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Original Article

How decisions are made: Antibiotic stewardship in dentistry

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Abstract

Background: We performed a preimplementation assessment of workflows, resources, needs, and antibiotic prescribing practices of trainees and practicing dentists to inform the development of an antibiotic-stewardship clinical decision-support tool (CDST) for dentists.

Methods: We used a technology implementation framework to conduct the preimplementation assessment via surveys and focus groups of students, residents, and faculty members. Using Likert scales, the survey assessed baseline knowledge and confidence in dental providers' antibiotic prescribing. The focus groups gathered information on existing workflows, resources, and needs for end users for our CDST.

Results: Of 355 dental providers recruited to take the survey, 213 (60%) responded: 151 students, 27 residents, and 35 faculty. The average confidence in antibiotic prescribing decisions was 3.2 ± 1.0 on a scale of 1 to 5 (ie, moderate). Dental students were less confident about prescribing antibiotics than residents and faculty ($P < .01$). However, antibiotic prescribing knowledge was no different between dental students, residents, and faculty. The mean likelihood of prescribing an antibiotic when it was not needed was 2.7 ± 0.6 on a scale of 1 to 5 (unlikely to maybe) and was not meaningfully different across subgroups ($P = .10$). We had 10 participants across 3 focus groups: 7 students, 2 residents, and 1 faculty member. Four major themes emerged, which indicated that dentists: (1) make antibiotic prescribing decisions based on anecdotal experiences; (2) defer to physicians' recommendations; (3) have limited access to evidence-based resources; and (4) want CDST for antibiotic prescribing.

Conclusions: Dentists' confidence in antibiotic prescribing increased by training level, but knowledge did not. Trainees and practicing dentists would benefit from a CDST to improve appropriateness of antibiotic prescribing.

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In outpatient settings, >1 in 10 antibiotic prescriptions are written by dentists[1]; between 73% and 92% of dental antibiotic prescriptions are inappropriate based on antibiotic selection, timing, or treatment duration.[2] Also, 15% of outpatient *Clostridioides difficile* infections (CDIs) are related to dental antibiotic prescribing.[3] In fact, even a single dose of clindamycin for dental antibiotic prophylaxis causes fatal episodes of CDI every year.[4] However, outpatient antibiotic prescribing rates among dental providers have remained unchanged.[5,6]

Implementing data-driven strategies to reduce inappropriate antibiotic prescribing in outpatient settings is challenging. Clinical decision-support tools (CDSTs) are one method to improve antibiotic prescribing. Common CDSTs include computerized alerts and reminders, clinical guidelines, and condition-specific order sets.[7] Advanced CDSTs can interface with electronic health records (EHRs) to extract key data elements for allergies, medications, and medical conditions to make important clinical decisions easier.[8] CDSTs improve clinician satisfaction and optimize the quality, safety, efficiency, and effectiveness of healthcare.[7] In theory, dental EHRs should be able to incorporate CDSTs and should be interoperable between vendors, similar to electronic medical records. However, comparatively little research has been performed in evaluating CDSTs in dental settings via mobile apps or EHR tools.

The purpose of this manuscript was to explore dental provider knowledge, confidence, interest, and perceived value in utilizing CDST to improve appropriate antibiotic prescribing in dentistry using the Contextualized Technology Adaptation Process (CTAP) framework. In this manuscript, we performed a preimplementation assessment of workflows, resources, needs, and antibiotic prescribing practices of trainees and practicing dentists to inform the development of an antibiotic stewardship CDST for dentists.

Methods

Clinical vignettes were developed to evaluate antibiotic prescribing knowledge and confidence of dental providers across subgroups of students, residents, and faculty members. Focus groups were

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conducted to determine how antibiotic prescribing decisions are currently being made at our pilot testing site. This study was conducted at the University of Illinois Chicago College of Dentistry in Chicago, Illinois. The study protocol was approved by the Washington University Human Rights Protection Office and the University of Illinois Chicago Institutional Review Board.

Survey

We developed a series of 7 clinical vignettes to assess the prescribing practices of dentists. The vignettes were developed using national and institutional clinical practice guidelines for acute swelling and/or pain in the oral cavity, endocarditis prophylaxis,[9] acute pericoronitis, and prosthetic joint infection prophylaxis.[10] The survey instrument and decision aids are included in the Supplementary Material (online).

