antibiotics [12-13]. The Australian government developed the Antimicrobial Stewardship in Australian Health Care while the Australian Dental Association calls on health professionals and patients to take pledge to exercise care in the prescription of antibiotics [14]. Different studies in Belgium, Iran, Saudi Arabia, India, Yemen, and Indonesia also reported inappropriate antibiotic prescribing [15-20]. These studies suggest inappropriate prescribing practices of dentists in different parts of the world. The researchers recommend continuing education programs to increase awareness of dentists. However, their respective governments are devising guideline to address the global threat of AMR.

Research objectives

This study aimed to describe antibiotic prescribing practices of Filipino dentists as part of basis for policy on antimicrobial stewardship. Specifically, the study aims to identify the first and second choice of antibiotics, duration of prescription, prescribing practices for selected dental conditions and procedures, medical conditions prior to dental surgery, non-clinical factors affecting prescribing practices, and familiarity with antimicrobial stewardship.

2. RESEARCH METHOD

This is an exploratory study on antibiotic prescribing practices of Filipino dentists to form a basis for antimicrobial stewardship policy for dentists. Informed consent was posted on the beginning of the questionnaire. The questionnaire was pilot-tested and validated. Ethics approval was sought from Emilio Aguinaldo college ethics review committee. A link to an online questionnaire using survey monkey was posted in a closed group Facebook account of Filipino dentists. Two hundred thirty (230) dentists participated in the online survey. Data was analyzed by Survey Monkey.

3. RESULTS AND DISCUSSIONS

Results are summarized in tables. The first and second choice of antibiotics are shown in Table 1 and Table 2.

Table 1. First choice of antibiotics

	Frequency	%
Amoxicillin	163	71.18
Amoxicillin with clavulanic acid	26	11.35
Cephalexin	5	2.18
Clindamycin	1	0.44
Doxycycline	1	0.44
Erythromycin	1	0.44
Metronidazole	1	0.44
Penicillin	5	2.18
Others	5	2.18
Total	229	100

n=229, Note: 1 respondent skipped in answering the question

Table 2. Second choice of antibiotics

	Frequency	%
Azithromycin	6	2.64
Cephalexin	71	31.28
Cefuroxime	7	3.08
Clindamycin	130	57.27
Doxycycline	4	1.76
Erythromycin	6	2.64
Others	16	7.05
Total	227	100

n= 227; Note: 3 respondents skipped in answering the question

Most of the respondents (71.18%) chose amoxicillin as the first choice of antibiotics while clindamycin is the second choice (57.27%). The duration of antibiotic prescription is shown in Table 3.

Table 3. Duration of antibiotic prescription

Duration	Frequency	%
Less than 3 days	0	0
3 to 6 days	16	7.05
7 days	189	83.26
More than 7	8	3.52
Total	227	100

n= 227; Note: 3 respondents skipped in answering this question

Most respondents (83.26%) prescribe antibiotics for 7 days, and none prescribe for less than days. Antibiotic prescribing for selected dental conditions are shown in Table 4.

Table 4. Antibiotic prescribing for selected dental conditions

Dental disease	Yes	%	No	%	Raw Total
Acute gingivitis	50	22.03	177	77.97	227
Stomatitis	46	20.54	178	79.46	224
Abscess with affected general conditions	134	59.56	91	40.44	225
Abscess with unaffected general conditions	221	96.93	7	3.07	228
Acute periapical abscess	193	84.28	36	15.72	229
Chronic periapical abscess	140	62.5	84	37.5	224
Pulpitis	75	33.63	148	66.37	223
Periodontal abscess	184	81.78	41	18.22	225
Acute dental pain	62	27.8	161	72.2	223
Pericoronitis	137	61.43	86	38.57	223
Dry socket	99	43.81	127	56.19	226
Cellulitis	222	97.37	6	2.63	228

Note: Some of the respondents did not provide answers

Most common dental conditions where the respondents would prescribe antibiotics are cellulitis (97.37%), abscess with unaffected general conditions (96.93%), acute periapical abscess (84.28%), and periodontal abscess (81.78%). Antibiotic prescribing for selected dental procedures are shown in Table 5.

