

UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

VERIDIANA LOPES RIZZATO

**Isolamento social durante a pandemia de COVID-19
intensificou o interesse por informações relacionadas a
dor de dente**

BAURU
2021

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Dissertação apresentada à Faculdade de Odontologia de Bauru da Universidade de São Paulo para obtenção do título de Mestre em Ciências no Programa de Ciências Odontológicas Aplicadas, na área de concentração Odontopediatria.

Orientador: Prof. Dr. Thiago Cruvinel

BAURU
2021

Rizzato, Veridiana Lopes

Isolamento social durante a pandemia de COVID-19 intensificou o interesse por informações relacionadas a dor de dente / Veridiana Lopes Rizzato. -- Bauru, 2021.

55 p. : il. ; 31 cm.

Dissertação (mestrado) -- Faculdade de Odontologia de Bauru, Universidade de São Paulo, 2021.

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ERRATA

FOLHA DE APROVAÇÃO

DEDICATÓRIA

Dedico este trabalho a minha mãe, Ana Maria Lopes Rizzato (em memória), meu pai, Norberto Rizzato, minhas irmãs, Carolina Oliveira Rizzato e Taís Lopes Rizzato, e a minha tia Maria Célia Lopes (em memória).

AGRADECIMENTOS

À **Faculdade de Odontologia de Bauru, Universidade de São Paulo**, na pessoa de seu Diretor, Prof. Dr. Carlos Ferreira dos Santos.

Ao **Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)**, pela concessão da bolsa de mestrado (processo 133232/2019-0). Esse auxílio financeiro foi o que permitiu minha dedicação integral à pesquisa e às atividades da pós-graduação, bem como a manutenção da minha estadia na cidade de Bauru.

Ao **Departamento de Odontopediatria** da FOB-USP e todos os seus professores, funcionários e demais colegas de pós-graduação.

A todos os **professores, colegas e funcionários da FOB** que, direta ou indiretamente, contribuíram para o aprendizado e para as vivências que tive nesses 2 anos.

Ao colega de pesquisa, **Matheus**, agradeço muito por todo auxílio, contribuição e disponibilidade desde o início até o final dessa pesquisa.

À **Anna Paola e Estef**, pelas conversas e desabafos, por estarem presentes e sempre dispostas me ajudar. Muito obrigada!

Ao **Prof. Dr. Thiago Cruvinel**, pelas oportunidades de aprendizado, por todos os ensinamentos, por estar sempre disponível para me auxiliar e me orientar durante todo esse processo. Também agradeço imensamente pela compreensão, paciência, gentileza e respeito com que o senhor sempre me tratou, principalmente diante dos momentos difíceis e problemas pessoais que tive ao longo do mestrado. Muito obrigada mesmo, professor!

À **Daniela**, por, desde a minha graduação até depois que mudei a área de pesquisa no mestrado, estar sempre comigo. Dani, muito obrigada, por tudo! Obrigada por sempre me ensinar, apoiar e ajudar. Agradeço também pela disposição e

paciência, pelas conversas sinceras e desabafos. Eu te admiro muito, por sua dedicação, competência e, principalmente, pela pessoa maravilhosa que você é. Que Deus te abençoe sempre, Dani!

À **Aline (Hashi), Matheus (Zuca) e Isabela (Pit)**, por todos os momentos e por estarem ao meu lado desde a graduação. Sem vocês, eu não teria conseguido. Pit, como eu sempre digo, se não fosse por você eu nem teria passado no mestrado. Obrigada por toda ajuda com as correrias da pós-graduação, pelas histórias e risadas. Hashi, obrigada por não desistir na minha amizade, por todos os momentos, pelos convites, por entender e sempre estar disposta a me ajudar com o que for. Zuca, muito obrigada, amigo! Obrigada por me ouvir sempre, obrigada pelos conselhos, “chorinhos” no shopping, desabafos, risadas e por dividir comigo os mesmos sufocos.

À minha **tia Célia** (em memória) por sempre ter cuidado de mim, da Taís e da Carola, principalmente depois que minha mãe não estava mais aqui. Apesar do meu jeito “marrento”, como você dizia, eu sempre soube que podia contar com você, com seu apoio, para qualquer coisa que eu precisasse. Obrigada por ter vindo e ter ficado com a gente na minha formatura, ver seu carinho e seu orgulho por mim significou muito. Obrigada por se preocupar comigo, pelo “carinho sincero” e puxões de orelha, por sempre tentar se aproximar e cuidar de mim. Eu te amo, tia!

Ao meu **pai, Norberto**, por me ajudar tanto até hoje. Pai, você já passou por tantas coisas difíceis e, mesmo que cansado, ainda continua de pé, continua a me ajudar. Espero conseguir te dar orgulho e retribuir tudo isso. Obrigada por tudo o que fez e ainda faz por mim, por ser meu exemplo de fé, paciência, honestidade, humildade e perdão. Se estou aqui é porque você me ajudou a tornar isso possível. Obrigada! Eu te amo muito! Que Deus te abençoe sempre, pai!

