

Original Article

## Attitudes on antibiotic prescription and antimicrobial resistance awareness: a cross-sectional study among Albanian dentists

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### Abstract

**Introduction:** Alexander Fleming's discovery of penicillin in 1928 revolutionized the treatment of infections, including those in dentistry. Nowadays, dentists are the second most common prescribers of antibiotics worldwide. However, inappropriate use has led to increased antimicrobial resistance (AMR), which is a growing global health issue. The World Health Organization has highlighted the impact of AMR on treatment efficacy, morbidity, mortality, and healthcare costs. During the coronavirus disease 2019 (COVID-19) pandemic, the misuse of antibiotics further exacerbated resistance, as unnecessary prescriptions and extended regimens diminished their effectiveness. Across Europe, excessive antibiotic use that is not aligned with guidelines has become common. Therefore, careful consideration is needed before prescribing antibiotics to minimize resistance risks.

**Methodology:** Our study aimed to evaluate the knowledge, attitudes, and practices (KAP) regarding antibiotic use and AMR among Albanian dentists. A cross-sectional survey was conducted among dentists in private clinics, academic staff, and dental students enrolled in specialization schools from November 2023 to April 2024.

**Results:** The study found high antibiotic prescription rates, often exceeding guidelines, with a significant proportion of dentists prescribing antibiotics every week. Common issues included overuse and inappropriate dosages, contributing to antibiotic resistance.

**Conclusions:** The findings underline the need for improved AMR awareness and adherence to guidelines among Albanian dentists, emphasizing the necessity for updated education and better stewardship practices to combat antibiotic resistance.

**Key words:** antibiotics; AMR; dentists; awareness; Albania.

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### Introduction

Since Alexander Fleming discovered penicillin in 1928, antibiotics have become the cornerstone of infection treatments in medicine and dentistry. Effective antibiotics are used for preventive and curative measures, and the dental community is the second most common prescriber of antibiotics worldwide [1]. Prescribing antibiotics is a practice in modern medicine that has also led to their inappropriate use or abuse, which unfortunately contributes to an increase in bacterial resistance to antimicrobials [2].

Antimicrobial resistance (AMR) is becoming a global problem according to the World Health Organization (WHO), which has described the situation as "combat antimicrobial resistance: no action today, no cure tomorrow." [3]. AMR has caused several issues such as treatment failure, morbidity and mortality, and increased healthcare costs [4].

Evidence recorded during the coronavirus disease 2019 (COVID-19) pandemic showed that many antibiotics do not work in the way they are prescribed [5]. Exposing patients to various antibiotics "just in case" as a preventative measure or prolongation of regimen is known to increase the risk that antibiotics will lose their effectiveness for certain patients [6]. Across Europe, AMR has also resulted from excessive antibiotics prescription rates which are not according to guidelines [7,8]. Care must be taken before the decision to prescribe antibiotics in terms of assessing the risk of antibiotic resistance from both the individual patient perspective and the impact on the wider population. When patients take antibiotics (as per guidance), we must ensure that they really need to take them, and the final decision is made based on the results of an antibiogram. WHO started an awareness campaign for antibiotic prescribers in 2016 which stated that

“antimicrobial resistance threatens the very core of modern medicine and the sustainability of an effective, global public health response to the enduring threat from infectious diseases”. As a consequence, the WHO action plan set out five strategic objectives, with an academic focus in one of them, which was “to strengthen knowledge through surveillance and research and to optimize the use of antimicrobial agents” [4].

AMR develops rapidly through the misuse and overuse of antimicrobials. Antibiotic use for human health is reported to be increasing substantially. Qualitative surveys in many countries show that a growing number of patients believe that antibiotics will cure viral infections that cause minor illnesses such as coughs, common colds, and fever.

