



Online search interest in the use of antibiotics for dental pain: an infodemiology study

Interesse em pesquisas online sobre o uso de antibióticos para dor dentária: um estudo infodemiológico

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ABSTRACT

Objective: The objective of this study was to evaluate the online search interest pertaining to queries regarding antibiotics for dental pain. **Material and Methods:** Google Trends™ was used to identify the online search interest. Previously, a literature search was performed on the most frequently used antibiotics in dentistry in Brazil. Accordingly, the search terms used were Amoxicillin (AM), Clindamycin (CD), Azithromycin (AZ) and Metronidazole (MD), with the phrase “for toothache” in Portuguese and English. A time-series covered the last 240 weeks (from 2015 to 2020), and the results of each term were compared to their respective annual value. Geographic regions were also evaluated. To obtain a relative search volume (RSV), the resulting Google Trends™ numbers were then scaled to a range from 0 to 100 based on the ratio of searches on a topic to searches across all topics. **Results:** We observed an upward trend in all antibiotics search terms over the 5 years analyzed, with a peak of greater interest in 2019. The antibiotic of most interest related to toothache was ‘AM’, followed by ‘AZ’, ‘MD’, and ‘CD’. The annual RSV of toothache searches rose steadily from 2015 to 2020. Variations were observed between Brazilian geographic regions, and the Northeast region presented with the greatest interest in the topic. **Conclusion:** Although there were variations in annual and regional trends, an expressive and persistent increase in collective interest regarding the use of antibiotics related to toothache, mainly amoxicillin, was observed. Our findings provide insights for public health promotion programs.

KEYWORDS

Antibiotics; Internet; Community pharmacies; Oral health; Public health.

RESUMO

Objetivo: O objetivo deste estudo foi avaliar o interesse da pesquisa online em consultas sobre antibióticos para dor de dente. **Material e métodos:** o Google Trends™ foi usado para identificar o interesse de pesquisa online. Anteriormente, foi realizada uma pesquisa bibliográfica sobre os antibióticos mais utilizados em odontologia no Brasil. A partir daí, os termos de busca utilizados foram Amoxicilina (AM), Clindamicina (CD), Aзитromicina (AZ) e Metronidazol (MD) com os termos “para dor de dente” em português e inglês. Uma série histórica abrangeu as últimas 240 semanas (abril de 2015 a abril de 2020), e os resultados de cada período foram comparados com seus respectivos valores anuais. Regiões geográficas também foram avaliadas. Os números resultantes do Google Trends™ são dimensionados para um intervalo de 0 a 100 com base na proporção de um tópico para todas as pesquisas em todos os tópicos de busca. Isso é chamado de volume relativo de pesquisa (RSV). **Resultados:** Foi observada uma tendência crescente para todos os termos de antibióticos ao longo dos 5 anos analisados, com

um pico de maior interesse em 2019. O antibiótico de maior interesse na dor de dente foi 'AM', seguido por 'AZ', 'MD' e 'CD'. O RSV anual das buscas de dor de dente cresceu continuamente de 2015 a 2020. Variações foram observadas entre as regiões geográficas brasileiras, sendo que a Região Nordeste apresentou o maior interesse pelo tema. **Conclusão:** Embora tenha havido variação nas tendências anuais e regionais, observou-se um aumento expressivo e persistente do interesse coletivo pelo uso de antibióticos relacionados à dor de dente, principalmente a amoxicilina. Nossas descobertas fornecem *insights* para programas de promoção pública.

PALAVRAS-CHAVE

Antibacterianos; Acesso à Internet; Saúde bucal; Medicamentos para a Atenção Básica, Saúde Pública.

