



SHORT COMMUNICATION

## Errors in Antibiotic Therapy: Study with Dentist's Prescriptions in a Large Brazilian City

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### Abstract

**Objective:** To evaluate errors in dental prescriptions of antibiotics for therapeutic purpose. **Material and Methods:** This was a descriptive study using a random and calculated sample of 366 prescriptions (July 1 2011 to June 30 2012), from a total of 31 105 dental prescriptions, was surveyed in an important drugstore chain in a large Brazilian city. Data was validated by double entry in Epi-data (EpiData Assoc, Odense M, Denmark) and then analysed in SPSS (version 19.0, Chicago, IL, USA). Statistical analyses included the calculation of proportions with a 95% confidence interval (CI). **Results:** We identified 272 prescriptions for therapeutic purpose. Prescription errors involved spelling of the antibiotic name, dose, dosing intervals and duration of treatment. A total of 116 prescriptions (42.6%; 95% CI 36.9%-48.6%) were considered to be totally correct with regard to the generic name, dose, dosing interval and duration of the antibiotic therapy. Most of the antibiotics prescribed by dentists showed errors related to the name, dose, intervals and duration of treatment. **Conclusion:** These errors may compromise the effectiveness of drug therapy, contribute to microbial resistance and increase the risk of adverse events and costs of treatment.

**Keywords:** Antibiotics; Medication Errors; Dentistry.

## Introduction

Dentists can prescribe antibiotics for the treatment of both odontogenic and non-odontogenic infections, including many cases with no established indications [1]. This practice could be related to the emergence of bacterial resistance, expanded duration of the disease and increased risk of adverse drug events and treatment costs [2]. In an attempt to reduce bacterial resistance and to contribute for the rational use of antibiotics, a Brazilian legislation regulating the prescription and sale of antibiotics was approved in 2011 [3]. However, a recent study highlighted that prescriptions for antibiotic prophylaxis in dentistry were mostly inadequate in a large Brazilian city and have legal problems too [4,5]. The quality of dental prescriptions for antibiotic therapy in Brazil has not yet been explored.

Studies conducted in the United Kingdom found discrepancies between prescriptions involving antibiotics in dentistry and recommendations provided by clinical guidelines [6,7]. In the study performed in 568 patients, most antibiotics prescribed in general dental practice involved cases without evidence of spreading infection and only 19% of antibiotics were prescribed as recommended by guidelines [7]. A comprehensive understanding of the patterns underlying the prescription of antibiotics by health professionals may enable the development of actions to promote the rational use of these drugs and reduce the consequences of inappropriate use. In this study, we aimed at evaluating errors in dental prescriptions of antibiotics for therapeutic purpose.

## Material and Methods

### Study Design

This was a descriptive study using a calculated and random sample of dental prescriptions received during one year at the largest drugstore chain in Belo Horizonte, Brazil. A calculated sample was randomly selected from the 31,105 dental prescriptions of antibiotics filed in from July 1st, 2011 to June 30, 2012 in all stores (120) of the drugstore of the study. The sample size calculation was performed using an estimated proportion of dental prescriptions errors equal to 50%. The level of precision was 5% and the level of confidence was 95%. Initially 434 prescriptions were selected, but those prescriptions involving the same patient or made by the same dentist were excluded in order to allow independent observations, resulting in 366 prescriptions. The level of precision was recalculated as 5.09% [8].

In this study, therapeutic use was characterized by the description in the dental prescription of the administration of antibiotics after an intervention. Determining the prescription errors in decision making [9] involved the analysis of the following variables: antibiotic name according to the generic name indicated by the Brazilian Common Denomination (BCD), i.e., writing 'amoxilin' instead of 'amoxicillin', dose, dosing intervals and treatment duration. These variables were selected according to the current legislation and to information available on Micromedex [3,10]. Due to variations encountered in the literature for the duration of antibiotic therapy, we have considered

duration as correct if it lasted from three to five days for azithromycin [10] and from five to 10 days for the other antibiotics [10,11].

### Statistical Analysis

The analysis was performed by a single researcher trained for this study (Cohen Kappa >0.6). Data was validated by double entry in Epi-data (EpiData Assoc, Odense M, Denmark) and then analysed in SPSS (version 19.0, Chicago, IL, USA). Statistical analyses included the calculation of proportions with a 95% confidence interval (CI).

### Ethical Aspects

This study was approved by the Ethics Committee for Human Research of the Federal University of Minas Gerais (CAAE 04645812.9.0000.5149).

