

# Dental antimicrobial stewardship: a qualitative study of perspectives among Canadian dentistry sector leaders and experts in antimicrobial stewardship

Christiana Martine <sup>1\*</sup>, Susan Sutherland<sup>1</sup>, Karen Born<sup>2</sup>, Wendy Thompson <sup>3</sup>, Leanne Teoh <sup>4</sup>  
and Sonica Singhal<sup>1</sup>

<sup>1</sup>Faculty of Dentistry, University of Toronto, 124 Edward St., Toronto M5G 1X3, ON, Canada; <sup>2</sup>Dalla Lana School of Public Health, University of Toronto, 155 College Street, Toronto M5T 3M6, ON, Canada; <sup>3</sup>Division of Dentistry, University of Manchester, Oxford Road, Manchester M13 9PL, UK; <sup>4</sup>Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne, 161 Barry St, Carlton VIC 3010, Australia

\*Corresponding author. E-mail: christiana.martine@utoronto.ca  
@bornk; @DrSSutherland1

Received 20 February 2024; accepted 5 May 2024

**Objectives:** Dentistry is a significant contributor to the burden of antimicrobial overprescribing and hence to the global problem of antimicrobial resistance. However, antimicrobial stewardship in Canadian dentistry is nascent, with an acknowledged need for research and coordinated stewardship efforts. This study aimed to gain insights into the perspectives of Canadian dentistry sector leaders and experts on the main drivers of dental antibiotic overprescribing and potential stewardship strategies.

**Methods:** Exploratory qualitative design. Data collection: four one-time, 1 h focus group discussions with 22 experts and stakeholders in antimicrobial stewardship in Canada, recruited through a mix of purposive and snowball sampling. Data analysis: inductive thematic analysis.

**Results:** The analysis yielded five themes: outdated patterns; antimicrobials as a Band-Aid; fear and risk aversion; behavioural change; and why reinvent the wheel? Overprescription in dentistry stems primarily from a perpetuation of outdated prescribing patterns, ubiquitous use of antibiotics as a temporary solution, and an overly cautious antibiotic use by risk-averse providers. Stewardship strategies should be grounded on behavioural change (motivation, robust data and enactment of new behaviours) and may be modelled after tested medical interventions.

**Conclusions:** This study presents a roadmap for behavioural change in dental antibiotic prescribing, and points to the fact that the success of a stewardship actionable plan for Canadian dentistry may depend more on concerted efforts for change than on the creation of novel strategies. Hence, contextualizing and testing medical stewardship programmes in Canadian dentistry may be effective in combatting antibiotic overprescription, thereby contributing to global efforts to reduce antimicrobial resistance.

## Introduction

Antimicrobial resistance (AMR) is recognized as one of the top 10 threats to global health.<sup>1</sup> In 2019, 1.27 million death cases were directly attributed to AMR and it was associated with around 5 million deaths worldwide.<sup>2</sup> Dentistry is responsible for approximately 10% of antibiotics prescribed across healthcare globally. The prescription of antibiotics in dentistry is essential but only as an adjunct to dental treatment: to prevent distant site

infections, such as infective endocarditis; to prevent surgical site infections; and to treat serious odontogenic infections. However, up to 80% of dental antibiotic prescriptions may be deemed unnecessary, with wide variation across countries.<sup>3</sup>

In an attempt to optimize antibiotic prescribing in dentistry, the World Dental Federation (Fédération Dentaire Internationale, FDI) has provided international guidance to dentists, dental teams and national associations on how they can contribute to reducing AMR.<sup>4</sup> However, while significant stewardship efforts

have been undertaken in dentistry in the UK and Australia, as well as in medicine and pharmacy in Canada, antimicrobial stewardship (AMS) in Canadian dentistry is incipient, and lacks a structured, consensus-driven and coordinated approach. Additionally, there is an acknowledged need for research in this domain.<sup>5</sup> Given the significance of AMR, it is crucial to improve its management and strategize its use in dentistry.

This study aimed to understand the perspectives of Canadian dentistry sector leaders and other experts on the main drivers of antibiotic overprescribing and stewardship strategies in dentistry. In collaboration with researchers from the universities of Manchester and Melbourne, this study informed the development of a multistakeholder workshop with the objective of developing an actionable plan for AMS in Canadian dentistry.

## Methods

### Ethics

Ethics approval was obtained from the University of Toronto Research Ethics Board, Health Sciences REB Committee (Protocol # 44461).

### Study design

Underpinned by a constructivist perspective, this study employed an exploratory, generic descriptive qualitative research methodology.<sup>6</sup>

### Participants

Twenty-two participants, including AMR and AMS experts, policy leaders, dental regulators, dentists, physicians and pharmacists, ranging from early to late career, with the majority in the mid-career category, were recruited through a mix of purposive and snowball sampling (refer to Table S1, available as [Supplementary data](#) at JAC-AMR Online). In addition to AMR and AMS experts, remaining participants were also included for their knowledge of, and/or connection with, the subject matter and, thus, were aware of significance and severity of the problem of AMR and its interrelationship with the environment, human and animals (One Health concept). The sample size, following Malterud *et al.*'s<sup>7</sup> concept of information power, was continually re-evaluated throughout the research process until sufficient information was gathered to create new knowledge and fill gaps in the literature.