À minha **mãe, Ana Maria** (em memória), por ter feito tanto por mim! Mãe, dói tanto não ter você aqui. Como sinto sua falta! Eu te amo tanto, tanto! Obrigada por tudo o que você me ensinou, por tudo o que fez por mim, pelo exemplo que você foi e sempre será para mim. Obrigada por me ensinar a ser corajosa, a lutar e buscar independência. Se consegui chegar até aqui foi graças a sua força gigante, ao seu

amor e a todos os sacrifícios que você fez por mim por tanto tempo. Obrigada! Espero conseguir te deixar orgulhosa de mim. Te amo demais! Até logo.

À minha irmã **Carola**, por ter escolhido me ajudar e tornar tudo isso possível. Obrigada por tudo o que você faz por mim todos os dias, Carola! Eu te admiro demais por sua força, coragem, competência e determinação. Tenho muito orgulho de você! Espero que Deus te abençoe sempre e que você possa realizar todos os sonhos. Eu te amo muito e vou grata para sempre!

À minha irmã **Taís**, por me ouvir, entender e ajudar sempre que possível. Eu te amo tanto e tenho tanto orgulho da pessoa que você é, do quanto você é forte e corajosa todos os dias. Espero que um dia você consiga se ver como eu te vejo, que Deus te abençoe e que você ainda seja muito, muito feliz. Eu te amo demais e sempre estarei aqui, por você!

A **Deus**, por todas as oportunidades e privilégios que tive, pela minha família e amigos. Senhor, obrigada por sempre estar ao meu lado e vir em meu auxílio, mesmo quando eu não consigo enxergar, mesmo quando a dor é tanta que chego a questionar Sua presença e Seu propósito para minha vida. Obrigada por tudo, meu Deus, por me dar força e me ajudar a continuar.

“Should've stayed, were there signs, I ignored?
Can I help you, not to hurt, anymore?
We saw brilliance, when the world, was asleep
There are things that we can have, but can't keep

*If they say
Who cares if one more light goes out?
In the sky of a million stars
It flickers, flickers
Who cares when someone's time runs out?
If a moment is all we are
Or quicker, quicker
Who cares if one more light goes out?
Well I do*

**The reminders, pull the floor from your feet
In the kitchen, one more chair than you need, oh
And you're angry, and you should be, it's not fair
Just 'cause you can't see it, doesn't mean it, isn't there**

*If they say
Who cares if one more light goes out?
In the sky of a million stars
It flickers, flickers
Who cares when someone's time runs out?
If a moment is all we are
Or quicker, quicker
Who cares if one more light goes out?
Well I do*

(I do)

*Who cares if one more light goes out?
In the sky of a million stars
It flickers, flickers
Who cares when someone's time runs out?
If a moment is all we are
Or quicker, quicker
Who cares if one more light goes out?
Well I do
Well I do”*

RESUMO

Para evitar a propagação do vírus SARS-CoV-2 durante a pandemia da COVID-19, governos de diversos países ao redor do mundo impuseram medidas sociais restritivas e o fechamento dos serviços. Este cenário dificultou o acesso da população ao atendimento odontológico, o que favorece o desenvolvimento de doenças e sintomas orais. O objetivo deste estudo foi analisar a relação das medidas de restrição social e o interesse das pessoas em pesquisar informações relacionadas à dor de dente na Internet. Para isso, os indicadores Stringency Index, Years Lived with Disability (YLDs) para cárie dentária, participação de mercado do Google, penetração na Internet e volume relativo de busca (RSV) para o tópico "Dor de Dente" no Google Trends foram determinados para 21 países com dados disponíveis, de abril de 2018 a maio de 2020. A análise estatística foi realizada utilizando o teste U de Mann-Whitney, os testes Qui-quadrado e de correlação de Pearson e o teste T ($\alpha=0,05$). Os valores de RSV aumentaram significativamente após o início das medidas de restrição em todos os países estudados, exceto no Japão. Os valores de RSV e índices de permanência em casa foram correlacionados com $r > |0.6|$ em 11 países, os quais apresentaram valores de RSV significativamente mais altos do que seus equivalentes ($r < 0,6$). Os termos mais comumente pesquisados estavam relacionados ao tratamento e à auto resolução da dor de dente, sendo que houve um aumento súbito do interesse pela associação entre o sintoma e a COVID-19. Portanto, o interesse em informações digitais relacionadas à dor de dente foi relacionado às medidas de restrição social. Estes resultados permitem identificar as demandas odontológicas de diferentes populações, contribuindo para o planejamento de políticas específicas de saúde pública durante e após o período pandêmico.