Each clinical vignette was developed by an ID physician (M.J.D.) and was reviewed and revised by an ID pharmacist (K.J.S.), an informatics dentist (N.S.), an urgent-care dentist (D.H.), and a patient-safety dentist (S.R.). At the end of each vignette, participants were asked to answer two 5-point Likert-scale questions: First, how likely are you to prescribe antibiotics? Possible answers ranged from never (1), to unlikely (2), maybe (3), probably (4), or always (5). Second, how confident are you in your decision? Answers ranged from not confident at all (1), to slightly confident (2), moderately confident (3), very confident (4), or extremely confident (5). The appropriate answer for each clinical vignette was that antibiotics should not be prescribed, corresponding to a survey response of 'never' (Likert score, 1). Vignettes were then pilot tested and revised based on feedback from 2 practicing dentists outside the study group. The finalized vignettes were uploaded into Qualtrics software (Qualtrics, Seattle, WA). Additional data on participant demographics were also included in the survey. We distributed the survey via email on July 13, 2021, to all dental students, residents, and faculty at the study site. We sent 2 once-weekly reminders to increase participation. We provided participants with an electronic $25 gift card to compensate them for their time.

We analyzed participants' knowledge and confidence in antibiotic prescribing overall and stratified by clinical vignette. We also performed stratified analyses based on level of training (student, resident, or faculty). Students were further divided into preclinical, defined as first-year dental students (D1) or second-year dental students (D2), as advanced standing (AS) international graduate students, or as clinical training students (defined as D3, D4, and AS4). Preclinical students were specifically included to serve as a control group because they have minimal training in clinical dentistry. Thus, we expected that their antibiotic prescribing knowledge and scores would be lower than those of other groups. It was not possible for AS3 students to participate in the survey due to the time of year the survey was administered.

We evaluated the correlation between likelihood of prescribing an antibiotic and confidence in antibiotic prescribing decisions. For categorical variables, descriptive statistics were reported as frequency (%), and analyses were performed using the χ^2 or Fisher exact test. For continuous variables, descriptive statistics were reported as mean ± standard deviation, and analyses were performed using ANOVA, Kruskal-Wallis tests, and Pearson correlations. All quantitative analyses were conducted in SAS for Windows version 9.4 software and SAS Enterprise Guide version 8.3 software (SAS Institute, Cary, NC). Statistical tests were 2-tailed, and we applied $\alpha = .05$ as the threshold for statistical significance.

Focus groups

We conducted a series of 3 focus groups with dental students, residents, and faculty between December 9, 2021, and January 17, 2022. Focus groups were stratified by training level, with one group each for students, residents, and faculty. We recruited study participants by sending emails to respondents who completed the survey and expressed a willingness to participate in future research studies. The first 8 respondents in each subgroup were invited to participate in each group. To incentivize participants, we offered a free catered lunch and a $50 gift card. Due to scheduling difficulties, the dental-faculty focus group took place on a Zoom video conference (Zoom Video Communications, San Jose, CA).

An ID physician (M.J.D.) developed the facilitation guide based on the CTAP. The guide focused on domains 1 and 2: current contextual evaluation and evaluation of the unadapted technology. The study team then reviewed, edited, and finalized the study guide. Then 3 investigators (M.J.D., T.B., and K.J.S.) facilitated focus groups. Each focus group was audio-recorded and transcribed verbatim.

Focus-group transcripts were entered into NVivo qualitative software (NVivo 12, QRS International, Burlington, MA) for coding. Investigators E.S. and M.J.D. independently coded the transcripts using a combined inductive and deductive approach. The coders met on several occasions to refine the codes and code book. Discrepancies were discussed and resolved by consensus. Smaller sets of codes were then placed together into larger, overarching coding domains for ease of interpretation. Study team members reviewed and selected quotes to articulate these findings for readers.

Results

Survey

Of 355 potential participants, 213 completed the survey (response rate, 60%). Most respondents were students (n = 151, 71%) followed by residents (n = 27, 13%), and faculty (n = 35, 16%). Roughly one-half of students (n = 83, 55%) were preclinical students (years 1–2 of the professional dental curriculum) and the other half of students (n = 66, 45%) were in the clinical phase (years 3–4 of the professional dental curriculum). Dental residents and faculty represented diverse dental specialties (Table 1).