### Data collection

Data was collected through four one-time, 1 h focus group discussions, each consisting of 4–6 participants. The semi-structured interview guide was adapted by S.Su and K.B. from Lim *et al.*'s<sup>8</sup> study— which explored stakeholders' perspectives on AMS in the context of pharmacy— around two overarching domains of inquiry: understanding the main drivers of antibiotic overprescribing; and exploring stewardship strategies in dentistry (File S2). After participants signed informed consent forms, focus groups were conducted in June and July 2023, virtually via Zoom, and recorded. Data were de-identified and transcribed verbatim by researcher C.M.

### Data analysis

Transcripts were proofed and read several times for familiarization with content and broader apprehension of their whole, as well as the identification of essential features that were related to the research topic. Data analysis was conducted inductively and coded manually by C.M., in a line-by-line semantic approach based on Braun and Clarke's<sup>9</sup> guidelines to thematic analysis. This was an iterative process, with a systematic return to the raw data for additional understanding and assurance of

consistency between the interpretations being made, in relation to the original data and research question. Data codes and initial categories were discussed and refined in concert with researchers S.Si., S.Su. and K.B. at a later date. Results and key themes were further refined in collaboration with researchers W.T. and L.T. for enhancing trustworthiness.<sup>10</sup>

## Results and discussion

Five main themes were identified (Table 1). Three themes (outdated patterns, antibiotics as a Band-Aid, and fear and risk aversion) were linked to overprescription drivers in dentistry. Two were linked to antibiotic stewardship in dentistry: behavioural change and why reinvent the wheel? Findings were connected to those found more broadly in medicine to identify comparative drivers and explore potential solutions proposed in the field.

### Overprescription drivers in dentistry

#### Outdated patterns

Outdated patterns refer to the perpetuation of antiquated prescribing beliefs and habits that no longer have scientific bearing and were described by participants as challenging and hard to change, particularly among dentists who have been practising for many years, and among patients who have a history of taking antibiotics for issues wherein they are no longer required (e.g. antibiotic prophylaxis following joint replacements). Past practices can create expectation among patients that antibiotics will be prescribed, making it difficult for dentists to convince them otherwise. The following quotes depict both dentists' and patients' challenges of breaking patterns in antibiotic prescribing:

I learned in dental school is the thing that people have a very difficult time breaking that habit, and unfortunately don't, don't seem to regularly update their, the evidence base of their practice...I remember the days of pre-printed prescription pads, both for antimicrobials and for opioids as a standard thing (Participant 20).

Because of some pattern that they've had as a previous habit, you know. With previous doctors saying for example, it's hard to, to talk the patient out of it. Not impossible, but hard to talk the patient out of it. And I would say that would only be the same here [in the context of dentistry] too (Participant 1).

The data suggest that dentists' outdated patterns of prescribing stem from both a knowledge gap concerning the evolution of antibiotic therapy recommendations, and the challenges associated with changing habits. This gap in knowledge was primarily attributed to a lack of continuing education, absence of standardization in the dental curriculum, and disparities between theoretical and clinical education in dental schools, as well as a lack of clear guidelines. Participants argued that dentists would generally prefer to attend continuing courses that focus on practical aspects driving their practice financially, rather than AMS ones. Moreover, they believe that those who attend AMS and AMR courses are already more knowledgeable in such topics than those who refrain from participating. This indicates that changing outdated patterns of prescribing through continuing education courses may depend on whether these courses are offered free

**Table 1.** Themes and quotes

Overarching domains of inquiry	Themes	Subcategories	Representative quotes
Overprescription drivers in dentistry	Outdated patterns	Dentists' and patients' patterns Difficulty changing habits Knowledge gap No clear guidelines	<ul style="list-style-type: none"> <li>• Those [dentists] who are a number of years out may stick to old patterns [of prescribing] that were taught by from the pulpit</li> <li>• Those historical patterns. If patients previously had been prescribed prophylactic antibiotics, because they've had a joint replacement or something where there's no longer evidence to support it, they just don't accept that the recommendations have changed</li> <li>• I have an infection, I need an antibiotic, this [prescription in such cases] is normal, why aren't you giving it to me?</li> <li>• There's a lot of education that probably needs to happen so that patients better understand what antimicrobial resistance is, and antibiotic stewardship...It [public awareness] is certainly an important component. And it can affect parts of it, you know, where there's that patient expectation for antibiotics can certainly impact that part of it</li> <li>• I think, you know, it's sort of known that a lot of dental curriculums are still, you know, in quite a desperate need of update and revamp...even into, you know, what type of questions are being asked on the dental board exams...</li> <li>• I just want to talk about education, because at the faculty, they are taught all of this, they're taught that didactically, but they don't see it clinically</li> <li>• A lot of it is habit, you know, and then, while we've always prescribed, you know, 7 days of antibiotics for this for prevention, and it's always seemed to work, so why change [this] sort of thing</li> <li>• One is ambiguity or lack of guidelines. We, if you look at every way that we prescribe antibiotics in dentistry, we have recommendations for five or six conditions. And those are only, those are only for healthy people and for adults. And so we don't have guidelines for medically compromised patients or really paediatric patients</li> <li>• I think there's risk aversion, right?...most people [referring to providers] are focused on the patient, not the population...Like we're worried about AMR, but we're worried about this person or animal in front of us</li> <li>• It's the concept of, well, it can't hurt [to prescribe antibiotics] you know, the risks versus the benefits of doing or not doing. It's like, well, you know, if I don't do it [prescribe antibiotics], then God forbid, this huge, horrible</li> </ul>
	Fear and risk aversion	Tangible consequences for not prescribing Antibiotics as the most judicious course of action Patients' fear	