Palavras-chave: Odontalgia. Infecções por Coronavirus. Quarentena.

ABSTRACT

Social isolation intensified interest in toothache-related information during the COVID-19 pandemic

To prevent the spread of the SARS-CoV-2 virus during the COVID-19 pandemic, governments of several countries worldwide imposed restrictive social measures and the closure of services. This scenario hampered the population's access to dental care, towards the development of oral diseases and symptoms. The aim of this study was to analyze the relationship of social restriction measures and people's interest in searching toothache-related information on the Internet. For that, the following indicators Stringency Index, Years Lived with Disability (YLDs) for dental caries, Google market share, Internet penetration, and relative search volume (RSV) for the Topic "Toothache" in Google Trends were determined for 21 countries with available data, from April 2018 to May 2020. Statistical analysis was performed using Mann-Whitney U test, Pearson's Chi-square and correlation tests, and T test ($\alpha=0.05$). RSV values increased significantly after restriction measures in all countries, except for Japan. RSV values and stay at home indices were cross-correlated with $r > |0.6|$ in 11 countries, of which presented significantly higher RSV values than their counterparts ($r < 0.6$). The most common searched terms were linked to the treatment and self-resolution of toothache, with a sudden increase of the interest in the relationship between the symptom and COVID-19. Therefore, the interest in toothache-related digital information was associated with social restriction measures. These results allow the identification of dental demands of distinct populations, contributing to the planning of specific public health policies during and after the pandemic period.

Keywords: Toothache. Coronavirus Infections. Quarantine.

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1

**Introdução e
Revisão de
Literatura**

1 INTRODUÇÃO E REVISÃO DE LITERATURA

Governments of several countries worldwide have adopted specific policies to endure the socioeconomic consequences and health impacts of the COVID-19 pandemic.(1) In an attempt to slow the spread of SARS-CoV-2 virus, authorities encouraged or imposed restrictive public health and social measures as mass quarantine, lockdown, self-isolation, and closures of non-essentials services.(1)

People undergoing this context could experience negative psychological effects (2–5). The most frequent mental problems are related to stress, depression, and anxiety (3–5). Loss of routine and daily activities, confinement, and financial difficulty are some of the reported stressors (2). Studies before the COVID-19 outbreak had already shown that stress and the financial crisis hinder the population's access to dental care, contributing to increased toothache (6–9). Routine changes during vacation periods were also associated with greater neglect of oral health care (10). Considering these aspects, there is a requirement to investigate how social isolation and the current pandemic scenario can impact the dental needs of populations.

Even after the recommendations to postpone routine dental care have ended, many clinics may remain closed due to government restrictions, problems with understaffing, appropriate PPE (protective personal equipment), or difficulties in adapting facilities (11–18). Thus, access to dental care may continue to be impaired. Also, whether by a self-imposed effort to stay at home (19,20) or by government impositions of confinement, people may end up ignoring signs of worsening of the dental clinical picture or avoid seeking care even in case of urgency, trying to self-manage their symptoms (19–21). This behavior can lead to a rapid progression of untreated diseases (11,17) and, as a result, cause serious late complications (16,20), also increasing the costs and complexity of future treatments (11). This scenario indicates the importance of studying how the population is dealing with dental problems in the context of pandemic and social isolation, especially about toothache, which is the main cause of dental urgency (22).

In this sense, the use of digital and computational Big Data can be helpful to understand impacts caused by COVID-19 and create strategies to deal with it (23). People suffering from toothache tend to search the Internet for information about this symptom (9,24–27). They used to look for ways to deal with the pain, whether with medication or home solutions (9,24–27). However, there are still no studies

investigating the relationship between social isolation and the interest in toothache-related searches.

Previously, studies have shown that determining what Internet users research about toothache can enable the identification of the requirements and concerns of people in a community (9,25,27). Thus, knowing the current profile of interest of Internet users on toothache would allow identifying and anticipating the dental needs presented by the population, in addition to developing health policies and strategies capable of meeting these demands in the pandemic and post-pandemic scenarios.

2

Proposição

2 PROPOSIÇÃO

The aim of this study was to evaluate the relationship between social isolation during the COVID-19 pandemic and people's interest in toothache-related information on the Internet. We hypothesized that isolation favors the increase of searches for digital contents towards self-resolution of pain.

3

Métodos

3 MÉTODOS

3.1 STUDY DESIGN

This longitudinal retrospective study evaluated the toothache-related computational metadata of 21 countries using the Google Trends tool. The relative search volume (RSV) the rising and main related queries of the topic “Toothache – Disease” were obtained from May 2018 to April 2020. The Years Lived with Disability (YLDs), Stringency Index, and Google market share were also determined in each country. The collected data were analyzed qualitatively and quantitatively.