INTRODUCTION

Dental pain, a common symptom that prompts patients to seek dental care, has an important impact on public health [1,2]. It has been strongly associated with loss of productivity and has a negative impact on social life, leading to undesirable consequences that affect sensory and emotional responses as well as conceptual and motivational aspects [2]. Dental caries is considered the main cause of dental pain [3,4]. Untreated dental caries in its early stages can progress to endodontic infection. In most cases, this situation can be resolved with conventional measures such as operative procedures, but in several instances, antibiotics and/or analgesics are prescribed as complementary therapies to conventional endodontic treatment [5,6]. Broad-spectrum antibiotics are the primary agents used to treat oral infections because endodontic infections are often polymicrobial, with an association between gram-positive and gram-negative facultative and/or anaerobic bacteria [7-9]. Antibiotic treatment is also prescribed for conditions such as oral lesions, bacterial infections, and complex postoperative extractions. Moreover, antibiotic treatment is indicated as an adjunctive treatment for acute cases of such conditions [10,11].

Dentists prescribe approximately 10% of the antibiotics dispensed in primary care [12]. According to the literature, amoxicillin (AM), azithromycin (AZ), clindamycin (CD), and metronidazole (MD) are the most commonly used antibiotics in dentistry [13,14]. In dentistry, antibiotics are prescribed as an empirical treatment because their use is based on clinical, bacteriological, and epidemiological factors. This may lead to the use of a very small range of broad-spectrum antibiotics. Inappropriate prescription and excessive use of antibiotics are associated with negative consequences such as antibiotic resistance, microbial ecosystem

disturbance [15], increased risk of potentially fatal anaphylactic reactions, and exposure to unnecessary side effects [16]. In Brazil, self-medication is considered a relatively frequent practice observed in 16.1% of the total population.

Although self-medication mostly involves the use of over-the-counter drugs, it is associated with health risks. In terms of medical utilization, antibiotics are usually prescribed as an over-the-counter medicine in Brazil and other Latin American countries, although national regulatory standards prohibit this practice [17]. In contrast self-medication with over-the-counter antibiotics has been reported in approximately one in 16 older adults in the United States [16].

In recent years, the use of infodemiology (web-based data on public health issues) has helped evaluate various features of online human behavior, especially regarding health issues. Google Trends™ (GT) is a free tool that tracks the frequency of terms searched over time worldwide on the Google platform [18]. GT has been used to evaluate health research and tendencies in different areas [10-24]. Therefore, the main objective of this study was to evaluate online search interest in the use of antibiotics to treat dental pain using Google searches in Brazil over 5 years.

MATERIALS & METHODS

Google trends

GT database was used to analyze a sample of Google™ searches over time and by geographical location. When specific terms are searched, this tool provides graphs based on Google data sampling. GT normalizes the search data to facilitate comparisons between the terms. The searches performed are divided by the total geographic searches and the time period to compare relative search popularity, such that regions that perform a larger number of

searches do not always rank higher and different regions with the same search interest do not always have the same total volume of searches. The resulting numbers are then scaled to a range of 0–100 based on the ratio of searches on a topic to searches across all topics. This is known as relative search volume (RSV) [18].

The data exhibited as RSV refers to the ratio between the specific issue and the total number of Google inquiries. For generated graphs of interest over time, the numbers represent the search interest relative to the highest point in the chart, and a value of 100 represents the peak popularity of a term. For graphs generated by subregion interest, the values are calculated on a scale of 0–100, where 100 is the most popular location as a fraction of the total searches in that location [18].

Search strategy

The GT tool was used to explore internet searches related to the use of antibiotics frequently prescribed in dentistry. According to the literature, the most commonly used prescribed antibiotics in dentistry are “AM,” “AZ,” “CD,” and “MD” [13,14]. The search was performed using the Portuguese and English terms for these medicines along with the phrase “for toothache.” The selected categories were “health” and “web searches,” and “Brazil” was selected as the region of interest. The incidence of the search terms was described according to the five regions of Brazil: north, northeast, midwest, southeast, and south. This study focused on evaluating online search interest in the use of antibiotics to treat dental pain in Brazil over the last 5 years (2015-2020).

This study was performed in accordance with the standard ethical guidelines, and approval from the Research Ethics Committee was not needed as only public domain data were used.

RESULTS

The results of the analysis of online interest in the use of antibiotics to treat dental pain in Brazil from 2015 to 2020 are presented in Figure 1. Overall, there was an increase in the number of searches for the term “antibiotics to treat dental pain” on the internet during the study period. AM had the highest RSV, followed by AZ, CD, and MD.