Dentist communities are the second most common antibiotic prescribers, and are sometimes not included in this challenge. WHO data concerning antibiotic drugs used among dentists indicate a rather high prescription rate that is between 30% and 66.5%; and the most dental prescriptions for antibiotics were recorded among outpatients, hospitalized patients, and “preventive” patients. Evidence suggests that antibiotic resistance may increase due to overuse, poor adherence, inappropriate dosage, and sometimes, self-administration by patients [9].

Optimizing antibiotic therapy among the dentist community remains a challenge for Albanian dentists. Prevention and treatment should be connected very carefully based on the specific antibiotic that is prescribed and the conditions for which it is prescribed [10–14]. When Albanian dentists use antibiotics for preventative reasons, it is usually for odontogenic and nonodontogenic purposes, as well as endocarditis in those individuals who are known to be at high risk of a heart condition.

Inappropriate dosage is the most common problem related to misused antibiotics [9,14]. A survey conducted in Albania [15] reported that antibiotic prescriptions have increased in recent years [15]. Dentists can have positive impact on the reduction of antibiotic resistance by adopting a more evidence-based use of antibiotics [14]. In a previous study, the community of Albanian dentists showed that decisions to prescribe antibiotics are rarely based on definitive diagnoses [16]. Effective, rapid, and low-cost diagnostic tools are needed to guide the optimal use of antibiotics. Evidence-based prescribing and dispensing should be the gold standard of care—and that is missing in our country.

The aim of this cross-sectional study was to

investigate the pattern of antibiotic prescription use by Albanian dentists, in terms of prevention and treatment; and to understand their knowledge about the importance of AMR to identify gaps in required training. A key objective was to assess their knowledge, attitude, and practice (KAP) in terms of antimicrobial drug use at a tertiary care teaching dental college in Albania. The study has taken into consideration the fact that dentists prescribe antibiotics according to their dental diagnosis, working experience, usual setting, knowledge gained from scientific reports, or verbal updates among colleagues. AMR is still a real and important problem that developed countries face, and we hope that the results of our survey will also contribute to the larger community of dentists where these problems are less common.

## **Methodology**

### *Study design*

We conducted a cross-sectional study to assess the KAP related to antimicrobial drug use among dental professionals in Albania. The study included a tertiary care clinic, private dental clinics, and dental clinics in schools. The questionnaire was created using Microsoft Forms and distributed to dentists online via a link from November 2023 to April 2024. Information about the purpose of the research was included in the questionnaire distributed to all participants, and they were requested to provide authorization to use their data. The questionnaires were collected anonymously. Our goal was to evaluate KAP results among the participating dentists.

### *Participants*

The questionnaire was randomly distributed to different categories of dentists including (i) dentists in private clinics selected from alumni of the Albanian University Dentistry Program, (ii) students enrolled in the Specialization School of Albanian University, and (iii) dentists serving as academic staff. The total number of dentists to which the questionnaire was addressed was estimated as 472, based on the school database. Of those, only 326 responded (69% response) by submitting the questionnaire, representing the final sample size. The sample size was determined using the same methodology as in similar studies [14,16,17]. All participants who were antibiotic prescribers were included.

### *Data collection*

The questionnaire consisted of 19 multiple-choice questions and 8 open questions, which were designed to

collect information in three main sections including:

1. Demographic data;
2. Antibiotic prescription: prophylaxis and therapy (outpatients and clinic university patients);
3. Antimicrobial resistance awareness.

*Statistical analysis*

The data collected in Microsoft Forms were initially exported to Microsoft Excel. Then, they were statistically analyzed using SPSS version 22 (SPSS IBM, Armonk, NY, USA) with a significance of *p* value < 0.05. The Chi square test was used to analyze demographic data, antibiotic prescriptions, knowledge of AMR, and the level of experience among the dentists.

**Results**

A total of 326 dentists (241 female (74%) and 85 male (26%)) participated in this survey by returning the filled questionnaire; however, as described below, each section of the questionnaire had a minor variation in terms of completion rates.