3.2 COUNTRIES SELECTION

The countries were selected according to the subsequent criteria: a) at least 50% of Internet penetration and 50 million inhabitants (28), b) available data on Oxford COVID-19 Government Response Tracker (OxCGRT) platform, and c) sufficient accessible data on Google Trends. Following these aspects, a total of 21 countries were listed: Brazil (BRA), China (CHI), Colombia (COL), Egypt (EGY), France (FRA), Germany (GER), India (IND), Indonesia (INA), Iran (IRA), Italy (ITA), Japan (JAP), Mexico (MEX), Philippines (PHI), Russia (RUS), South Africa (RSA), South Korea (KOR), Thailand (THA), Turkey (TUR), United Kingdom (GBR), United States (USA) e Vietnam (VIE).

3.3 SEARCH VOLUME TRENDS

The RSV indicates the proportion between the search volume of a specific query by the volume of overall queries performed by users on Google Search, normalized by the maximum value observed in a timeline (RSV=100) and presented on a weekly or monthly basis. The results can be filtered by period, source, location, and category.

On May 11, 2020, the RSV values were collected for each country between May 2018 and April 2020. These data resulted from the search by the topic “Toothache – Disease”, including “web search” and “all categories”. The function “topic” is based on automatic algorithms provided by Google Trends.

3.4 TOP AND RISING QUERIES

Google Trends also provides a list of related queries, indicating which terms were also searched by users interested in a particular term or topic, revealing the main queries (top) and those that have suddenly come to be sought more frequently (rising). Queries marked as "breakout" stand out once they show an exponential increase, probably because they are new or previously there was little or no demand for them.

A list of rising and top queries related to "Toothache – Disease" was obtained for all countries from May 2018 to April 2020. Then, the main queries were classified according to the type of information sought ("cause/symptom" or "treatment/self-resolution") and interest in home remedies ("yes" or "no").

3.5 STRINGENCY INDEX

OxCGRT is an initiative of the Blavatnik School of Government, University of Oxford (1). This project aims to study the evolution of policies and special measures adopted by governments of several countries during the propagation of COVID-19. Through data collected and updated in real-time, the developed indexes allow evaluating the extent of government responses during the pandemic period. They are based on 17 indicators that include closure and containment measures, as well as economics and health aspects.

One of these indices is called the Stringency Index (SI), which evaluates the extent and degree of the restrictive order measures, ranging from 0 to 100. It is composed of 1 indicator related to health, which evaluates the existence of public information campaigns on COVID-19, and another 8 related to closure and containment, as follows: a) school closing, b) workplaces closing, c) cancel public events, d) restrictions on gatherings, e) close public transport, f) stay at home requirements, g) restrictions on internal movement, and h) international travel controls.

On May 12, 2020, the daily scores of stay at home requirements (SHR) and restrictions on internal movement (RIM), respectively ranging between 0-3 and 0-2, were collected for each country from January 01, 2020 (since data started to be presented in OxCGRT) to May 02, 2020. The weekly averages for SI, SHR, and RIM were then calculated for every country from the daily scores.

3.6 YLDs

The YLDs indices for untreated caries in permanent teeth were compiled from the results of the project Global Burden Disease, available in the database of the

Institute for Health Metrics and Evaluation (29). The data cover the period from 2013 through 2017, considering both genders and all ages.

3.7 GOOGLE MARKET SHARE AND INTERNET PENETRATION

The Google market share values were retrieved from Search Engine Market Share data, available on StatCounter GlobalStats website(30). The Internet penetration data for the countries were collected from the digital global report of 2020, provided by the Hootsuite (28).

The Council on Ethics in Human Research from the Bauru School of Dentistry considers that research using publicly available data does not involve human subjects, as defined by federal regulations. Therefore, institutional review board approval was not required for this study.

3.8 DATA ANALYSIS

Data were analyzed with the Statistical Package for Social Sciences (version 21.0; SPSS, Chicago, IL, USA), as follows:

i. The curves of observed RSV values were analyzed heuristically, and the percentage of variation of RSV values was calculated regarding a month (30 days) before and after the beginning of social isolation ($SI > 0$).

ii. The normality and homogeneity of data were assessed by Shapiro-Wilk and Levene tests, respectively.

iii. Pearson's cross-correlation test was applied to investigate the relationship between the variation of weekly mean RSV and isolation indices (SI, SHR, and RIM) for each country.

iv. t-Student test was applied for comparisons of RSV, SHR, and Google market share (parametric analysis), while the Mann-Whitney U test was applied for comparison of RIM, SI, YLDs, and Internet penetration (non-parametric) between country-based groups, which were dichotomized according to the cross-correlation ($r < |0.6|$ and $r > |0.6|$) and the percentage variation of RSV values ($\leq 20\%$ and $> 20\%$).

v. The differences in the distribution of the main toothache-related queries according to distinct categories were evaluated between distinct countries by Pearson's Chi-square test.

For all analyses, P values < 0.05 were considered statistically significant.

