

opportunity to adopt appropriate antibiotic prescribing behaviors.⁷ In contrast, the summary TPB scores did not correlate with antibiotic prescribing behavior. This finding contrasts with a systematic review of TPB domain scores reporting an association with antibiotic prescription behaviors.⁸ It is plausible that the weight of the individual TPB determinants requires future refinement.⁸ A second study finding was the key predictor of “considering patients as first priority” as a key predictor of appropriate antibiotic use. This finding suggests a patient safety and quality-improvement opportunity, while additional efforts may exist to minimize unnecessary antibiotic combinations for surgical prophylaxis and to shorten postoperative antibiotic duration.

The limitations of this study include acknowledgment of reported findings which may not be generalizable to other study populations, given the exploratory study design, small sample size, and single institutional study site. Additionally, despite structured interviews, inherent bias may have occurred in the TTM and TPB assessments, and have influenced the unweighted, cumulative TPB scores. Future work is planned for assessment of TTM stage-based prescriber interventions associated with antibiotic prescribing practices along with further characterization of the TPB intrapersonal behavior theory.

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Dentists' perceptions of antimicrobial use for dental procedures

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To the Editor—The importance of promoting antimicrobial stewardship in dentistry is being increasingly recognized; up to 10% of all antimicrobials are prescribed by dentists in high-income countries,^{1,2} and a previous study revealed that only 8.2% of antimicrobial prophylaxes for dental procedures were appropriate.³ Although professional societies widely recommend antimicrobial prophylaxis against infective endocarditis (IE) among high-risk populations,^{4,5} no recommendations exist for antimicrobial prophylaxis against local infections or complications following invasive dental procedures, including tooth extraction and dental implant placement. Recent systematic reviews have revealed that antimicrobial prophylaxis can prevent local infections and other complications due to these procedures.^{6,7}

Although understanding dentists' perceptions of antimicrobial use and prescribing patterns is essential to promoting antimicrobial stewardship in the discipline, these perceptions are still poorly

understood. The aim of the study was to investigate dentists' perception of antimicrobial use to promote antimicrobial stewardship in the field.

Material and Methods

An online questionnaire on antimicrobial use before and after a dental procedure was administered to regional dental conference attendees (Japanese Society of Oral and Maxillofacial Surgeons, JSOMS) in December 2018. In total, 54 close-ended survey questions were used to collect data, including current patterns of antimicrobial prophylaxis against IE, infections and complications following tooth extraction or dental implant surgery, and dentists' perceptions of antimicrobial use.

Results

Of the 231 dentists attending the session, 111 (48.1%) responded to the questionnaire. Moreover, 70% of respondents were male, with the median age of 36 years (range, 24–64 years) and median post-graduate duration of 11 years (range, 1–44 years). University hospitals were the most common place of employment (n = 49, 44.1%) (Appendix 1 online).

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Table 1. Dentists' Perceptions of Antimicrobial Prophylaxis Against Infective Endocarditis and Infection or Complications After Selected Dental Procedures