*Participants’ demographic data, and practice in dental clinics (n = 326)*

The first section of the questionnaire, regarding general information about the participants, was completed by all 326 dentists. After collecting and analyzing the data it was determined that most of the participants belonged to the age group 41–50 years old (37.73%), and the majority of them (26.07%) had 20–25 years of work experience. As for their occupation, most of participants worked in private clinics with associates/alone (31.60%/31.29%), and practiced different specialties of dentistry. The demographic data of the participants are summarized in Table 1.

*Antibiotic prescription (n = 320)*

This section of the questionnaire was completed by 320 dentists, representing 98.16% (320/326) of respondents. The questions aimed to gather data on

**Table 1.** Demographic data of participants \*.

Variable	% (n)
<b>Gender</b>	
Female	74% (241)
Male	26% (85)
<b>Age (years)</b>	
< 30	12.88% (42)
31–40	19.32% (63)
41–50	37.73% (123)
51–60	16.87% (55)
> 61	13.19% (43)
<b>Working experience (years)</b>	
< 5	7.67% (25)
5–10	12.88% (42)
10–15	15.95% (52)
15–20	20.55% (67)
20–25	26.07% (85)
> 25	16.87% (55)
<b>Type of dental practice</b>	
Private clinic with associates	31.60% (103)
Private clinic alone	31.29% (102)
Public clinic (hospitals)	6.75% (22)
Public clinic (schools)	10.43% (34)
Universities	19.94% (65)
<b>Dental practice (Specialty)</b>	
Restorative dentistry	10.43% (34)
Endodontics	22.70% (74)
Oral surgery	19.02% (62)
Prosthetics	12.88% (42)
Implantology	11.35% (37)
Orthodontics	9.82% (32)
Periodontology	9.50% (31)
Pediatric dentistry	4.29% (14)

\* This section was completed by all participants (n = 326).

diagnosis, patient comorbidities, potential drug-to-drug interactions, and the side effects of antibiotics used alone or with other medications. Antibiotic use was analyzed for two main purposes: prophylaxis and therapy. The data are presented in Table 2.

Antibiotic prescription was a normal procedure for the Albanian dentists, and was part of their everyday dental practice. Dentists frequently prescribed antibiotics for both preventive and therapeutic purposes. As shown in Table 2, dentists prescribed antibiotics for prophylaxis more than for treating specific infections. Experienced dentists were more likely to prescribe antibiotics compared to the less-experienced dentists (*p* = 0.006). It was evident that when prescribing for preventive purposes, antibiotics

**Table 2.** Antibiotics used by dentists for prophylaxis and therapy.

<b>Antibiotics’ use for prophylaxis</b>				
Dental practice	Always	Only comorbid patients	Never	No idea
Tooth extraction	16.86% (54)	57.5% (184)	24.38% (78)	1.25 % (4)
Oral surgery	65.63% (210)	23.44% (75)	6.88% (22)	4.06 % (13)
Implants	73.13% (234)	14.75 (44)	3.44% (11)	9.69% (31)
Regenerative dentistry	39.38% (156)	21.56 (69)	2.5% (8)	27.19% (87)
<b>Antibiotics’ use for therapy</b>				
Dental practice	Always	Only comorbid patients	Never	No idea
Pulpitis	8.75% (28)	7.5% (24)	69.68% (223)	14.06% (45)
Dental abscess	80.93% (259)	9.37% (30)	0.31% (1)	9.37% (30)
Periodontitis	59.37% (190)	27.5% (88)	3.43% (11)	9.68% (31)
Pericoronitis	48.43% (155)	21.56% (69)	16.87% (54)	13.12% (42)

**Table 3.** Antibiotic prescriptions’ frequency.

Frequency of prescription	% (number)
Daily	10.94 % (35/320)
Weekly	58.75 % (188/320)
Monthly	19.38 % (62/320)
Annually	10.31 % (33/320)
Never	0.63 % (2/320)

were mostly used in oral surgery, tooth extractions, and implants. When prescribing for therapeutic purposes, the antibiotics were mostly used to treat dental abscesses and pericoronitis.