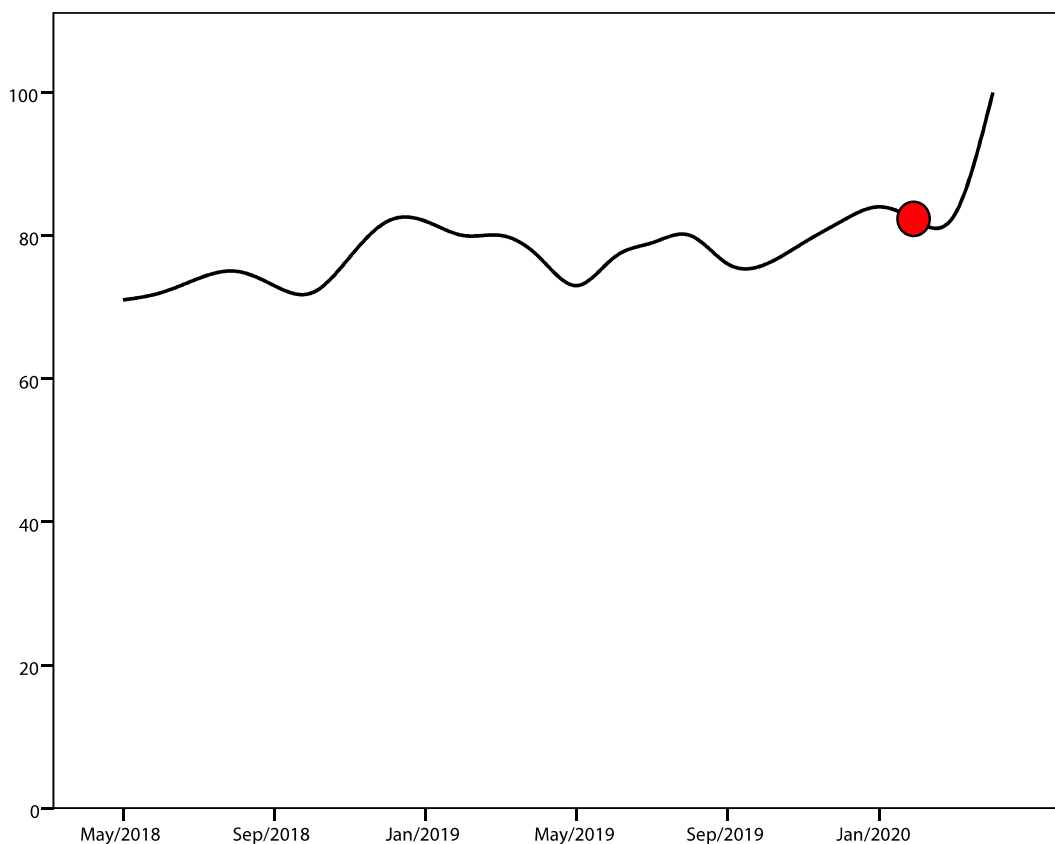
4

Resultados

4 RESULTADOS

Figure 1 shows the curve of monthly variation of RSV values for the topic "Toothache" worldwide from May 2018 to April 2020. The red point indicates January 20, 2020, when the social isolation (SI>0) started in China. From that point, it was observed a sudden and unequivocal trend of increase of RSV values.

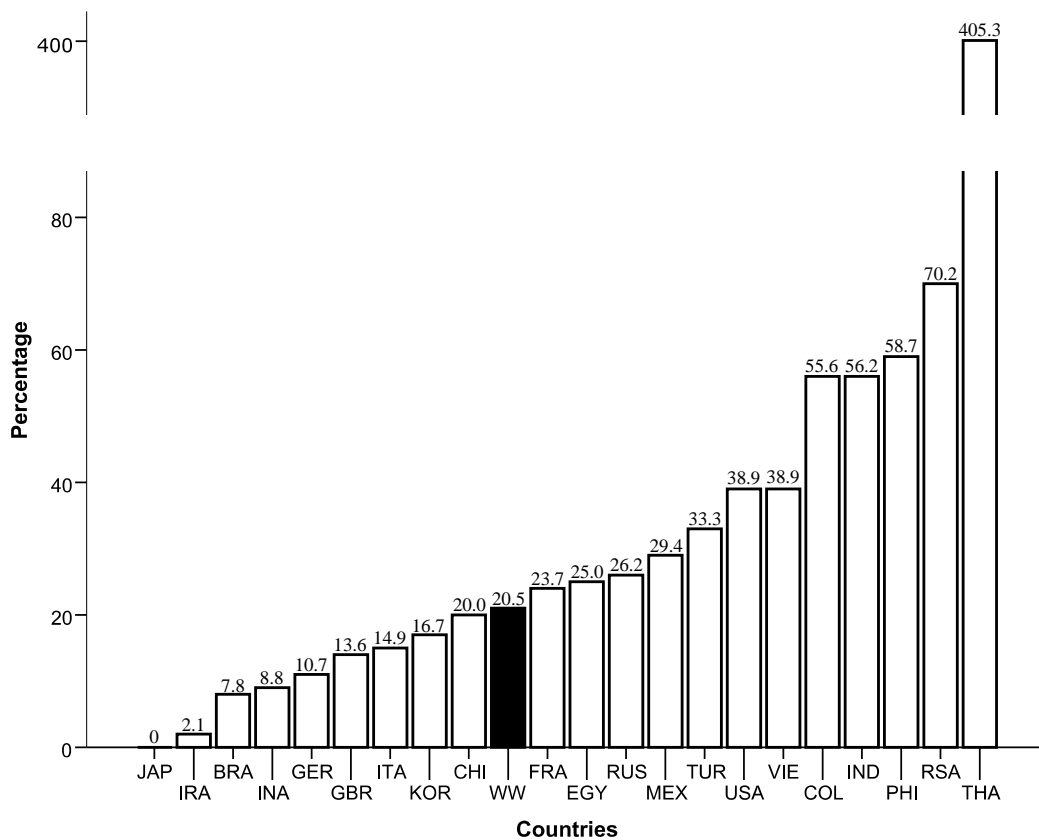
Figure 1 - The variation of interest in toothache-related digital information worldwide from May 2018 to April 2020. The red point indicates January 20, 2020, when the social isolation started in China (SI>0).