There was a substantial increase in the number of searches for the term “AM” with the phrase “for toothache” from 2015 to 2020. The interest in AM was 2.88 times higher in 2020 than in 2015 (from 709 to 2,044 RSV). When analyzing the trends for the other antibiotics used in treating toothache, there was an increase in the number of searches for AZ, mainly in 2019 and 2020, and for CD, particularly in 2017. MD has received mild attention in recent years, mainly in 2018, 2019, and 2020.

The number of searches for the term “toothache” showed a significant increase over the last 5 years (Figure 2). The top five searches related to dental pain were “for toothache,” “medicine of toothache,” “medicine toothache,” “medicine for toothache,” and “toothache medicine” (Table I).

The regions that performed the most searches were northeast, north, midwest, southeast, and south (Table II).

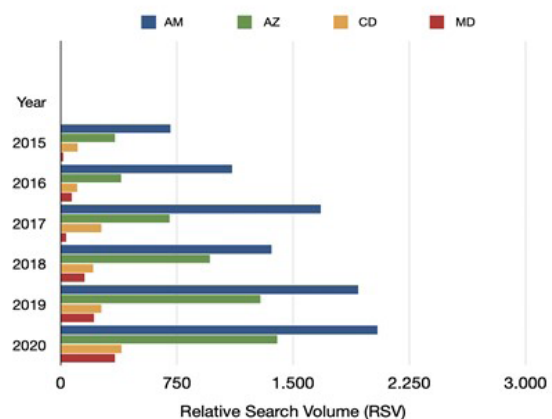


Figure 1 - Comparisons of the online search terms amoxicillin (AM), azithromycin (AZ), metronidazole (MD), and clindamycin (CD) with the term “for toothache” according to their RSV from 2015 to 2020.

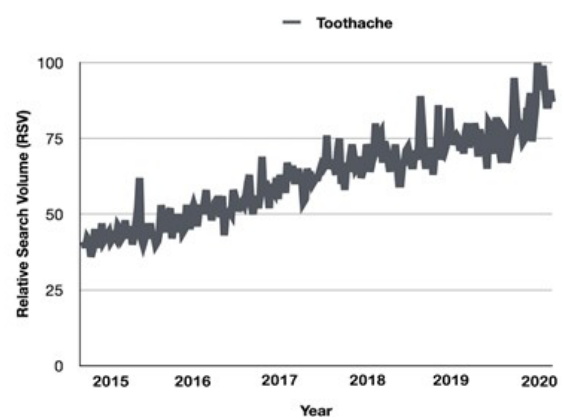


Figure 2 - RSV trend for the past 5 years in Brazil according to toothache.

Table I - List of terms found in related searches when searching for toothache

Ranking	Terms (English/Portuguese)	RSV
1	"For toothache" "Para dor de dente"	100
2	"Medicine of toothache" "Remédio de dor dente"	56
3	"Medicine toothache" "Remédio dor de dente"	55
4	"Medicine for toothache" "Remédio para dor de dente"	43
5	"Toothache medicine" "Dor de dente remédio"	19

Abbreviation: RSV, relative search volume.

Table II. Searches related to antibiotics for toothache and their respective RSV for each region in Brazil (2015-2020)

Geographic regions	AM	AZ	CD	MD
North				
Acre	96	90	90	100
Roraima	76	77	67	84
Amazonas	91	70	92	78
Amapá	100	100	38	93
Rondônia	78	59	76	70
Pará	75	74	65	65
Tocantins	70	53	97	71
Total	586	523	525	561
Northeast				
Alagoas	78	59	72	56
Bahia	81	48	76	63
Sergipe	83	50	69	53
Paraíba	68	49	84	57
Pernambuco	74	52	78	58
Ceará	70	58	66	57
Rio Grande do Norte	68	45	56	46
Maranhão	67	74	63	74
Piauí	67	60	88	70
Total	656	495	652	534
Southeast				
Rio de Janeiro	76	53	70	47
Minas Gerais	72	42	65	46
São Paulo	67	40	86	41
Espírito Santo	67	48	61	44
Total	282	183	282	178
Midwest				
Mato Grosso do Sul	67	47	83	58
Goiás	72	48	81	52
Distrito Federal	66	42	100	48
Mato Grosso	67	51	75	53
Total	272	188	339	211
South				
Rio Grande do Sul	69	41	77	45
Santa Catarina	63	42	62	43
Paraná	62	38	62	42
Total	194	121	201	130

Abbreviations: Relative search volume (RSV), amoxicillin (AM), azithromycin (AZ), clindamycin (CD) and metronidazole (MD).