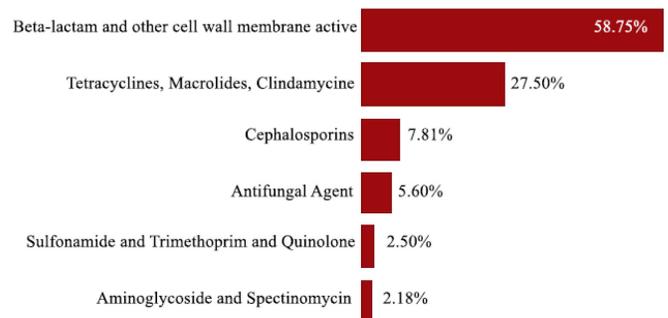
The prescription frequency for antibiotics is summarized in Table 3. Most dentists (58.8%) prescribed antibiotics weekly. This frequent prescribing may contribute to misuse and the development of AMR. Table 4 and Figure 1 summarize the type of antibiotics prescribed by the dentists.

The questionnaire included an open-ended question about antibiotics used in cases of known allergies. We observed that the most reported allergic reactions were to beta-lactams (e.g., penicillin). In such cases, the dentists preferred to use alternative classes of antibiotics. Specifically, 94% of the respondents (300 out of 320) opted for macrolides as an alternative.

**Table 4.** Type of antibiotics prescribed by dentists.

Antibiotics	% (number/total)
Beta-lactam and other cell wall membrane active	58.75% (188/320)
Tetracyclines, macrolides, clindamycine	27.5% (88/320)
Cephalosporins	7.81% (25/320)
Antifungal agent	5.6% (15/320)
Sulfonamide, trimethoprim, and quinolone	2.5% (8/320)
Aminoglycoside and spectinomycin	2.18% (7/320)

**Figure 1.** Types of antibiotics used by dentists.



**Table 5.** Open-ended questions from the online questionnaire.

Open questions	Results
<b>When you prescribe any antibiotics (for prophylaxis or treatment), are you referring to:</b>	
Protocols/guidelines	2.9% (9)
School knowledge	67.97% (208)
Experience	29.08% (89)
<b>Do you have any guideline/approved protocol for antibiotic use in dental practice?</b>	
Yes	0.65% (2)
No	99.35% (304)
<b>Do you prescribe antibiotics (if/when required) according to the evidence of cost-effectiveness? (this question is valid for no answers)</b>	
Always	3.92% (12)
Often	25.49% (78)
Occasionally	69.6% (213)
Never	0.98% (3)
<b>Do you know anything about antibiotic resistance?</b>	
Yes	98.69% (302)
No	1.3% (4)
<b>What is the main reason for antibiotic resistance according to your opinion?</b>	
Wrong diagnosis	7.19% (22)
Wrong doses	3.92% (12)
Wrong regimen	11.43% (35)
Overused antibiotics	77.45% (237)
<b>Do you think that known allergies contribute to antibiotic resistance?</b>	
Yes	45% (138)
No	55% (168)
<b>Are dentists—as part of the healthcare system that prescribe antibiotics in their daily practice—responsible for the rise of antibiotic resistance?</b>	
Yes	1.3% (4)
No	94.77% (290)
Don't know	3.92% (12)
<b>Where do you usually get the information about preventing antibiotic resistance?</b>	
Textbooks	61.76% (189)
Scientific journal	17.65% (54)
Guidelines	22.55% (69)
Internet	43.79% (134)
Colleagues’ communications	69.28% (212)
Pharmaceutical companies	58.17% (178)

### *Dentists' attitudes to antimicrobial resistance awareness (n = 306)*

This section was the most important part of our study, as it logically connected with the other elements of the questionnaire; and provided a comprehensive view of the participants in terms of awareness, including staff knowledge, attitudes, and behaviors concerning antibiotic resistance. The open-ended questions included in the survey are listed in Table 5. The participation rate for this section was high, with a substantial return rate of 93.9% (306 out of 326 forms completed).