Fonte: Elaborado por Matheus Lotto

Figure 2 depicts the percentage variation of RSV values by the comparison of the means of a month before and after the beginning of restrictive measures in each country. From this analysis, it was observed an increase in toothache-related searches in all countries and worldwide, except for Japan.

Figure 2 - The percentage variation of toothache-related interest before and after the beginning of restrictive measures in each country.



Fonte: Elaborado por Matheus Lotto

Table 1 presents the cross-correlation values between the RSV values related to the volume of toothache-related searches and the social isolation indices (SHR, RIM, and SI) for each country. Brazil, India, Iran, Philippines, South Africa, Thailand, Turkey, and the United Kingdom showed a positive correlation higher than 0.6 between RSV and each of the 3 indices evaluated. The United States and Indonesia presented a positive correlation higher than 0.6 only between RSV and SHR and RIM indices. Egypt only showed a positive correlation higher than 0.6 between RSV and SI. Germany was the only country that showed a negative correlation higher than 0.6 between RSV and SHR and SI indices. The other countries showed moderate or low correlations ($<|0.6|$) between RSV and the 3 isolation indices.

Table 1 - Cross-correlations between Relative Search Volume (RSV) for toothache-related information and social restriction measures. Asterisks represent significant correlations ($P < 0.05$)

Countries	Stay at home	Restrictions on internal movement	Stringency index
Brazil	0.748 (0.021)*	0.833 (0.005)*	0.794 (0.011)*
China	-0.044 (0.876)	0.144 (0.609)	0.069 (0.807)
Colombia	0.498 (0.059)	0.498 (0.059)	0.426 (0.113)
Egypt	0.566 (0.186)	0.566 (0.186)	0.625 (0.133)
France	0.534 (0.040)*	0.534 (0.040)*	0.458 (0.086)
Germany	-0.693 (0.004)*	-0.593 (0.020)*	-0.636 (0.011)*
India	0.920 (0.001)*	0.959 (0.001)*	0.981(0.001)*
Indonesia	0.728 (0.001)*	0.700 (0.002)*	0.516 (0.034)*
Iran	0.685 (0.020)*	0.724 (0.012)*	0.688 (0.019)*
Italy	0.338 (0.219)	0.257 (0.355)	0.438 (0.103)
Japan	-0.308 (0.229)	-0.308 (0.229)	-0.311 (0.225)
Mexico	-0.153 (0.674)	-0.161 (0.657)	-0.141 (0.697)
Philippines	0.917 (0.001)*	0.904 (0.001)*	0.921(0.001)*
Russia	0.128 (0.663)	-0.054 (0.855)	0.073 (0.804)
South Africa	0.888 (0.001)*	0.830 (0.001)*	0.837 (0.001)*
South Korea	0.553 (0.040)*	0.553 (0.040)*	0.543 (0.045)*
Thailand	0.798 (0.010)*	0.945 (0.001)*	0.823 (0.006)*
Turkey	0.895 (0.001)*	0.933 (0.001)*	0.882 (0.001)*
United Kingdom	0.886 (0.001)*	0.874 (0.001)*	0.880 (0.001)*
United States	0.602 (0.029)*	0.668 (0.013)*	0.595 (0.032)*
Vietnam	0.581(0.023)*	-0.119 (0.674)	0.430 (0.109)
Worldwide	0.144 (0.015)*	0.223 (0.001)*	0.250 (0.001)*

P values are presented between brackets.