Among all 7 clinical vignettes, the mean likelihood of prescribing an antibiotic was 2.7 ± 0.6, which corresponds to "maybe" prescribing an antibiotic. Mean scores varied based on the theme of the clinical vignette (Table 2). The distribution of Likert responses is available in Supplementary Table 1 (online). Confidence in antibiotic prescribing was 3.2 ± 1.0, which corresponds to "moderately" confident (Table 2). The distribution of Likert responses is available in Supplementary Table 2 (online).

The overall mean likelihood of prescribing an antibiotic stratified by level of training showed no significant differences between students (2.7 ± 0.5), residents (2.5 ± 0.6), and faculty (2.6 ± 0.7; $P = .1$) (Table 3). Detailed responses are available in Supplementary Table 3 (online). However, there were some differences based on individual clinical vignette. Clinical dental students reported a higher likelihood of prescribing an antibiotic (2.8 ± 0.5) compared to preclinical dental students (2.6 ± 0.5) and dental residents (2.5 ± 0.6; $P = 001$) (Supplementary Table 4 online). This finding appears to be largely driven by the high likelihood of clinical students to prescribe antibiotics according to the prosthetic joint infection and endocarditis prophylaxis clinical vignettes.

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Table 1. Demographics of Survey Respondents

Training Level	No. (%)
D1	41 (19)
D2	19 (9)
D3	30 (14)
D4	25 (12)
AS2	23 (11)
AS3	0 (0)
AS4	11 (5)
Resident[1]	27 (13)
Faculty[2]	35 (16)

Note. Two students did not document a training level. D1, first year dental student; D2, second year dental student; D3, third year dental student; D4, fourth year dental student; AS2, advanced standing non-US dental student; AS3, advanced standing non-US dental student; AS4, advanced standing non-US dental student. Residents included the following specialties: endodontics (n=2), pediatric dentistry (n=3), periodontics (n=4), prosthodontics (n=1), orthodontics (n=11), and oral and maxillofacial surgery (n=6). Faculty included the following specialties: endodontics (n=2), general dentistry (n=13), pediatric dentistry (n=4), periodontics (n=6), oral medicine (n=2), oral and maxillofacial surgery (n=1), orthodontics (n=1), and prosthodontics (n=5), and dental public health (n=1).

Table 2. Likelihood of Prescribing Antibiotics and Confidence in Decision by Scenario and Overall (n=213)

Vignette Number	Mean ± SD Abx Rx	Mean ± SD Confidence
Vignette 1: Prosthetic joint infection prophylaxis	2.69 ± 1.12	3.21 ± 1.17
Vignette 2: Acute pericoronitis	3.1 ± 1.14	3.32 ± 1.07
Vignette 3: Acute oral pain	2.57 ± 1.1	3.21 ± 1.16
Vignette 4: Endocarditis prophylaxis	2.19 ± 1.01	3.15 ± 1.15
Vignette 5: Acute oral pain	2.08 ± 1.06	3.4 ± 1.2
Vignette 6: Prosthetic joint infection prophylaxis	3.17 ± 1.22	3.26 ± 1.13
Vignette 7: Endocarditis prophylaxis	2.86 ± 1.24	3.09 ± 1.16
Average likelihood of prescribing antibiotics across all 7 vignettes	2.67 ± 0.55	3.24 ± 0.97

Note. Average likelihood is a mean of all scenarios and ranges from 1-5 (analogous to the original scale), where higher values indicate higher likelihood of prescribing antibiotics overall. Perfect score for vignettes is 1.00.

Overall confidence in antibiotic prescribing by level of training was different between students (3.0 ± 0.9), residents (3.8 ± 0.7), and faculty (3.9 ± 0.7; $P < .01$) (Table 3). Detailed response data are available in Supplementary Table 5 (online). We also observed a progression in confidence in antibiotic prescribing among trainees, with preclinical dental students being the least confident (2.7 ± 1.1), followed by clinical dental students (3.3 ± 0.6) and dental residents (3.8 ± 0.7; $P < .01$) (Supplementary Table 6 online).

We did not observe a correlation between the likelihood of prescribing antibiotics and confidence in antibiotic prescribing decisions overall ($P = .80$) (Supplementary Fig. 5 online). Similarly, stratified analyses showed no correlation among students ($P = .20$) (Supplementary Fig. 6a online) or faculty ($P = .20$) (Supplementary Fig. 6b). However, we did observe a significant correlation among dental residents, indicating that they were more confident in their decisions and less likely to prescribe an antibiotic ($P < .01$) (Supplementary Fig. 6c).