### **Discussion**

Our study reports the knowledge and attitudes of the Albanian dentist community. This was a cross-sectional survey that assessed the nature of antibiotics prescriptions in everyday practice of dentists. The dentists provided their opinions on prophylaxis and treatment data. Although the main aim was to analyze aspects related to AMR, our survey retrieved some interesting and valuable data covering other aspects of dental practice.

In the first part of the survey, we found that there was a connection between antibiotic prescriptions and dentists' experience, their usual setting, and type of dental practice. In the second part we surveyed antibiotic use following available guidelines; although these are not used in dental practice. In the third part, we focused on AMR, which is a well-known side effect of inappropriate use of antibiotics by the dentists, but is not adequately evidence-based. We noted that both the information and the knowledge of the dentists had an impact on the attitudes.

There was a higher participation from female dentists. The antibiotic prescription rates showed that Albanian dentists did not usually prescribe antibiotics daily (only about 11% did); most of them prescribed these medicines weekly (about 59%), and about 19% prescribed them monthly. The number of those prescribing annually or never was low. Despite this, in terms of attitudes, we found a high number of our participants using antibiotics.

From a prophylactic perspective, antibiotics were most prescribed for oral surgery (65.63%) and implants (73.13%); however, antibiotics were not used as much for tooth extraction in everyday practice (16.86%). The frequency of antibiotic prescriptions was higher among dentists with more than 20 years of experience, which is in line with other studies that confirm that recent graduates generally score better than their colleagues for antibiotic prescribing [18]. Albanian dentists

reported an increased level of prescribing antibiotics for regenerative dentistry (39.38%). These types of therapies are relatively new, and are most likely used by younger dentists. Therefore, this may indicate a higher prescription frequency among dentists with fewer years of experience. Although experience and years of practice can play a role in antibiotic prescription attitudes, our findings reveal high-frequency antibiotic prescriptions in different age categories, indicating an important impact of dentists on AMR.

Use of antibiotics for prophylactic purposes in two common practices—oral surgery (65.63%) and implants (73.13%)—indicate overuse. Data from other dentists' communities in some European countries like Croatia, Italy, France, Spain; as well as Canada; suggest an increased trend in terms of the use of antibiotics for these treatments [19–23]. However, a shift in attitudes was observed among dentists in the UK and Australia, who had achieved a significant reduction in antibiotic prescriptions from 2014 to 2018 [24,25].

In the present survey, 57.5% of Albanian dentists reported administering antimicrobials for prophylactic reasons when performing tooth extractions in patients with comorbidities, whereas 16.9% of them still prescribed antibiotics for prevention in such procedures on healthy patients. This result supports the evidence from other studies of antibiotic overprescriptions in unnecessary situations, without following the recommended guidelines [16,26]. However, variations in antibiotic prophylaxis guidelines for dental treatments; in the UK, Europe, and the US; regarding the indications as well as prophylaxis regimens, may also contribute to this ambiguity [27]. In 2019, the American Dental Association (ADA) published updated clinical practice guidelines, which provide recommendations for the urgent management of symptomatic irreversible pulpitis, with or without symptomatic apical periodontitis, pulp necrosis with symptomatic apical periodontitis, or pulp necrosis with a localized acute apical abscess. These guidelines include the use of antibiotics, either alone or in combination with definitive conservative dental treatment (DCDT), for immunocompetent adults. The guidelines also include updated recommendations on antibiotic prophylaxis prior to dental procedures [28,29].