*Continued*

Table 1. Continued

Overarching domains of inquiry	Themes	Subcategories	Representative quotes
			<p>outcome happens. I'm better to just do it. Because what's really the risk of, of giving the antibiotic really, right?...that's sort of like [AMR], it's kind of like climate change. That's a future problem, right?</p>
			<ul style="list-style-type: none"> <li>• When the prescriber has that negative experience case happening, there's kind of some, some sort of self-censoring. In the back of their mind, the right thing to do is be judicious in prescribing that antibiotic</li> <li>• I think generally even in the physician world, fear is an issue. Just in terms of, by the physicians, dentists in this case, you know, in terms of the consequences of, of not giving an antibiotic...And then also the other way. I think fear by physi, or by the patient...I think it [fear] works both ways</li> </ul>
			<ul style="list-style-type: none"> <li>• I get a lot of patients coming in. And you know, they almost don't want to deal with me. They just, you know. No, no, no. Give me my antibiotic and let me get out here, right?</li> </ul>
			<ul style="list-style-type: none"> <li>• Rather than try and squeeze them [patients] in at the end of the day, we prescribe an antibiotic to get them through to Monday. Without understanding, really, that you need to get at the root cause so to speak, as opposed to just put a Band-Aid on something</li> </ul>
			<ul style="list-style-type: none"> <li>• It [tooth] needs to come out. They're not ready to do it today...What can you do? So, you know, and even in patients with an abscess, you know, and we've had that conversation. There's nothing that can be done</li> </ul>
			<ul style="list-style-type: none"> <li>• So, for example, you're working as an associate in a private practice, a patient comes in with a problem. And in fact it's, you know, second molar or something with complex or challenging anatomy, that you simply are not comfortable providing that definitive treatment. What do you do? Well, you feel like you [as a dentist] have to do something...So, the provider, that the patient walks into not being able to provide the definitive treatment, and that provider feeling like they have to do something</li> </ul>
			<ul style="list-style-type: none"> <li>• As a dentist, then often times you feel you have to do something. And that might be where the when the prescribing takes place</li> </ul>
			<ul style="list-style-type: none"> <li>• Keeping patients happy, that they think something's been done for them</li> </ul>
			<ul style="list-style-type: none"> <li>• People tend to take the approach of, you know, we're programmed to do something as clinicians, and we don't like not doing something</li> </ul>
	Antibiotics as a Band-Aid	The need to do something	
		Physicians' use of Band-Aids	

- In some areas like, you know, some dentists are going for one or twice a day. Maybe that area wouldn't see a dentist, or a dental hygienist within the next couple of weeks. So, when this kind of scenario are [sic] playing in the back, back of dentists' mind, they take their decision
- When the dentist had a feeling that the patient might not come [back for treatment], because of either the distance, or the patient's demographic background is such that, you know, it's very likely that the patient will not return or will not have a chance to return to that. There might be some other social factors and demographic factors
- Within a population that is low income, that often suffers from infections. If they cannot access care, antibiotics becomes the next, becomes the next possibility
- So if there's not going to be an extraction or a root canal, then an antibiotic is often what people will give. Definitely, family docs will give an antibiotic. So that's definitely something I see a lot
- The solution for, you know, swelling and pain is to, to, get rid of the source of the infection. And, you know, physicians are not equipped to do that. And, so, the easiest thing for them is antibiotic or referral to the ER, when it gets so severe that someone has to manage it
- What am I supposed to do [as a physician] when I cannot get them, you know, to an outside dentist, for example? And the same in family practice. Well, if they don't have insurance, then that's a lot of money, you know, what are my alternatives, really?
- It's not anything to do with science [referring to prescribing habits], it's getting people willing to do what, in a lot of situations they know, they should do. So figuring out those, those why components is the really big thing for me
- My hope was that we will get some more data. We'll get some more interest and that we can, you know, initiate more of, you know, stewardship interventions to dentists
- It's very hard to do quality improvement without data, you don't know what you're measuring, and you don't know where you're going. And, so you, as a very first step, you need the data
- There should be a lot of impetus to get those data links, given on both of those [referring to opioids and antibiotics], for national security reasons and track by the federal government, because it is a national security issue
- I think a lot of it comes down to reframing what the safe side is. You know, I think historically, we used to say that,

Antibiotic stewardship in dentistry

Behavioural change

Understanding motivation

Robust data:

Dissemination

- Education
- GuidelinesCarrats x sticks

Continued

**Table 1.** *Continued*

Overarching domains of inquiry	Themes	Subcategories	Representative quotes
			<p>let's just prescribe antibiotics just in case you're just to be safe. But now, I think we're trying to reverse that and think about okay, what does actually the safe side mean? So, I think that reframing piece is really important</p> <ul style="list-style-type: none"> <li>• It's going to take a lot of communication to translate that risks [of overprescribing] that we're finding in the grey literature to our patients, and to our colleagues</li> <li>• Start pushing this public messaging through with work from our colleges with support from public health, because (inaudible) has the vehicles to push out the message</li> <li>• Having some posters available for dentist office, that sort of thing to influence public</li> <li>• Looking at the roster of questions at the educational level, because I do think it's sort of it really is going to be a generational shift from the ground up, and we need to target students</li> <li>• Maybe we can elicit more continuing education courses or programmes, or encourage participation and things like choosing wisely webinars</li> <li>• It's very easy for us in continuing education to just sort of, even among the category one offerings, of course, is to kind of cherry-pick those topics that are of greatest interest to us...So, if you made it free, and you made it worth a high-value point, you know, category one for CE, and you somehow made it more mandatory</li> <li>• So, going to a CE talk, right? The problem is CE talks on any microbial uses, most of your audience is probably doing it well, right? Because they're motivated. People that are horrible, aren't going to go to it</li> <li>• We could certainly look at how do we incorporate questions into that examination around antibiotic stewardship and appropriate prescribing practices. And what that would do is it might prompt people to do a bit of review in that area, and therefore influence practice</li> <li>• It all ties into understanding sort of the pathophysiology of a toothache. And that's where that physician's education piece comes into play</li> <li>• So thinking about some sort of integration [referring to the integration of dental antimicrobial resistance (AMR) stewardship into physicians' curriculum], you know</li> <li>• To discuss, you know, appropriate times of, you know, when a dental issue is actually improved or not improved by prescription</li> </ul>

- A very clear set of guidelines. So that dentists can, can point this out to patients
- I think those nudge behaviours are really useful, because they do a couple of things. They educate, they make it easier
- I think there are two high-yield ways that I've seen effective in private practice and both hospital practice. One is adding the guidelines or recommendations into the electronic dental record software
- Enacting new behaviours
- I think a kind of non-punitive monitoring system, where data is collected and fed, fed back to the prescribers
- So I think people listen up when the College gets involved
- Have the hammer guy, you have [to have] a hammer somewhere. Because this is a serious global problem
- Too much of a hammer, I think really doesn't appreciate the complexity...It has so many different drivers, you know. I don't know this patient very well, it's a Friday night, I've seen 17 patients today. Like all of those things. I don't have data, I don't have good, whatever
- No, no. I don't care if you're stressed. You have the same responsibility in the morning as you do at eight at night. And those are not, those are not excuses or reasons
- I don't think we should try to reinvent the wheel...I think then we can get somewhere, don't reinvent the wheel, take the info from other places
- Could see in dentists' offices for sort of like the equivalent of the viral prescription pad, [which] is a very good stewardship strategy within upper respiratory tract infection, right?
- What we know in primary care as an example is that the viral prescription pad really does work quite well...maybe some version of that same kind of thing, not a viral prescription pad, obviously, like, what you do instead, kind of prescription pad
- I think the viral [pad], something to give to the patient has worked, I believe
- So people can see those messages apply in that [dental] realm as well
- There could be very simple things like getting dentists to hang like letters in their office, which has been shown in primary care to be effective as well
- [You] could see a rule in dentists' offices for sort of like the equivalent of the viral prescription pad, [which] is a very good stewardship strategy within upper respiratory tract infection, right?

Why reinvent the wheel?

Continued

**Table 1.** Continued

Overarching domains of inquiry	Themes	Subcategories	Representative quotes
			<ul style="list-style-type: none"> <li>• Most young parents now are aware of the watchful waiting protocol for kids with ear infections and that kind of thing. Like, that's pretty commonly accepted knowledge...So, those campaigns have been very successful. So, I think we just need to translate it over to dentistry</li> <li>• Outliers [in AMR stewardship], you can address that top 10%, 20%, because people may not realize it. And the people [providers] are probably more likely to adapt if they're lined up next to their peers, than if it aligns next to guidelines and a lot of situations because it's a little more understanding</li> </ul>

of charge and/or are mandatory. In addition, it underscores the importance of strategies to change behaviours.

In Canada, there is no uniformity in the teaching of AMR and AMS courses, nor is there consistency in the number of hours dedicated to this topic in dental schools. Although such courses might be taught theoretically, experts believe that such knowledge is not necessarily translated to instructors who teach students in the clinical setting, creating a discrepancy between theory and practice. Not only do clinical instructors have varied levels of education in AMS, but they do not have set protocols for prescribing antibiotics for patients in dental school clinics and tend to overprescribe, as explained by a dental school dean:

they [clinical instructors] want to definitely make sure that they are covering the bases...some instructors say nope, antibiotics are definitely not needed. But we will also have the instructors that will say let's give a prescription just in case (Participant 17).

The lack of clear knowledge regarding what is being taught theoretically regarding AMS and AMR in dental schools, as well as how it is translated into clinical teaching, indicates the need for comprehensive understanding of these issues. Hence, future research should investigate baseline data and teaching patterns across all 10 Canadian dental schools. This includes assessing standardized protocols for antibiotic prescribing in school clinics and continuing education courses to better address knowledge gaps in dental antibiotic prescribing.

The lack of clear guidelines was also highlighted. These would not only support dentists in prescribing appropriately, but also safeguard their decision to not comply with patients' potential expectations for antibiotics. In the province of Quebec, a study demonstrated that the distribution of 11 types of guidelines to pharmacists and physicians had a significant impact on the reduction of antibiotic prescriptions in that province, when compared with the rest of Canada.<sup>11</sup> Without clear guidance, efforts to promote better education and awareness may be unavailing.