DISCUSSION

This survey was conducted using GT, an online search tool that provides information pertaining to search trends on the Google platform. The main objective of this study was to analyze the public search interest in using antibiotics for toothache. There was an increasing interest in the search for antibiotics to treat dental pain by the Brazilian population, with AM being the most searched antibiotic. Moreover, the present exploratory analysis showed that the demand for antibiotics depended on the geographical location and the year of analysis. Although some studies used GT to analyze internet searches related to medicine use [24-27], to the best of our knowledge, no studies have investigated the interest in different antibiotics to treat dental pain in the Brazilian population.

The interest in antibiotics and dental pain may be explained by self-medication, a common form of self-care worldwide [24]. This behavior is frequently observed in Brazil, with a prevalence of 16.1% [18,21]. However, self-medication presents a challenge in cases where antibiotics can only be dispensed with a prescription [28,29]. Moreover, with a prescription, patients are fully instructed on how to use the medicine. In addition, there are several campaigns across the country that propose abolishing self-medication practices.

Online searches for antibiotic use have increased [30,31], and a greater number of patients may be using antibiotics without prescription; therefore, such patients may lack adequate guidance from physicians, dentists, and pharmacists on their proper use [31,32]. In dentistry, most diseases can be treated with clinical intervention by dentists, and only a few cases require an antibiotic prescription [33]. Therefore, the search for antibiotics for treating “toothache” has even more contradictions than those previously mentioned.

Regarding the search results for each antibiotic, AM was the most searched antibiotic in the country. According to the literature, AM is the primary choice among dentists to treat dental infections in Brazil. This finding is different from that reported in prior international studies [13,34]. CD was the least searched antibiotic, possibly owing to the higher incidence of gastrointestinal effects than with other antibiotics, although it is effective and included

in the list of medicines offered for free by the Brazilian Unified Health System [3,35].

According to our data, most searches were performed in the northeastern and northern regions of Brazil. In previous studies, these regions were associated with higher rates of self-medication [17,36]. The coverage of primary health care and oral health has significantly increased in the north and northeast regions in recent years [37]. However, a large segment of the population lives in rural areas, where access to urban centers is difficult. Moreover, most health professionals are concentrated in these regions, and the precarious health structures could explain the results of our study [37-39].

This study has some limitations. GT does not allow the identification of the user profile (age, sex, and education) and the specific reason for the search (self-medication or study purposes). Therefore, the results obtained should be interpreted with caution. GT considers only a part of the community with internet access. However, our findings can be used as an initial exploratory analysis of data to develop and implement strategies to control the self-medication of antibiotics and professional prescription patterns.

CONCLUSION

We observed an increasing interest in the use of antibiotics to treat dental pain over the last 5 years among Brazilian Google users, regardless of geographical location. Oral health-related campaigns against the indiscriminate use of medicines may benefit the Brazilian population.

Authors' Contributions

MRG: Conceptualization; formal analysis; visualization; writing original draft preparation; read and agreed to the published version of the manuscript. FVB: Conceptualization; formal analysis; visualization; editing original draft; read and agreed to the published version of the manuscript. CBA: Formal analysis; methodology— review and editing writing original draft preparation; read and agreed to the published version of the manuscript. TF: Visualization; editing original draft; read and agreed to the published version of the manuscript. VCC5: Visualization; editing original draft; read and agreed to the published version of the manuscript.

Conflict of Interest

The authors have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this manuscript.

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Regulatory Statement

No approval requests to the Research Ethics Committee were needed as only secondary and public domain data were used.

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