Focus groups

In total, 17 people signed up to participate in the focus groups, and 10 people attended the focus groups (7 students, 2 residents, and 1 faculty member). We identified 4 major themes in the analysis, which are summarized in the paragraphs below. Comprehensive quotes from all themes are included in the Appendix (online).

Theme 1: Dental practices

Participants generally identified 3 common scenarios in which antibiotics would be required: systemic infections, localized infections with poor source control, and antibiotic prophylaxis. For infections, participants stated that amoxicillin 500 mg 3 times per day for 7 days was the standard. This response was largely derived from practices their senior residents or faculty members taught them. Some responses were also based on default durations set in the electronic dental record. Participants were generally knowledgeable about endocarditis prophylaxis guidelines. Participants stated that they would generally have to look up or review the guidelines in settings where an antibiotic might be needed. To determine whether an antibiotic was needed, several of the participants referenced the American Academy of Orthopedic Surgeons' (AAOS) online decision-tree tool. Fewer participants mentioned looking up the American Heart Association (AHA) guidelines. None of the participants mentioned existing paper-based algorithms to aid in antibiotic prescribing. Participants used Lexicomp to look up antibiotic dose and duration information. Upon further reflection of the landscape of potential resources, one of the residents stated, "I think that there is an overabundance of resources. I think that [kind] of muddies the waters as far as when to and when not to [prescribe antibiotics]."

In the setting of a penicillin allergy or intolerance, participants generally considered clindamycin to be the preferred second-line antibiotic. However, some participants recognized that this might be changing: "We have been taught for a while clindamycin [is second-line], but I believe that just changed recently [to azithromycin]." Two participants also mentioned that cephalosporins could also be used as a second-line antibiotic but reported that this was not seen in practice.

Theme 2: Physicians and dentists

Dentists typically followed what physicians recommended, regardless of whether the dentists thought this information was correct. "We just do what the doctor says [regarding antibiotic instructions]; that's the end of it." The dentists elaborated that "It feels like it could be more appropriate for [the physician] to make the call" because "they . . . have a more holistic view of the entire body and everything that's going on." Tools that would help dentists improve confidence in antibiotic prescribing decisions without having to ask a physician were appealing.

Theme 3: Workflow and knowledge

Trainees expressed some uncertainty about antibiotic knowledge and prescribing in general: "I personally have not prescribed antibiotics . . ." One participant expressed uncertainty about antibiotic prescription duration, stating, "Maybe I'm overdoing things [with a 7-day prescription of antibiotics]." They expressed that this duration was typically ordered because it was the default duration in the electronic dental record. Much of their suggested antibiotic prescribing was defensive in nature. Two participants provided specific examples of how antibiotics would be prescribed out of an overabundance of caution: "The mentality is 'I just want

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Table 3. Comparison of Average Likelihood of Antibiotic Prescribing and Confidence in Decision Across Students, Residents, and Faculty for Each Scenario and Overall