Table 2 presents the comparison of country-based groups according to dichotomized r values and percentage variation of RSV before and after the beginning of isolation ($SI > 0$). Significant statistical differences were observed only for RSV values, with higher values found in countries with $r > |0.6|$ and $\leq 20\%$ of RSV variation.

Table 2 - Mean (\pm SD), median (IQR) and P value of Relative Search Volume (RSV), Stay at Home, Restrictions on Internal Movement, Stringency Index, Years Lived with Disability (YLDs), internet penetration and Google market share according to distinct criteria of dichotomized country groups

Criteria	Dichotomized groups					P
	Correlation		P	RSV variation (%)		
	<0.6	>0.6		$\leq 20\%$	>20%	
Relative Search Volume (RSV)	56.87 \pm 21.85	73.54 \pm 20.08		67.62 \pm 23.69	60.86 \pm 21.89	
	62.50(30.25)	77.00(26.50)	<0.001*	75.00(25.25)	62.00(26.50)	0.022*
Stay at home	1.08 \pm 0.55	0.96 \pm 0.40		1.00 \pm 0.56	1.12 \pm 0.39	
	0.93(0.86)	0.92(0.46)	0.705	0.91(0.73)	0.97(0.68)	0.754
Restrictions on internal movement	1.15 \pm 0.40	1.01 \pm 0.42		1.13 \pm 0.53	1.00 \pm 0.27	
	1.12(0.72)	0.42(0.33)	0.483	1.04(0.93)	0.92(0.30)	0.676
Stringency index	52.78 \pm 12.84	47.60 \pm 8.07		47.96 \pm 11.01	50.75 \pm 11.60	
	51.56(16.82)	44.44(15.19)	0.415	44.84(19.68)	49.01(10.99)	0.496
Years Lived with Disabilities (YLDs)	27.62 \pm 10.12	26.98 \pm 8.75		27.09 \pm 7.55	27.28 \pm 11.42	
	26.81(17.52)	23.64(15.91)	0.737	25.22(11.63)	25.45(20.99)	0.934
Internet penetration	76.10 \pm 14.11	73.40 \pm 14.54		79.33 \pm 13.67	68.44 \pm 12.32	
	75.50(23.25)	70.50(25.00)	0.680	82.00(25.50)	69.00(20.00)	0.191
Google market share	78.51 \pm 29.88	94.36 \pm 4.89		80.96 \pm 30.46	92.20 \pm 14.12	
	92.43(25.35)	96.57(6.49)	0.072	92.95(20.47)	96.99(4.11)	0.422

Fonte: Elaborado por Matheus Lotto

Table 3 summarizes the toothache-related queries with a sudden increase of interest over time. Queries combining toothache and COVID-19 were detected in Germany ("toothache corona"), Japan ("corona toothache"), the United Kingdom ("toothache during coronavirus", "toothache during lockdown"), the United States ("toothache coronavirus"), and worldwide ("toothache coronavirus").

Table 3 - Toothache-related queries that suddenly increased in coronavirus pandemic months

Toothache (Topic)			
Region	Queries	Region	Queries
Worldwide	Toothache coronavirus Toothache spray medicine	Philippines	Celecoxib Acupressure for toothache Natural remedy for toothache
Brazil	How to relieve toothache Home remedy for inflamed tooth pain	Russia	How to remove toothache How to relieve toothache How to reduce toothache Toothache plot What to drink from toothache
France	How to calm a toothache Toothache remedy	Turkey	What is good for toothache Prayer for tooth pain What is good for a toothache Toothache while fasting Dicloflam What does toothache Prayers that are good for toothache
Germany	Toothache corona Toothache during pregnancy	United	Toothache during coronavirus What to do with toothache How to deal with toothache Broken tooth pain Toothache during lockdown
India	Home remedies for tooth ache Home remedies for toothache Dental clinic near me	USA	Toothache coronavirus Home remedies for toothaches How to stop tooth pain fast ICD code for tooth pain What to do if your tooth hurts How to ease a toothache Home remedies for teeth pain How to stop a toothache fast
Indonesia	Cooling 5 Toothache spray Cooling 5 toothache medication Toothache medicine spray Cooling toothache medicine 5 plus Toothache medicine spray Cooling 5 plus for toothache		
Iran	Immediate tooth removal Home remedy for toothache What should be done for toothache? Home Toothache		
Italy	Zimox for toothache		
Japan	Corona toothache		
Mexico	Causes of toothache		

Table 4 shows the distribution of main toothache-related queries according to distinct categories. In general, these terms were mostly associated with treatment and self-resolution of toothache, with the observation of a common interest in home remedies to relieve this symptom.