Table 5. Antibiotic prescribing for selected dental procedures

Dental procedure	Yes	%	No	%	Raw Total
Periodontal treatment with surgery	202	89.99	25	11.01	227
Periodontal treatment without surgery	53	23.56	172	76.44	225
Routine endodontics	59	26.7	162	73.3	221
Endodontic surgery	166	75.45	54	24.55	220
Anesthesia failure is expected	82	37.79	135	62.21	217
Uncomplicated extraction	30	13.45	193	86.55	223
Complicated extraction	214	94.69	12	5.31	226
Extraction of tooth with chronic infection	153	68.3	71	31.7	224
Third molar surgery	197	87.17	29	12.83	226

Note: Some respondents did not provide answers

Majority of the respondents would prescribe antibiotics for certain procedures like periodontal treatment with surgery (89.99%), endodontic surgery (75.45%), complicated extraction (94.69%), third molar surgery (87.17%), extraction of a tooth with chronic infection (68.3%). Some will also prescribe for common dental procedures like periodontal treatment without surgery (23.56%), routine endodontics (26.7%), uncomplicated extraction (13.45%), or when anesthesia failure is expected (37.79%). Non-clinical factors that affect antibiotic prescribing are shown in Table 6.

Most common non-clinical factor that affect antibiotic prescribing are effectiveness in previous case (91.07%), international guidelines (89.95%), knowledge gained from undergraduate/graduate training (86.22%), reading of scientific materials (85.71%), and recommended by a colleague/expert (73.42%). Antibiotic prescribing for certain medical conditions prior to dental surgery is shown in Table 7.

Most common medical conditions wherein respondents will prescribe antibiotics are infective endocarditis (92.69%) and rheumatic heart disease (87.84%). Familiarity of Filipino dentists with antimicrobial stewardship is shown in Table 8.

Table 6. Non-clinical factors that affect antibiotic prescribing

Factors	Yes	%	No	%	Raw Total
Patient preference	110	48.67	116	51.33	226
Reading of scientific materials	192	85.71	32	14.29	224
Knowledge gained from undergraduate/ graduate training	194	86.22	31	13.78	225
Availability of the nearest pharmacy	99	44	126	56	225
Cost of antibiotics	112	49.56	114	50.44	226
Recommended by a colleague	163	73.42	59	26.58	222
Effectiveness in previous case	204	91.07	20	8.93	224
When in doubt in diagnosis	134	60.36	88	39.64	222
When under time pressure	57	25.68	165	74.32	222
International guidelines	197	89.95	22	10.05	219

Note: Some respondents did not provide answers

Table 7. Antibiotic prescribing for certain medical conditions prior to dental surgery

Factors	Yes	%	No	%	Raw Total
Diabetes mellitus	126	57.80	92	42.20	218
AIDS	141	65.28	75	34.72	216
Patient with pacemaker	155	70.45	65	29.55	220
Autoimmune diseases	151	70.23	64	29.77	215
Patients on immunosuppressive	151	70.56	63	29.44	214
Renal transplant patients	140	65.12	75	34.88	215
Rheumatic heart disease	195	87.84	27	12.16	222
Hodgkin's disease	132	64.08	74	35.92	206
History of coronary bypass surgery	165	75.00	55	25.00	220
Infective endocarditis	203	92.69	16	7.31	219
Cardiac valve prosthesis	171	79.17	45	20.83	216
Ventricular septal defect	172	78.90	46	21.10	218

Note: Some of the respondents did not provide answers

Table 8. Familiarity with antimicrobial stewardship

Familiarity	Frequency	%
Extremely familiar	7	3.06
Very familiar	24	10.48
Somewhat familiar	107	46.72
Not so familiar	75	32.75
Not at all familiar	16	6.99
Total	230	100

n=230

Only 10.48% of the respondents are very familiar with antimicrobial stewardship, while 46.72% are somewhat familiar and 32.75% are not so familiar, and only 3.06% are extremely familiar, while 6.99% are not at all familiar. Attendance of Filipino dentists to lecture/workshop on antimicrobial resistance specifically for dentists is shown in Table 9

Table 9. Attendance to lecture/workshop on antimicrobial resistance specifically for dentists

Answer	Frequency	%
Yes	69	30.26
No	159	69.74
Total	228	100

n=228 Note: 2 respondents skipped in answering the question

Most of the respondents (69.74%) have not attended a lecture or workshop regarding antimicrobial resistance specifically for dentists.