Measure	Scenario	Student, Mean ± SD (Range) [No.]	Resident, Mean ± SD (Range) [No.]	Faculty, Mean ± SD (Range) [No.]	*P* Value
Likelihood of prescribing antibiotics	Vignette 1: Prosthetic joint infection prophylaxis	2.69 ± 1.03 (1– 5) [151]	2.3 ± 1.17 (1–5) [27]	3.03 ± 1.34 (1–5) [35]	.042
	Vignette 2: Acute pericoronitis	3.22 ± 1.12 (1–5) [151]	2.93 ± 0.96 (2–5) [27]	2.74 ± 1.24 (1–5) [35]	.056
	Vignette 3: Acute oral pain	2.56 ± 1.08 (1–5) [151]	2.48 ± 1.05 (1–5) [27]	2.66 ± 1.24 (1–5) [35]	.867
	Vignette 4: Endocarditis prophylaxis	2.33 ± 0.98 (1–5) [151]	1.85 ± 1.23 (1–5) [27]	1.83 ± 0.82 (1–4) [35]	<.001
	Vignette 5: Acute oral pain	2.13 ± 1 (1–5) [151]	1.93 ± 1.11 (1–5) [27]	2 ± 1.24 (1–5) [35]	.206
	Vignette 6: Prosthetic joint infection prophylaxis	3.12 ± 1.17 (1–5) [151]	3.19 ± 1.24 (1–5) [27]	3.37 ± 1.42 (1–5) [35]	.553
	Vignette 7: Endocarditis prophylaxis	2.95 ± 1.2 (1–5) [151]	2.7 ± 1.38 (1–5) [27]	2.6 ± 1.31 (1–5) [35]	.168
	Average across all 7 vignettes	2.72 ± 0.5 (1.14–4) [151]	2.48 ± 0.61 (1.29–4) [27]	2.6 ± 0.67 (1.14–4.43) [35]	.095
Confidence in decision	Vignette 1: Prosthetic joint infection prophylaxis	2.94 ± 1.17 (1–5) [151]	3.89 ± 0.89 (2–5) [27]	3.86 ± 0.91 (1–5) [35]	<.001
	Vignette 2: Acute pericoronitis	3.11 ± 1.08 (1–5) [151]	3.81 ± 0.83 (2–5) [27]	3.89 ± 0.83 (2–5) [35]	<.001
	Vignette 3: Acute oral pain	2.97 ± 1.17 (1–5) [151]	3.74 ± 1.02 (1–5) [27]	3.83 ± 0.86 (1–5) [35]	<.001
	Vignette 4: Endocarditis prophylaxis	2.85 ± 1.11 (1–5) [151]	3.89 ± 0.89 (2–5) [27]	3.91 ± 0.89 (2–5) [35]	<.001
	Vignette 5: Acute oral pain	3.09 ± 1.2 (1–5) [151]	4.04 ± 0.94 (2–5) [27]	4.26 ± 0.66 (3–5) [35]	<.001
	Vignette 6: Prosthetic joint infection prophylaxis	3.02 ± 1.11 (1–5) [151]	3.7 ± 0.91 (2–5) [27]	3.94 ± 1 (1–5) [35]	<.001
	Vignette 7: Endocarditis prophylaxis	2.84 ± 1.12 (1–5) [151]	3.63 ± 1.01 (1–5) [27]	3.74 ± 1.07 (1–5) [35]	<.001
	Average across all 7 vignettes	2.97 ± 0.94 (1–5) [151]	3.81 ± 0.72 (2–5) [27]	3.92 ± 0.67 (2.14–5) [35]	<.001

Note. Statistics reported as mean ± standard deviation (range) [n]. *P* values generated from the Kruskal-Wallis test for individual scenarios and ANOVA for average across all scenarios.

to be on the safe side.' . . . I don't want [the joint replacement] to fail." Another stated, "I don't see [defensive dentistry] too much with prophylactic antibiotics. I see it more when patients come in as an 'emergency' and they have pain, but they don't really need antibiotics." One participant stated that antibiotics helped address patient concerns, explaining, "If the patient is pushing for antibiotics, sometimes we will placate their desire," and "Sometimes if you don't give it to them, they just assume you don't know what you're doing."

Theme 4: Tool preferences

There was a consensus that a CDST would be helpful. One participant stated, "Creating a more authoritative [tool] . . . has the ability to be the main resource for dentists and whoever else is prophylactically prescribing because there is a ton of gray area." Another said, "I think [a tool] would be very helpful, especially with antibiotics and the fear of creating resistance." Participants also indicated a preference for electronic tools, especially tools they could access via axiUm (ie, the electronic dental record). One participant stated, "I think the electronic approach works better than the paper approach because . . . [you can] work it up right there on the spot . . . It's more efficient then." Regarding availability on axiUm, another participant said, "The good thing of having [the tool] on axiUm and the computer is that you don't have to use your phone. Some patients might think you're doing something else."

All the participants had favorable views of decision tree tools. As one explained, "I like [the AAOS decision tree]. Because it's less subjective, I feel. You have some objective questions that are being asked." The same participant later stated, "If we had something like that for other situations, I feel like it would be very useful." With regard to decision trees, another individual noted, "It just helps . . . organizing information in my head, because if they just give us a list of different pathologies and say, 'Okay, go memorize this,' there's not an organized and structured way to go about diagnosing. When you have decision trees, it's a lot easier."