*Fear and risk aversion*

Dentists' fear of negative outcomes—which could potentially arise from refraining to prescribe antibiotics—was described as critical to the issue of dental overprescribing. It could be interpreted from the data that, when confronted with unclear diagnosis, dentists prescribe antibiotics rather than risk potential complications from the dental condition. This is especially significant for providers who have previously dealt with serious infections and outcomes in their practice. In this sense, complications are seen as more tangible than the problem of AMR, considered by participants to be a more abstract problem. Patients who experience serious AMR adverse events often seek medical care without their dentists' knowledge. This contributes to a lack of awareness among dentists regarding the harm caused. From this perspective, AMR-related issues can be interpreted as having an esoteric origin. In contrast, complications connected from not prescribing are believed to reflect directly and negatively upon dentists' care. Prescribing antibiotics is thus perceived by risk-averse providers as the most judicious course of action.



We have differential acceptance of risk. So, is the dentist more willing to risk an AMR or risk *C. diff* [*Clostridium difficile* infection]. When there is risk of complication in their patient, because they feel bad when the complication in the patient reflects on their care, versus the person that gets *C. diff*. Well, you know, that's the antibiotic's fault, or that's God's fault or whatever. It's not my fault, because I did something (Participant 11).

Additionally, discussions within focus groups pointed to how patients' fear of going to the dentist constitutes another driver of overprescription in dentistry, given that fearful patients would rather have an antibiotic prescribed to them, than undergo dental treatment, the most effective way of addressing infections. This seemed particularly meaningful when considering patients' patterns, as discussed earlier, and the influence of patients' expectations on antibiotic overprescribing.

Fear and risk aversion resonate with inappropriate antibiotic prescribing that results from practising defensive medicine in the medical context.<sup>12</sup> Physicians were found to prescribe antibiotics inappropriately, when faced with symptoms that do not have a definitive diagnosis, to both avoid risks and alleviate their feelings of uncertainty.<sup>12-14</sup> In addition, patients often feel reassured when antibiotics are prescribed, as it signals that their ailment has a clear cause and is being managed. The need for reassurance thus leads to a high patient demand for antibiotics.<sup>12</sup>

Participants also noted that dentists may prescribe antibiotics out of fear of legal actions from patients. In such situations, dentists prefer to face the consequences of prescribing an antibiotic.

The medical legal perception of covering your butt clinically [referring to antibiotic prescribing]. You don't want to take a chance on something blowing up and then have the College come back at you later for not having done everything possible to prevent that (Participant 20).

#### *Antibiotics as a Band-Aid*

Another important driver to overprescription in dentistry, as identified in the data, was linked to the ubiquitous use of antibiotics by dentists as a temporary or 'Band-Aid' type of solution, particularly in situations where definitive treatment cannot be administered on the same visit. References to the following scenarios were primarily tied to the use of antibiotics as a Band-Aid solution: the need to assist patients until they can see a specialist; situations where they are going on vacation and cannot undergo treatment; or to get them 'through to Monday' (Participant 14) when, for instance, the dentist will not, or cannot, provide the treatment before the weekend; when patients seek treatment only at a more advanced stage of infection (e.g. abscess); and when patients cannot afford treatment, in a context of extremely limited public health coverage. This parallels the unnecessary prescription of antibiotics, driven by 'time pressures' of busy clinical environments and the resulting need for 'quick fixes,' as observed in medicine.<sup>13</sup>

Another aspect of using antibiotics as a Band-Aid is linked to dentists' inherent need to take immediate action or, as some of the participants put it, to their need to 'do something' when in the presence of a patient who is experiencing dental problems. Given the need to do something, providers use antibiotics as a

Band-Aid even though this might not be aligned with evidence-based practices.

You may feel that you have somebody who's, who's in pain, for example. Probably a better example is in pain from a toothache. You know there's no antibiotic indicated, but you feel like you have to do something to let's say, get them to the endodontist office or, you know, that sort of a thing (Participant 4).

The use of antibiotics as a temporary solution to meet the immediate need for action finds a similar pattern in medicine. Deschepper *et al.*<sup>12</sup> found that physicians often prescribe antibiotics because they feel the 'inner urge to do something'. They further explain that this urge to act stems from the expectation that, as experts, physicians need to consistently provide patients with a solution. However, in medical practice, the 'need to do something' seems to be connected to discomfort arising from diagnostic uncertainty or to fear and risk aversion, while in the domain of dentistry, this was found to be primarily connected to the use of antibiotics as a temporary solution.

The rollout of the Federal Government's Canadian Dental Care Program can be expected to improve access to care for vulnerable populations. Nevertheless, it could also compound inappropriate antibiotic prescribing, given the overprescription drivers discussed above. On the other hand, it also presents several opportunities for collecting data, one of the priorities identified here for the development of AMS in Canadian dentistry.

#### *Physicians' use of Band-Aids*

Data codes tied to 'antibiotics as a Band-Aid' theme, as well the 'need to do something' subtheme, reveal that such drivers in dentistry are not solely linked to dentists, but to providers more broadly, particularly physicians, as noted by a pharmacist, expert in AMR and AMS:

'I've seen a lot of patients coming through emerge, who are low income, and they can't afford the root canal. So they end up being prescribed by dentists and family physicians, not just dentists' (Participant 10).