### Results

Antibiotics were prescribed for therapeutic purpose in 272 dental prescriptions analyzed. It was not possible to identify the name of the antibiotic prescribed in three prescriptions. Amoxicillin (n = 181; 66.5% 95% CI 60.7%-71.9%) was the most frequently prescribed antibiotic. The generic name was incorrectly spelled in 29.0% of prescriptions. Errors in dose, interval and duration of use were found in 10.7%, 23.5% and 29.8% of the studied prescriptions, respectively (Table 1). Four prescriptions indicated the use of amoxicillin for less than five days (two and three days), and three prescriptions for more than 10 days, including amoxicillin, ciprofloxacin and nitrofurantoin individually. There was one prescription of azithromycin to be used for six days. Overall, 71 prescriptions did not mention the duration of treatment. A total of 116 prescriptions (42.6%; 95% CI 36.9%-48.6%) were considered to be completely correct regarding generic name, dose, dosing interval and duration of antibiotic therapy (Table 1).

**Table 1. Frequency of errors in dental prescriptions for antibiotic therapy among Brazilian dentists, 2011-2012.**

Variables	Prescription Error (%)	% (CI 95%)
Drug Name	29.0	24.0-34.7
Duration of Use*	29.8	24.7-35.5
Dose**	10.7	7.5-14.9
Dosing Interval***	23.5	18.9-28.9

\*Three with short duration, seven with long duration and 71 without information; \*\*Five with underdose, six with overdose and 18 without information; \*\*\*Twelve with intervals superior and eight with intervals inferior to those recommended by guidelines, and 42 without information.

### Discussion

Our results revealed that most prescriptions had at least one of the studied errors, which was deemed to be quite problematic. Our findings were consistent with previous studies discussing the occurrence of errors in dose, intervals and duration of antibiotic therapy in dental prescriptions [6,7].

The prescription of overdoses of antibiotics increases the risk of adverse effects, whereas insufficient doses compromise the achievement of expected therapeutic effect [12]. Our study showed that nearly a quarter of the prescribers made a mistake when defining dosing intervals. Administration intervals superior to those recommended by the guidelines or indicated by the manufacturer may imply therapeutic failure, whereas shorter intervals may induce adverse effects.

These effects can be exemplified by allergic reactions, diarrhea, and even by severe effects such as cardiac arrhythmias, cholestatic hepatitis and pseudomembranous colitis [10,12]. Errors in the duration of treatment involved the use of antibiotics for fewer than five days or more than 10 days in most cases [1,13]. Not only incorrect dose but also inappropriate duration of antibiotic therapy are strongly related to the development of bacterial resistance [14,15]. Antibiotics used for a shorter period of time may reduce the chance of healing, whereas more prolonged use (10 days or more) may destroy the microbiota and eliminate the natural resistance to colonization by pathogenic bacteria [1,12]. Upon analyzing 17,007 dental prescriptions of antibiotics, authors found that beyond the inconsistencies in dose and intervals, errors in duration involved prolonged course of antibiotics [6].

The improvement of the quality of dental prescriptions seems to be complex and to require more actions than only modifications in antibiotic regulations. Clear guidelines and constant educational initiatives focused on undergraduates and professionals should be encouraged. The frequency of absent information on dose, intervals and duration of antibiotic therapy in this study is worrisome. In these cases, the responsibility for defining the correct antibiotic or dose to be dispensed seems to lie on pharmacists or patients' previous experience. This may also delay the acquisition of the antibiotic because consumers need to seek for prescribers to obtain additional information. Dispensing would be a critical step to detect prescribing errors and to perform actions to prevent patients from clinical consequences of adverse drug events [15]. Pharmacists may offer substantial contributions for the rational use of antibiotics by providing appropriate interventions. These should be focused on the interaction with dentists and education of patients regarding the correct use of drugs. Other aspects could also be considered such as monitoring significant pharmacological interactions, lack of adherence and occurrence of adverse effects [16].

Some limitations of the present study should be highlighted. The correlation between the prescription of antibiotic therapy and the patients' clinical conditions could not be determined, since our sample involved prescriptions collected in a drugstore. Moreover, this study was performed in a drugstore chain of a single city, although it is the largest chain located in a large Brazilian city.

To date, after the implementation of the Brazilian legislation on the prescription and sale of antibiotics, this was a relevant study to apply adequate methodological precision to investigate errors in antibiotic therapy in dentistry. Further studies on this topic are needed to explore the factors underlying errors in dental prescriptions and to investigate effective interventions to improve the quality of antibiotic prescribing by dentists.

## Conclusion

The analysis of prescription errors of antibiotics for therapeutic purpose by dentists showed errors in the dose, dosing interval and duration of treatment and drug name. These errors may compromise the effectiveness and safety of drug therapy.

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