Questions (N = 111)	Strongly Agree or Agree	Neither Agree nor Disagree	Disagree or Strongly Disagree
Antimicrobial prophylaxis for infective endocarditis			
I understand the indications for antimicrobial prophylaxis against IE (eg, the AHA guidelines).	94 (84.7)	13 (11.7)	4 (3.6)
I ask patients if they have any medical conditions normally requiring antimicrobial prophylaxis against IE prior to performing a dental procedure. (eg, history of IE, prosthetic valve placement, congenital heart disease).	102 (91.9)	7 (6.3)	2 (1.8)
Perceptions of preprocedural antimicrobial prophylaxis only for IE prevention			
I believe that administering preprocedural antimicrobial prophylaxis only is adequate to prevent IE.	33 (29.7)	39 (35.1)	39 (35.1)
I was taught that preprocedural antimicrobial prophylaxis only is adequate to prevent IE.	22 (19.8)	46 (41.4)	43 (38.7)
Administering preprocedural antimicrobial prophylaxis only is common at my current workplace.	17 (15.3)	37 (33.3)	57 (51.4)
I administer preprocedural antimicrobial prophylaxis only (without postprocedural antimicrobials) because I am concerned about the emergence of antimicrobial resistance.	63 (56.8)	31 (27.9)	17 (15.3)
I administer preprocedural antimicrobial prophylaxis only (without postprocedural antimicrobial administration) because I am concerned about antimicrobial side effects.	46 (41.4)	32 (28.8)	33 (29.7)
I administer preprocedural antimicrobial prophylaxis only (without postprocedural antimicrobial administration) because the development of <i>Clostridium difficile</i> infection is worrisome.	36 (32.4)	35 (31.5)	40 (36.0)
Perceptions of postprocedural antimicrobial prophylaxis for IE prevention			
I believe continuing antimicrobial prophylaxis after a dental procedure is important to prevent IE.	81 (73.0)	15 (13.5)	15 (13.5)
I continue to prescribe antimicrobials postprocedurally because I believe that antimicrobials can further reduce IE incidence.	69 (62.2)	19 (17.1)	23 (20.7)
I continue to prescribe antimicrobials postprocedurally because I believe that antimicrobials can further reduce the severity of pain.	15 (13.5)	18 (16.2)	78 (70.3)
I continue to prescribe antimicrobials postprocedurally because I believe that antimicrobials can reduce the duration of pain.	19 (17.1)	17 (15.3)	75 (67.6)
I continue to prescribe antimicrobials postprocedurally because my workplace has a culture of prescribing postprocedural antimicrobials.	60 (54.1)	22 (19.8)	29 (26.1)
I continue to prescribe antimicrobials postprocedurally because of previous education during my training.	67 (60.4)	23 (20.7)	21 (18.1)
I continue to prescribe antimicrobials post-procedurally due to my fear of lawsuits (if IE occurs in the absence of postprocedural antimicrobials).	72 (64.9)	22 (19.8)	17 (15.3)
I continue to prescribe antimicrobials postprocedurally because patients ask for them.	32 (28.8)	41 (36.9)	38 (34.2)
I continue to prescribe antimicrobials postprocedurally because patients' families ask for them.	29 (26.1)	41 (36.9)	41 (36.9)
I continue to prescribe antimicrobials postprocedurally just to be safe.	48 (43.2)	33 (29.7)	30 (27.1)
I continue to prescribe antimicrobials postprocedurally because other dentists do so.	35 (31.5)	30 (27.1)	36 (32.4)
Perception of antimicrobial prophylaxis for tooth extraction			
Preprocedural antimicrobial administration is more important than postprocedural antimicrobial administration.	80 (72.1)	17 (15.3)	14 (12.6)
Both pre- and postprocedural antimicrobial administrations are important.	68 (61.2)	19 (17.1)	24 (21.6)
Postprocedural antimicrobial administration is more important than preprocedural antimicrobial administration.	26 (23.4)	32 (28.8)	53 (47.7)
Risk of infection and complications is different after wisdom tooth extraction than after first premolar tooth extraction.	98 (88.3)	6 (5.4)	7 (6.3)
Perception of antimicrobial prophylaxis for dental implants			
Preprocedural antimicrobial administration is more important than postprocedural antimicrobial administration.	74 (66.7)	20 (18.0)	17 (15.3)
Both pre- and postprocedural antimicrobial administrations are important.	65 (58.6)	19 (17.1)	27 (24.3)
Postprocedural antimicrobial administration is more important than preprocedural antimicrobial administration.	30 (27.0)	28 (25.2)	53 (47.7)
Perceptions of antimicrobial resistance			
I am aware of the Japanese government's antimicrobial resistance action plan of 2016.	53 (47.7)	N/A	58 (52.3)
I am aware that the Ministry of Health, Labour and Welfare of Japan published guidelines for antimicrobial stewardship in 2017.	68 (61.3)	N/A	43 (38.7)
I believe that antimicrobial prescription practices in dentistry should be improved.	97 (87.4)	8 (7.2)	6 (5.4)

NOTE. IE; infective endocarditis, AHA; American heart association, N/A; not available.