Amoxicillin is the first choice of antibiotics of the respondents. Amoxicillin is a broad-spectrum antibiotic commonly used in management of odontogenic infections, and is commonly used around the world. Resistance to amoxicillin is uncommon. However, a study in UK wherein dental plaque samples from 40 children were screened for the presence of bacteria resistant to amoxicillin. Participants were 15 children who had used amoxicillin and 25 had not used any antibiotics in the 3 months prior to sample collection. Results revealed that 100% of the children harbored amoxicillin-resistant oral bacteria, 224 amoxicillin-resistant bacteria were isolated from 40 children, and 17 amoxicillin-resistant isolates were also resistant to penicillin, erythromycin, and tetracycline [21]. A study in Norway revealed that dentists

prefer narrow-spectrum antibiotics (phenoxymethylpenicillin) as the first choice of antibiotics for dental infections, prescribing is conservative and relatively low compared to physicians [22].

Clindamycin is the second choice of antibiotics of the respondents. It is the usual drug of choice for odontogenic infection among patients with allergy to penicillin. Clindamycin is a broad-spectrum antibiotic with high oral absorption and significant tissue penetration. A review of literature concluded that clindamycin can be considered as a first line of defense, and claim that the association between clindamycin and pseudomembranous colitis is unfounded [23]. In the United Kingdom, the Dental Practitioner's Formulary (DPF) recommends that clindamycin should not be used routinely for the treatment of dental infections, due to its association with acute pseudomembranous colitis due to *Clostridium difficile*, and is used primarily for prophylaxis against infective endocarditis. There is growing concern for *Clostridium difficile* infection (CDI) caused by disruption of indigenous intestinal microflora, associated with Clindamycin and third-generation cephalosporin. Restricted use of clindamycin and third-generation cephalosporins have been associated with reductions in CDI [24-26]. Majority of the respondents prescribe antibiotics for 7 days. However, some authors suggest that antibiotics should be prescribed for 3 to 4 days, then to be followed up if there is a need to continue. The Faculty of General Dental Practice (FGDP) UK recommends review of condition of the patient after 2-3 days, then discontinue if resolved [27].

Most respondents would prescribe antibiotics for infections with affected general conditions. A systematic review on use of antibiotics in odontogenic infections recommended that "when the real need for antibiotic therapy is detected, antibiotics should be used for the shortest time possible until the patient's clinical cure is achieved" [28]. However, some respondents answered that they will prescribe antibiotics for routine procedures including routine root canal treatment, uncomplicated extraction, and non-surgical periodontal treatment. Antibiotics will be prescribed by majority of the respondents for endodontic surgery, periodontal surgery, and third molar surgery. Some authors do not agree in giving routine prophylactic antibiotics for third molar surgery [29-31] but a systematic review by the Cochrane Collaboration on the use of antibiotics for infection prophylaxis following tooth extraction found that antibiotics reduced the risk of infection [32]. The American Association of Endodontists recommends shortest effective course of antibiotics, minimize use of broad spectrum antibiotics, but only if debridement and drainage are ineffective, or adjunct in treatment of acute apical abscess with systemic involvement. Some evidence suggest that shorter courses of 2-3 days may be successfully used as adjuvant therapies [33]. Antibiotics can be considered for patients with medical conditions with compromised immunity since they are more susceptible to complications arising from endodontic infection [34]. Antibiotics may be prescribed for patients who do not respond to conventional periodontal therapy or acute periodontal infections associated with systemic manifestations [35].