Given the physical barriers to accessing dental care experienced by remote and rural populations in Canada, as well as the financial challenges encountered by low-income individuals and those without insurance, patients seek their primary care physician to prescribe antibiotics as a short-term, Band-Aid type of solution. In Australia, difficulties in accessing dental care among rural and low socioeconomic populations have also been found to drive GPs to prescribe antibiotics for dental conditions.<sup>15</sup>

Since physicians are not equipped to treat dental ailments, they prescribe antibiotics as a temporary or Band-Aid solution. This is not only because it is their only option, but also because it satisfies an inherent 'need to do something' for patients until they are able to access care from a dentist.

We [family doctors] only have one solution. It's the antibiotics. We don't know what to do with those [dental problems]...What can wait [for antibiotics] but cannot wait...I work in long-term care, and what am I supposed to

do with somebody that has, you know, tooth pain, where there's no dentist that's gonna ever come (Participant 13)?

The quote above, from a family physician, also highlights a gap in knowledge in dental prescribing, suggesting that more education and clear guidelines (as discussed above) could equally help physicians recognize situations wherein antibiotics are appropriately recommended, rather than using them as a Band-Aid for every dental issue. Moreover, it reflects the dilemma between the need to do something and physicians' lack of resources to deal with dental afflictions.

In light of this, it seems critical that future studies should explore medical school curricula on dental antibiotic prescribing, as this could ultimately help to guide physicians in prescribing antibiotics only when essential.

Commonalities between medicine and dentistry, in the context of AMS, are corroborated by an umbrella/systematic review of factors influencing antibiotic prescribing for adults with acute conditions. This study identified many potentially modifiable factors common to medicine and dentistry. Fear and risk aversion was characterized as 'fear of conflict', 'fear of adverse outcomes' and differences in 'risk perception' between clinicians. Similarly, the 'prescribing habits of clinicians', which include outdated patterns of prescribing, were noted as a factor that varies at the practitioner level.<sup>16</sup> However, there are at least two factors that were found to be unique to dentistry, which primarily stem from the fact that dental conditions are often readily amendable to operative procedures, rather than an antibiotic prescription.<sup>17</sup> An ethnographic study, within urgent dental care in England, demonstrated that some dentists use antibiotics as a temporary 'quick fix' rather than definitive solution, similarly to using antibiotics as a Band-Aid as described here.<sup>18</sup>

## Antibiotic stewardship in dentistry

### Behavioural change

Proposed strategies for antibiotic stewardship in dentistry were found to be grounded in behavioural change. Data segments identified as being connected with such behavioural changes went beyond this more evident and broad category to reveal a distinct roadmap with three key components for the facilitation of these changes.

First, to change behaviour, it is critical to understand dentists' motivation for prescribing antibiotics unnecessarily.

If you don't get the why components [for overprescribing antibiotics], [it] doesn't matter how many guidelines you've got. If someone is just risk averse, then you have to figure out how you correct that behaviour. And that's the big challenge because the biggest barrier to stewardship is the human brain (Participant 11).

Participants underscored the need for behavioural science studies to employ an overarching behavioural theory lens to understand the motivation behind certain behaviours. Theories such as the Theoretical Domains Framework, Capability-Opportunity-Motivation-Behaviour model, and Behaviour Change Wheel have served as analytical lenses in the context of dental AMS.<sup>16,19,20</sup>

Second, the need to create robust data was found to be essential for behaviour change. Currently, in Canada, data on dental

prescribing are sparse, and there is no system of communication among different segments of collected information. Referring to the current state of data collection, a key informant stated that trying to get a 'complete picture [of the data] is a nightmare' (Participant 18). An AMS expert and infectious disease specialist compared the lack of proper data on dental antibiotic prescribing, in Canada, with the 'wild west of stewardship' (Participant 21).

Once robust data is established, it needs to be presented such that it is both understandable and meaningful to providers and patients. 'Education at different levels' (Participant 9)—encompassing the education and continuing education of patients, dentists and other providers— as well as the establishment of clear guidelines, were identified as the primary channels whereby data regarding AMR and AMS should be communicated and disseminated.

However, participants also indicated that guidelines alone might not suffice and suggested mechanisms to nudge providers into following these guidelines, such as dental software prompts and other forms of clinical decision support.

Guidelines are the essential first component for any of this but, but by themselves are usually inadequate. So, you need some other component that's going to create the behaviour change to both get dentists to attend to the guideline, but actually get them to do what we want them to do which is, which is to change some sort of behaviour (Participant 21).

In Australia, when including dentistry in its national AMS, strategies in 2022, the Australian Commission on Safety and Quality in Health Care also highlighted the importance of prescribing guidelines and professional education, as well as engaging patients on the risks of inappropriate antibiotic use.<sup>21</sup> Moreover, a pre-post pilot study conducted in Australia also demonstrated the value of targeted education and a prescribing tool for encouraging dentists to improve antibiotic prescribing in dentistry.<sup>22</sup> The importance of nudging mechanisms to help providers follow guidelines is also corroborated by a study assessing adherence to antibiotic guidelines for the management of gonorrhoea, in the context of medicine. It found that the passive dissemination of guidelines alone, without strategies to improve their uptake, such as electronic prompts and audit and feedback, may be ineffective in changing prescribing behaviours.<sup>23</sup>

Third, behavioural change for dental antibiotic prescribing needs to be mandated and/or encouraged through the enactment of legislation and/or incentives. However, although participants from all groups believe that implementing such measures is instrumental to these changes, discussions about how to effectively execute change presented a dichotomy that was reflected in one of the participants' use of the metaphorical expression, 'the carrot or the stick' (Participant 3). Participants from one group referred to regulatory enforcements as 'hammers' and questioned whether such measures or non-punitive forms of encouragement are more effective. It is noteworthy that participants did not reach a consensus on how the enactment of new behaviours should be implemented. This strong division of opinions suggests that the best way to move forward might be to combine both approaches.