Table 1 shows the respondents' perceptions of antimicrobials prophylaxis. Regarding antimicrobial prophylaxis against IE, although >80% of respondents reported that they understood the guidelines for the prevention of infective endocarditis,^{4,5} >70% believed that continuing postprocedural antimicrobial administration was important for IE prevention, and >80% reported having prescribed prophylactic antimicrobials against the current guidelines to patients with high-risk cardiac conditions in both the pre- and postprocedural periods (Appendix 2 online).^{4,5} Moreover, antimicrobial prophylaxis against IE was commonly administered to patients with other cardiac conditions, such as those with a pacemaker or history of percutaneous coronary intervention. The prescribing practices were influenced by the fear of a lawsuit (64.9%), previous training in antimicrobial prophylaxis (60.4%), and/or the prescribing culture at the respondents' current place of employment (54.1%) (Table 1).

Regarding antimicrobial prophylaxis to prevent infections or complications following selected dental procedures in patients with no underlying illness, 81.1% of respondents reported that they did not prescribe antimicrobials for noninvasive procedures but did so for dental implant placements (95.5%), wisdom tooth extractions (93.7%), frenotomies (76.6%), and orthodontic premolar tooth extractions (64.9%) (Appendix 2 online). Although more than half the respondents considered pre- and postprocedural antimicrobial prophylaxis necessary to prevent infections or complications, they frequently prescribed antimicrobials only after a dental procedure (Appendix 2 online).

Discussion

The current study revealed that among dentists, behaviors dictating their prescription of antimicrobial prophylaxis against IE, local infections, and complications following common dental procedures varied widely. Moreover, respondents' self-reported behavior demonstrated that periprocedural antimicrobial overprescribing apparently stems from deeply entrenched misperceptions about the relevant pathophysiology, litigation fears, and prevailing culture despite putative familiarity with current recommendations against this behavior.

Most respondents reported understanding the current guidelines for IE prevention using antimicrobial prophylaxis but considered it important to continue postprocedural antimicrobial administration in contradiction to the guidelines. They also prescribed antimicrobial prophylaxis for non-high-risk cardiac conditions. Both the extended duration and expanded use of antimicrobial prophylaxis are likely to be associated with entrenched beliefs regarding periprocedural antimicrobial therapy. The current guidelines recommend antimicrobial prophylaxis only before a procedure in patients with a high-risk cardiac condition, such as cyanotic heart disease, a history of IE or prosthetic valve.^{4,5} However, in real-life settings, antimicrobial prophylaxis was frequently prescribed postprocedurally.³ The frequency of litigation related to dental procedures in Japan may be influencing dentists' prescribing behavior.⁸ In terms of the association between antimicrobial prescribing patterns and previous education or workplace culture, dentists' perception of antimicrobial prophylaxis did not differ significantly between hospital settings in this study (Appendix 3), suggesting that inadequate education and the failure to update antimicrobial practice in dentistry may be quite widespread in Japan.

Current evidence supports prophylactic antimicrobial use against local infections and complications following invasive

dental procedures, such as tooth extractions and dental implantations.^{6,7} In this study, more than half of the respondents reported prescribing antimicrobials only after a dental procedure (Appendix 2 online). In principle, antimicrobial prophylaxis should be administered before an invasive procedure. Moreover, continuing postprocedural administration to reduce further the risk of local complications or infections remains controversial.^{6,7} Previous studies have also cited the inappropriate continuation of postprocedural prophylaxis.^{3,9}

This study has a number of limitations. The sample size was small, and selection bias may have occurred because the respondents were attendees of a regional academic conference. Moreover, their responses may not reflect their actual antimicrobial prescribing practices. Also, the questionnaire did not ask about the specific types of antimicrobial most frequently prescribed.

Dental antimicrobial prescribing practices for the prevention of IE, local infections, and complications following common dental procedures varied widely, and multiple factors influenced the decision to prescribe. Dentists often prescribed antimicrobials postprocedurally despite limited supporting evidence. Current practice patterns suggest that antimicrobials may be overprescribed in dentistry. Intervention is urgently needed to optimize antimicrobial prescription in dentistry.

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