Discussion

Our survey revealed gaps in dentists' knowledge and confidence in antibiotic prescribing for dental conditions. Survey participants

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commonly recommended antibiotics when they were not warranted, and dental faculty had a similar correct response rate to preclinical dental students. Other surveys have demonstrated opportunities for improvement in antibiotic prescribing decisions for endodontic patients,[11–16] patients undergoing dental implant placement,[17,18] emergency dental care,[19–21] and general dentistry.[22–26] Other conditions, such as use of systemic antibiotics prior to periodontic treatments, have shown considerable variability. Work is underway to standardize candidate outcome sets for dental antibiotic stewardship.[27]

Overall, our survey findings indicated that confidence in antibiotic prescribing decisions increased by training level but that knowledge did not. Our findings that dental training level had no impact on appropriateness of antibiotic prescribing is different from reports that additional postgraduate training level and recent graduation from dental school correlated with a higher survey correct response rate.[22,28–30] Knowledge may not translate into appropriate action, however. Previous surveys have emphasized that guidelines and scientific literature have a large influence on antibiotic prescribing.[31] However, dentists report difficulty interpreting these guidelines. One study indicated that 78% of dentists felt that the guidelines for antibiotic prophylaxis for endocarditis were clear, but only 49% felt the same way about prophylaxis for prosthetic joint infections.[32]

Our qualitative assessment of baseline dental antibiotic decision making demonstrated substantial knowledge in first-line antibiotic use for antibiotic prophylaxis and treatment. However, there was uncertainty in antibiotic treatment duration or second-line antibiotic use among study participants. Similarly, cases that might be unusual or have some degree of complexity led to confusion and may result in consultation requests for advice from medical providers. Some behavior tends to be associated with defensive practices, such as prescribing an antibiotic "just to be safe" or following a physician's recommendation even if they believe it may be incorrect. Participants stated that they would be very interested in utilizing a CDST to aid in antibiotic decision making. Current resources included Google, which was considered unprofessional by several participants. The ideal tool would be embedded into the electronic dental record, incorporate evidence-based practices from authoritative bodies (eg, the American Dental Association, AHA), include simple algorithms or decision trees with pragmatic advice, and be regularly updated.

External pressures, including risk of litigation, patient requests, and other healthcare providers' requests for antibiotics are well recognized as influencing antibiotic prescribing decisions.[31,33] Higher-volume practices may also engage in more inappropriate antibiotic use[34] than lower-volume practices, whereas female dentists may be more likely to follow evidence-based practices[35] than male dentists. The COVID-19 pandemic may have exacerbated these problems.[36] We did not assess these factors in the current study, and this topic should be pursued in future research.

This study had several limitations. The clinical vignettes varied in difficulty, with some more challenging questions requiring dentists to decide whether specific medications, such as hydroxychloroquine, would classify a patient as immunosuppressed. Although our vignettes were designed to reflect real-world scenarios that a dentist may encounter, the more challenging scenarios may have increased uncertainty among participants and biased our results toward the null. Our sample size was small, and we were unable to detect statistically significant differences between subgroups. However, our descriptive findings are clinically meaningful and are enhanced by the qualitative findings. Although a sample size of 10 for our qualitative work was reasonable,[37] and we reached thematic saturation overall, we acknowledge low participation among dental residents and faculty. Preclinical (first and second year) dental students receive limited training regarding antibiotics: antibiotic pharmacology, prescription writing, microbiology, or antibiotic use. Although minimal, these may have biased our results closer to the null for both knowledge and confidence in antibiotic prescribing. The way that we constructed the vignettes with all of the answers being "no" antibiotics may have increased the likelihood of response biases, in which participants might default to "maybe" and select antibiotics for some of the vignettes. Finally, it is possible that study participants responded differently to clinical vignettes compared to real interactions with patients.

Ultimately, our mixed-methods study revealed a need and interest in using CDSTs to optimize antibiotic prescribing practices in dental settings. Opportunities remain to improve both antibiotic prescribing confidence and knowledge in dentistry. To our knowledge, this is the first study to incorporate an information technology framework and mixed methods design to guide the preimplementation development of a dental CDST. This study provides an example for future research groups who intend to develop CDST interventions in dental and other nontraditional healthcare settings.

In conclusion, confidence in antibiotic prescribing increased by training level, but knowledge did not. An ideal CDST may provide simple-to-follow and comprehensive guidance from authoritative sources, such as clinical practice guidelines, to enhance knowledge and confidence in antibiotic prescribing.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/ice.2023.173

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