### Why 'reinvent the wheel'?

In terms of practical strategies for stewardship in dentistry, the analysis overwhelmingly pointed to employing AMS interventions in Canadian dentistry that have previously been implemented, particularly in medicine. The phrase 'no need to reinvent the wheel', as expressed by Participant 7, is emblematic of the fact that stakeholders believe that practical solutions for AMS in dentistry may not need to be groundbreaking or extraordinarily intricate; rather, they could already reside in well-established and tested medical interventions.

In medicine, we've done a lot of work around audit and feedback. So, you know, if dentists were to receive a piece of paper to say that this is the prescribing that you've done this month, and this is what happened with your peers...that's one way to help with respect to prescribing habits.

It was mainly suggested that the following approaches to AMS can be used in the context of dentistry in Canada: adapting the viral prescription pad, originally developed to reduce antibiotic prescribing for upper respiratory tract infection, for dental pain; implementing watchful waiting; and conducting audit and feedback.

The idea that AMS strategies can be translated from medical to dental contexts finds parallels in empirical and grey literature. In 2022, the Australian Commission on Safety and Quality in Health Care suggested that audit and individual clinician feedback should be included as part of its dental AMS interventions, and that lessons learned from both hospitals and communities could be applied to the dental context.<sup>21</sup> Based on an adaptation of the viral prescription pad, a tool for shared decision-making between dentists and patients was developed in England for steering interventions towards clinical procedures and away from antibiotic prescriptions unless strictly necessary, during urgent dental appointments.<sup>20</sup> In Scotland, a study examining the NHS data found that the use of an individualized audit and feedback approach, in the context of dentistry, significantly reduced dental antibiotic prescribing rates.<sup>24</sup>

However, when developing a national dental AMS plan, careful examination of local issues for developing context-specific approaches should be considered.<sup>4</sup> Hence, while commonalities between medicine and dentistry further support stakeholders' belief that dental AMS in Canada can be modelled after tested medical interventions, further research, aimed at identifying factors unique to the context of dentistry in Canada, is required to understand whether these interventions could be used.

The major limitation of this study stems from failing to include patients' perspectives on the main drivers to overprescription in dentistry, as well as the potential strategies to dental AMS. This could have helped to better inform and direct the later workshop for coordinating an AMS strategy for Canadian dentistry, which was the ultimate goal of this study. However, the researchers plan to involve public representatives in future engagements to support decision-making for directing AMS policies in Canadian dentistry.

### Conclusions

This study shows that the main drivers of overprescription in Canadian dentistry stem primarily from a combination of factors:

the perpetuation of prescribing patterns that are no longer supported by evidence; the ubiquitous use of antibiotics as a temporary solution; and the overly cautious use of antibiotics by risk-averse providers. Moreover, it suggests a roadmap for behaviour change that involves understanding providers' motivation through a behavioural theory lens, acquiring and disseminating robust data, and enacting new behaviours. It also points to the fact that the success of an AMS actionable plan for Canadian dentistry may be less dependent on the creation of novel strategies, and more on a concerted effort and strong commitment to change among dental policy leaders. As such, contextualizing and testing medical stewardship programmes in Canadian dentistry may be an effective approach to combat antibiotic overprescription. Moreover, this study suggests avenues for future research, which can help to develop an actionable stewardship plan for Canadian dentistry, thereby contributing to global efforts to reduce AMR.

### Funding

This work was supported by the Manchester-Melbourne-Toronto (MMT) Research Fund 2022, awarded to the investigators in June 2022, to inform the development of a multistakeholder workshop with the objective of developing an actionable plan for Canadian AMS in dentistry, in collaboration with researchers from the universities of Manchester and Melbourne.

### Transparency declarations

None to declare.

### Supplementary data

Table S1 and File S2 are available as [Supplementary data](#) at [JAC-AMR Online](#).

### References

- 1 WHO. Global action plan on antimicrobial resistance. 2015. <https://www.who.int/publications/i/item/9789241509763>.
- 2 Murray CJ, Ikuta KS, Sharara F *et al*. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *Lancet* 2022; **399**: 629–55. [https://doi.org/10.1016/S0140-6736\(21\)02724-0](https://doi.org/10.1016/S0140-6736(21)02724-0)
- 3 Thompson W, Teoh L, Hubbard C *et al*. Patterns of dental antibiotic prescribing in 2017: Australia, England, United States, and British Columbia (Canada). *Infect Control Hosp Epidemiol* 2022; **43**: 191–8. <https://doi.org/10.1017/ice.2021.87>
- 4 Thompson W, Williams D, Pulcini C *et al*. FDI World Dental Federation white paper: The essential role of the dental team in reducing antibiotic resistance. 2020. <https://www.fdiworlddental.org/resource/fdi-white-paper-essential-role-dental-team-reducing-antibiotic-resistance>.
- 5 Office of the Chief Dental Officer of Canada. Canada's oral health professionals and antimicrobial stewardship. *Can Commun Dis Rep* 2020; **46**: 376–9. <https://doi.org/10.14745/ccdr.v46i1112a02>
- 6 Kelly M. The role of theory in qualitative health research. *Fam Pract* 2010; **27**: 285–90. <https://doi.org/10.1093/fampra/cmp077>
- 7 Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. *Qual Health Res* 2016; **26**: 1753–60. <https://doi.org/10.1177/1049732315617444>