Non-clinical factors including shared attitudes and beliefs and diagnostic uncertainty may also influence antibiotic prescribing [36]. Not all of the respondents answered they will prescribe antibiotics for indicated heart conditions and medical problems with decreased immune response prior to dental surgery. The American Heart Association recommends prophylactic antibiotics for patients with high risk of infective endocarditis [37]. The European Society of Cardiology recommends antibiotic prophylaxis for dental procedures requiring manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa [38]. Immunocompromised patients may benefit from antibiotics when receiving invasive dental procedures like extraction, deep periodontal scaling, and apical surgery [39].

Only 10.48% of the respondents consider themselves to be *very familiar* with antimicrobial stewardship, while most of the respondents (69.74%) have not attended a lecture or workshop on antimicrobial resistance specifically for dentists. This calls for action in increasing awareness of dentists regarding antimicrobial resistance or stewardship through continuing education programs and consultation with different stakeholders including the leaders of the dental profession in the Philippines.

4. CONCLUSION

Results of the study suggest that there is inappropriate prescribing of antibiotics by the respondents on certain dental diseases, dental procedures, and medical conditions. Only a small percentage consider themselves to be very familiar with antimicrobial stewardship, while most have not attended continuing education programs on antimicrobial resistance or stewardship specifically for dentists.

Further research is needed with more participants to determine antibiotic prescribing practices of the general population of Filipino dentists. Authors suggest to call for an expert panel from different dental disciplines including general practitioners and other stakeholders to discuss antimicrobial resistance. It is needed to formulate policy or guidelines on Antimicrobial Stewardship for Dentists or antibiotic prescribing guidelines for general dental practitioners. Participation with the stakeholders is also important regarding antimicrobial stewardship in the Philippines.