Another finding from our survey is that antibiotics were mostly used for the treatment of dental abscess (80.93%) and periodontitis (59.37%); followed by pericoronitis (48.43%), and pulpitis (8.75%). These findings are in line with other studies from Albania, Kosovo, Croatia, and Spain; where although the

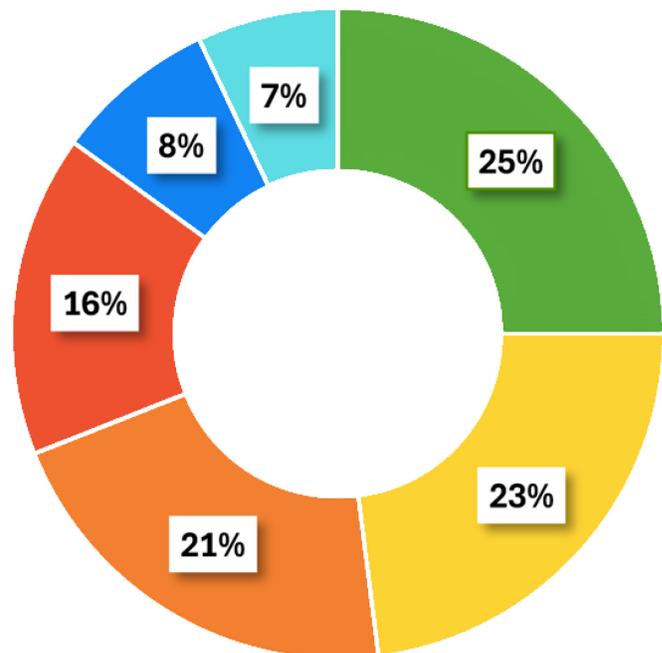
frequencies may differ (from 24.9% to 95.5%), dental abscess was the most common indication for therapeutic antibiotic prescription [16,30–32]. The findings vary from other studies [26] regarding antibiotic use in cases of pulpitis where 8.75% of Albanian dentists confirmed the use in healthy patients. However, in cases of endodontically involved teeth, dentists should practice responsible antibiotic use. ADA's ACE Panel Report recommendations on antibiotic use for endodontic infections, specify that infections should be managed primarily through effective root canal debridement, disinfection, and abscess drainage. The report advises against the use of systemic antibiotics, as they are ineffective in reaching necrotic tissue and contribute to issues such as antibiotic resistance [33]. However, the guidelines note that appropriate antibiotics may be prescribed at the right dose and for the right duration, when needed [7,8,34].

The attitudes of Albanian dentists toward AMR reveal some important issues that are worth discussing. Most of the participants (67.97%) reported that they referred only to school knowledge when prescribing antibiotics, 29.08% prescribed based on their experience, and only a small percentage of dentists (2.9%) referred to guidelines. In addition, the lack of practical evidence-based guidelines about the use of antibiotics for dental practice, as referred by almost all the dentists (99.35%), is a concerning finding which we believe to be one of the main reasons linked to the inappropriate antibiotic prescription. It appeared, from the survey responses, that our community of dentists operated based on colleagues' communications, conferences or workshops organized by pharmaceutical companies, and internet information from medical websites (Figure 2). Considering the diverse responses (Table 5), we emphasize that relevant antibiotic prescribing guidelines should be the primary sources consulted for information on AMR and recommendations for antibiotic use. Increasing awareness about AMR among Albanian dentists, through awareness programs and educational courses is crucial, since AMR is recognized as a significant worldwide public health issue. Dentists are an important antibiotic-prescribing community, and must be aware of, and understand the importance of following the current guidelines to minimize AMR [25].