- 8** Lim K, Broom A, Olsen A et al. Community pharmacists as antimicrobial guardians and gatekeepers – a qualitative study of the perspectives of pharmacy sector stakeholders. *Explor Res Clin Soc Pharm* 2023; **9**: 100212. <https://doi.org/10.1016/j.rscsop.2022.100212>
- 9** Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006; **3**: 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- 10** Richards A, Hemphill M. A practical guide to collaborative qualitative data analysis. *J Teach Phys Educ* 2018; **37**: 225–31. <https://doi.org/10.1123/jtpe.2017-0084>
- 11** Weiss K, Blais R, Fortin A et al. Impact of a multipronged education strategy on antibiotic prescribing in Quebec, Canada. *Clin Infect Dis* 2011; **53**: 433–9. <https://doi.org/10.1093/cid/cir409>
- 12** Deschepper R, Grigoryan L, Lundborg CS et al. Are cultural dimensions relevant for explaining cross-national differences in antibiotic use in Europe? *BMC Health Serv Res* 2008; **8**: 123. <https://doi.org/10.1186/1472-6963-8-123>
- 13** Public Health Agency of Canada. Handle with care: preserving antibiotics now and into the future—Chief Public Health Officer of Canada's 2019 spotlight report. 2019. [https://www.canada.ca/content/dam/phac-aspc/documents/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/preserving-antibiotics/Final\\_CPHO\\_Report\\_EN\\_June6\\_2019.pdf](https://www.canada.ca/content/dam/phac-aspc/documents/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/preserving-antibiotics/Final_CPHO_Report_EN_June6_2019.pdf).
- 14** Gaygisiz Ü, Lajunen T, Gaygisiz E. Socio-economic factors, cultural values, national personality and antibiotics use: a cross-cultural study among European countries. *J Infect Public Health* 2017; **10**: 755–60. <https://doi.org/10.1016/j.jiph.2016.11.011>
- 15** Biezen R, Leong A, Teoh L. Perceptions of general practitioners towards managing dental presentations in Australia: a qualitative study. *Aust J Prim Health* 2024; **30**: PY23217. <https://doi.org/10.1071/PY23217>
- 16** Thompson W, Tonkin-Crine S, Pavitt S et al. Factors associated with antibiotic prescribing for adults with acute conditions: an umbrella review across primary care and a systematic review focusing on primary dental care. *J Antimicrob Chemother* 2019; **74**: 2139–52. <https://doi.org/10.1093/jac/dkz152>
- 17** Teoh L, Thompson W, Suda K. Antimicrobial stewardship in dental practice. *J Am Dent Assoc* 2020; **151**: 589–95. <https://doi.org/10.1016/j.esmoop.2020.04.023>
- 18** Thompson W. Antibiotic prescribing: towards a reduction during urgent NHS dental appointments in England (The APTITUDE Study). PhD thesis. University of Leeds, 2019. <https://etheses.whiterose.ac.uk/25384/>.
- 19** Thompson W, McEachan R, Pavitt S et al. Clinician and patient factors influencing treatment decisions: ethnographic study of antibiotic prescribing and operative procedures in out-of-hours and general dental practices. *Antibiotics* 2020; **9**: 575. <https://doi.org/10.3390/antibiotics9090575>
- 20** Thompson W, Sandoe J, Pavitt S et al. Co-developing an antibiotic stewardship tool for dentistry: shared decision-making for adults with toothache or infection. *Antibiotics* 2021; **10**: 1345. <https://doi.org/10.3390/antibiotics10111345>
- 21** Australian Commission on Safety and Quality in Health Care. Antimicrobial Stewardship in Australian Health Care. 2022. <https://www.safetyandquality.gov.au/publications-and-resources/resource-library/antimicrobial-stewardship-australian-health-care>.
- 22** Teoh L, Stewart K, Marino RJ et al. Improvement of dental prescribing practices using education and a prescribing tool: a pilot intervention study. *Br J Clin Pharmacol* 2021; **87**: 152–62. <https://doi.org/10.1111/bcp.14373>
- 23** Dickson C, Taljaard M, Friedman DS et al. The antibiotic management of gonorrhoea in Ontario, Canada following multiple changes in guidelines: an interrupted time-series analysis. *Sex Transm Infect* 2017; **93**: 561–5. <https://doi.org/10.1136/sextrans-2017-053224>
- 24** Elouafkaoui P, Young L, Newlands R et al. An audit and feedback intervention for reducing antibiotic prescribing in general dental practice: the RAPiD cluster randomised controlled trial. *PLoS Med* 2016; **13**: e1002115. <https://doi.org/10.1371/journal.pmed.1002115>