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REFERENCES

1. World Health Organization. Worldwide Country Situation Analysis: Response to Antimicrobial Resistance. SBN: 9789241564946 WHO reference number: WHO/HSE/PED/AIP/2015.1, available at: <https://www.who.int/drugresistance/documents/situationanalysis/en>
2. Cope AL, Francis NA, Wood F, Chestnutt IG. Antibiotic prescribing in UK general dental practice: a cross-sectional study. *Community Dent Oral Epidemiol.*, 44(2):145-53. 2016.
3. Palmer NOA, Martin MV, Pealing R, Ireland S, Roy K, Smith A, Bagg J. Antibiotic prescribing knowledge of National Health Service general dental practitioners in England and Scotland. *J Antimicrob Chemother.*, 47(2):233-237. 2001.
4. Faculty of General Dental Practice (UK), Antimicrobial Prescribing for General Dental Practitioners <https://www.fgdp.org.uk/antimicrobial-prescribing>
5. Durkin MJ, Hsueh K, Sallah YH, Feng Q, Jafarzadeh R, Munshi K, Lockhart P, Thornhill MH, Henderson RR, Fraser VJ. An evaluation of dental antibiotic prescribing practices in the United States. *JADA*, 148(12):878-886. 2017.
6. Marra F, George D, Chong M, Sutherland S, Patrick DM. Antibiotic prescribing by dentists has increased: Why?, *J Am Dent Assoc.* 2016 May;147(5):320-7. doi: 10.1016/j.adaj.2015.12.014. Epub 2016 Feb 5.
7. Lauber C, Lalh SS, Grace M, Smith MH, MacDougall K, West P, Compton S. Antibiotic prophylaxis practices in dentistry: a survey of dentists and physicians, *J Can Dent Assoc.* 2007 Apr;73(3):245, Available at: [https://jada.ada.org/article/S0002-8177\(15\)01213-1/fulltext](https://jada.ada.org/article/S0002-8177(15)01213-1/fulltext), 2007.
8. American Dental Association, Council on Scientific Affairs, Combating antibiotic resistance, *JADA*, Vol. 135, April 2004, Available at: [https://jada.ada.org/article/S0002-8177\(14\)61234-4/fulltext](https://jada.ada.org/article/S0002-8177(14)61234-4/fulltext)
9. Center for Disease Control and Prevention, Antibiotic Resistance Solutions Initiative 2018, Available at: <https://www.cdc.gov/drugresistance/solutions-initiative/>
10. Public Health Agency of Canada, Tackling Antimicrobial Resistance and Antibiotic Resistance and Antimicrobial Use: A Pan-Canadian Framework for Action, 2017, Available at: <https://www.canada.ca/en/health-canada/services/publications/drugs-health-products/tackling-antimicrobial-resistance-use-pan-canadian-framework-action.html>
11. Teoh L, Stewart K, Marino RJ, McCullough MJ. Current prescribing trends of antibiotics by dentists in Australia from 2013 to 2016, *Aust Dent J*, Vol 63, Iss 3, September 2018.
12. Jaunay T, Dambroak P, Goss A. Antibiotic prescribing practices by South Australian general dental practitioners. *Aust Dent J*, 45(3):179-186. 2000.
13. Tan JC, Riley TV, Slack-Smith LM. An investigation into the antibiotic prescribing practices of Western Australian dental practitioners. *Aust Dent J.*, 59(4):S44. 2014.
14. Australian Commission on Safety and Quality in Health Care, Antimicrobial Stewardship in Australian Health Care, 2018, Available at: <https://www.safetyandquality.gov.au/our-work/healthcare-associated-infection/antimicrobial-stewardship/book/>
15. Mainjot A, D'Hoore W, Vanheusden A, Van Nieuwenhuysen JP. Antibiotic prescribing in dental practice in Belgium. *Int Endod J.*, 42(12):1112-7. 2009.
16. Vessal G, Khabiri A, Mirkhani H, Cookson BD, Askarian M. Study of antibiotic prescribing among dental practitioners in Shiraz, *Islamic Republic of Iran. East Mediterr Health J.*, 17(10):763-9. 2011.
17. Al Khuzaei NM, Assery MK, Al Rahbeni T, Al Mansoori M. Knowledge of antibiotics among dentists in Saudi Arabia. *J Int Oral Health*, 9(2):71-80. 2017.
18. Kumar KP, Kaushik M, Udaya Kumar P, Shilpa Reddy M, and Prashar N. Antibiotic prescribing habits of dental surgeons in Hyderabad City, India, for pulpal and periapical pathologies: a survey. *Adv Pharmacol Sci.* 2013;2013:537385.
19. Al-Haroni M, Skaug N. Knowledge of prescribing antimicrobials among Yemeni general dentists. *Acta Odontol Scand.*, 64(5):274-80. 2006.
20. Rachmawati MW, Yoshida N, Tsuboi H, Kimura K. Antibiotic Utilization in a Dental Teaching Hospital in Yogyakarta, Indonesia. *Science J of Clin Med.*, 3(3):37-42. 2014.
21. Ready D, Lancaster H, Qureshi F, Bedi R, Mullany P, Wilson M. Effect of amoxicillin use on oral microbiota in young children, *Antimicrob Agents Chemother.* Vol 48 No 8, 2004, Available at: <https://aac.asm.org/content/48/8/2883>, 2004.
22. Al-Haroni M, Skaug N. Incidence of antibiotic prescribing in dental practice in Norway and its contribution to national consumption. *J Ant Chem.* 59(6):1161-1166. 2007.
23. Brook I, Lewis MA, Sándor GK, Jeffcoat M, Samaranayake LP, Vera Rojas J. Clindamycin in dentistry: More than just effective prophylaxis *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* Nov;100(5):550-8. 2005.
24. Owens RC, Donskey JC, Gaynes RP, Loo VG, Muto CA. Antimicrobial-Associated Risk Factors for *Clostridium difficile* Infection. *Clinical Infectious Diseases*, 46:S19-31. 2008.