Among the survey respondents, 98.7% responded as being aware of AMR, but the majority did not accept being responsible for the increase in AMR (94.8%). Based on the survey responses, the most common

factors related to AMR were antibiotic overuse (77.45%), wrong regimen given (11.4%), wrong diagnosis (7.2%), and wrong doses (3.9%). The overuse and misuse of antibiotics in dentistry is a common finding with other studies. For example, a study reported that in Italy where various types of antibiotics and prophylactic regimens were administered without any evidence-based support, prescription of systemic antibiotic prophylaxis (AP) was made without an indication, and evidence-based recommendations on AP provided by guidelines were not consistently followed by general dentists [12]. A study in Spain reported that half of all dentists surveyed displayed inappropriate antibiotic prescribing habits in more than 28.6% of the clinical situations studied. In addition, work experience of more than 30 years increased the risk of inappropriate prescribing. Furthermore, fear and economic benefit also seemed to exert a negative influence on prescribing quality in dentistry [35]. In India, where patient compliance played a major role in effective treatment, affordability of the brand was considered the main factor while prescribing a particular brand, and 35% of the respondents prescribed antibiotics even before the start of the treatment [36]. There are many factors that prescribers of antibiotics should consider before initiating any treatment; including, comorbidities, regimen treatment for

**Figure 2.** Dentists' source of information about antibiotic resistance.



Green: colleagues' communications; yellow: textbooks; orange: pharmaceutical companies; red: internet; blue: guidelines; light blue: scientific journals.

possible drug-to-drug interactions, ratio of benefit/risk of treatment, oral health status of patients, and treatments used in the past. In addition, patients who are prescribed antibiotics should be monitored for the entire course of treatment.

Beta-lactams and other cell wall membrane active antibiotics are the most prescribed by the Albanian dentists' community (58.75%), followed by macrolides, clindamycin, and tetracyclines (doxycycline) (27.5%). Several studies have shown that amoxicillin and phenoxymethylpenicillin are the first-choice therapeutic antibiotics in patients without a penicillin allergy [37–39]. In cases when patients are allergic to beta-lactams it is important to know the alternative treatment. In the case of Albanian dentists, the preferred options in such cases were azithromycin or spiramycin + metronidazole (27.5%). These results are comparable with those of other studies. Among the dentists in Kolkata, the first choice of antibiotic in patients with penicillin allergy was erythromycin (53%), followed by azithromycin (22%) and clindamycin (19%) [36]. Macrolides were the choice of 52.9% of Italian oral implant surgeons [26], whereas among Spanish dentists attending specialization programs in endodontics, the majority (72%) preferred clindamycin and 28% preferred azithromycin [32]. Clindamycin was the drug of choice for patients with penicillin allergy (59%) among the dentists' community in Turkey [40].

A common conclusion of a multitude of studies around the world is that dentists prescribe antibiotics inappropriately. Since they are the second largest community of antibiotic prescribers, it is mandatory to raise awareness, improve their knowledge through education and research, optimize the use of antibiotics, and follow relevant guidelines; in addition to strengthening surveillance, to reduce AMR [41].

#### *Study limitations*

The present study has some limitations. The questionnaire was self-administered; and the response to the open questions may have been affected if they were misinterpreted by the dentists. The survey was filled out by dentists who participated voluntarily; therefore, the sample may not represent the entire community, considering the number of dentists that practice in Albania. However, this study can help create a clearer view of antibiotic use and misuse among Albanian dentists.

#### **Conclusions**

Our study highlights some significant patterns and practices concerning antibiotic use among Albanian

dentists. The high frequency of antibiotic prescriptions, particularly for prophylactic purposes in oral surgery and implants, indicated a tendency towards overuse, which is consistent with trends also observed in other countries. Although most dentists were aware of AMR, their responses indicated a lack of adherence to evidence-based protocols. The prevalent use of beta-lactams and macrolides among Albanian dentists, suggests a need for updated guidelines and specific training.

Thus, there is an immediate need for more robust education on antimicrobial stewardship and the development of comprehensive, practice-specific guidelines. Enhancing the current education curriculum and integrating AMR into dental training programs will be crucial in promoting responsible antibiotic use and mitigating the risks associated with antibiotic overuse and misuse. This approach will contribute to better patient outcomes and support global efforts to combat antimicrobial resistance.

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#### **Conflict of interests**

No conflict of interests is declared.

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