25. Evidence Summary, NICE Guidance, Clostridium difficile infection: risk with broad-spectrum antibiotics, March 2015, Available at: <https://www.nice.org.uk/advice/esmpb1/chapter/full-evidence-summary-medicines-and-prescribing-briefing> Accessed: June 06, 2018.
26. Beacher N, Sweeney MP, Bagg J. Dentists, antibiotics and Clostridium difficile-associated disease. *Br Dent J*, 219(6):275-279. 2015.
27. Faculty of General Dental Practice UK, Antimicrobial Prescribing for GPs, Accessed: March 14, 2019, Available at: <https://www.fgdp.org.uk/guidance-standards/antimicrobial-prescribing-gdps>
28. Martins JR, Chagas OL, Velasques BD, Bobrowski AN, Correa MB, Torriani MA. The Use of Antibiotics in Odontogenic Infections: What Is the Best Choice? A Systematic Review, *J Oral Maxillofac Surg*. 75(12): 2606.e1-2606.e11. 2017.
29. Martin, MV, Kanatas AN, Hardy P. Antibiotic prophylaxis and third molar surgery. *Br Dent J*. 2005;198:327-330.
30. Oomens MA, Forouzanfar T. Antibiotic prophylaxis in third molar surgery: a review. *Oral Surg Oral Med Oral Pathol Oral Radiol*. Dec;114(6):e5-12. 2012.
31. Bulut EI, Bulut S, Etikan I, Koseoglu O. The value of routine antibiotic prophylaxis in mandibular third molar surgery: acute-phase protein levels as indicators of infection. Randomized controlled trial. *J Oral Sci*. Jun;43(2):117-22. 2001.
32. Lodi GI, Figini L, Sardella A, Carrassi A, Del Fabbro M, Furness S. Antibiotics to prevent complications following tooth extractions. *Cochrane Database Syst Rev*. 2012;11:CD003811.
33. American Association of Endodontists Guidance on the Use of Systemic Antibiotics in Endodontics Position Statement. Available at: https://www.aae.org/specialty/wp-content/uploads/sites/2/2017/06/aae_systemic-antibiotics.pdf. Accessed: June 12, 2018
34. Segura-Egea JJ, Martín-González J, Jiménez-Sánchez MDC, Crespo-Gallardo I, Saúco-Márquez JJ, Velasco-Ortega E. Worldwide pattern of antibiotic prescription in endodontic infections. *Int Dent J*. 2017;67(4):197-205.
35. American Academy of Periodontics, Position paper on systemic antibiotics, *J Periodontol*. 75:1553-1565, 2004. Accessed Mar 10, 2019, Available at: <https://onlinelibrary.wiley.com/doi/epdf/10.1902/jop.2004.75.11.1553>
36. Livorsi D, Comer AR, Bair MJ. Barriers to guideline-concordant antibiotic use among inpatient physicians: A case vignette qualitative study. *J Hosp Med*. 2016;11(3):174-180.
37. American Heart Association. Infective Endocarditis. Available at: http://www.heart.org/HEARTORG/Conditions/CongenitalHeartDefects/TheImpactofCongenitalHeartDefects/Infective-Endocarditis_UCM_307108_Article.jsp#.Wx8b5IozZdg Accessed: June 12, 2018
38. 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). *Euro Heart J*. 36(44):3075-3128. 2015.
39. Ramu C, Padmanabhan TV. Indications of antibiotic prophylaxis in dental practice- Review. *Asian Pac J Trop Biomed*. 2(9):749-754. 2012.

BIOGRAPHIES OF AUTHORS



Melchor A. Sarmiento, DMD, MPH is an associate professor at Emilio Aguinaldo College Manila, School of Dentistry. He obtained his Doctor of Dental Medicine at Centro Escolar University and Master of Public Health from the University of the Philippines. He is a Fellow of Philippine Board of Dental Public Health and President of Philippine Academy of Dental Public Health.



Mariano T. Maglutac, Jr, DMD, MHA is the Dean of Emilio Aguinaldo College Manila, School of Dentistry. He obtained his Doctor of Dental Medicine and Master of Hospital Administration from the University of the Philippines. He is a Fellow of Philippine Board of Dental Public Health and a consultant at Medical Center Manila and De La Salle Medical Center in Cavite.



Ma Susan Yanga-Mabunga, DMD, MScD is the Assistant to the Dean for Academic Affairs and faculty and former Chair of Department of Health Policy and Administration at the University of the Philippines College of Public Health. She is a Fellow and Chair of Philippine Board of Dental Public Health and the Founding President of Philippine Academy of Dental Public Health.