Table 4 - Distribution of the main toothache-related queries according to particular categories. Distinct superscript lowercase letters indicate significant statistical differences between countries in relation to the category of searching information, while distinct superscript uppercase letters indicate significant statistical differences between countries in relation to the home remedies usage

(continua)

Countries	Searching information		Home remedies	
	Causes/Symptoms	Treatment/Self-resolution	No	Yes
Brazil ^{a,A}	230 (3.0%)	7330 (97.0%)	6820 (93.0%)	510 (7.0%)
France ^{b,B}	0 (0%)	680 (100%)	0 (0%)	680 (100%)
Germany ^{c,C}	320 (28.1%)	820 (71.9%)	0 (0%)	820 (100.0%)
India ^{d,D}	210 (10.0%)	1900 (90.0%)	0 (0%)	1900 (100.0%)
Indonesia ^{e,E}	340 (17.1%)	1650 (82.9%)	0 (0%)	1650 (100.0%)
Iran ^{d,D}	210 (10.6%)	1780 (89.4%)	0 (0%)	1780 (100.0%)
Italy ^{c,C}	160 (25.4%)	470 (74.6%)	0 (0%)	470 (100.0%)
Japan ^{f,F}	180 (75.0%)	60 (25.0%)	60 (100%)	0 (0%)

Table 4 - Distribution of the main toothache-related queries according to particular categories. Distinct superscript lowercase letters indicate significant statistical differences between countries in relation to the category of searching information, while distinct superscript uppercase letters indicate significant statistical differences between countries in relation to the home remedies usage

(conclusão)

Countries	Searching information		Home remedies	
	Causes/Symptoms	Treatment/Self-resolution	No	Yes
Mexico ^{g,G}	50 (2.2%)	2250 (97.8%)	0 (0%)	2250 (100.0%)
Philippines ^{h,H}	0 (0%)	1850 (100%)	0 (0%)	1850 (100%)
Russia ^{f,I}	380 (73.1%)	140 (26.9%)	0 (0%)	140 (100.0%)
South Africa ^{i,J}	0 (0%)	160 (100%)	0 (0%)	160 (100.0%)
Thailand ^{d,D}	70 (10.9%)	570 (89.1%)	0 (0%)	570 (100.0%)
Turkey ^{d,D}	370 (10%)	3320 (90.0%)	0 (0%)	3320 (100.0%)
United Kingdom ^{a,K}	60 (3.6%)	1620 (96.4%)	0 (0%)	1620 (100.0%)
United States ^{a,K}	490 (3.4%)	13990 (96.6%)	0 (0%)	13990 (100.0%)
Vietnam ^{c,C}	130 (28.3%)	330 (71.7%)	0 (0%)	330 (100.0%)
Worldwide ^{i,L}	0 (0%)	2950 (100.0%)	0 (0%)	2950 (100.0%)

Fonte: Elaborado por Matheus Lotto

5

Discussão

5 DISCUSSÃO

In this study, we investigated whether social isolation could influence people's behaviors in searching for toothache-related contents on the Internet, regarding the first months of the pandemic period. In general, the volume of searches increased after the beginning of restriction measures, except for Japan. Interestingly, the group of countries with cross-correlation $> |0.6|$ between SI and RSV, and those with RSV variation $\leq 20\%$ presented statistically higher RSV values than their counterparts. In addition, people preferably conducted their searches for seeking information on self-resolution of toothache, commonly interested in homemade alternative methods, with a sudden growth of searches combining toothache and COVID-19 over time.

According to the aim of this study, we selected 2 components of SI that indicates more specifically the level of social constraint, to characterize the difficulties of people in seeking for dental treatment. In this context, the fact that most countries presented at least SHR and RSV correlated moderately (>0.4) demonstrates the relationship between the restriction measures and the interest in toothache-related digital information, since the indicator refers to the degree which people were required to stay at home. The results of THA, GER, and EGI showed some peculiarities. The abrupt increase of the interest in toothache-related contents observed in Thailand was linked to an unexpected relative decrease of search volume observed prior to the beginning of restrictions in the country. A possible explanation for this behavior could be the activity of Google users in seeking information on the outbreak of COVID-19 in China, which relatively reduced the significance of searches for other health conditions. In Germany, the negative correlation between restriction measures and search volume can be explained by the decision of the initial milestone of isolation measures in the countries, starting when $SI > 0$, which occurred in the penultimate week of January 2020 with national campaigns warning about the virus. In this period, the SI values remained low with SHR and RIM components equal to zero, while the interest in toothache-related searches increased. As expected, the SI, SHR, and RIM increased after some weeks; however, the relative volume of searches for toothache decreased simultaneously, probably because an overinformed audience sensitized to concern about respiratory symptoms. Finally, Egypt was the only country that showed a positive

correlation value higher than 0.6 without statistical significance, which can be attributed to the short-time range selected for data analysis.

The analysis of RSV variation indicates a general trend of increase of toothache-related searches over time, similarly with previous studies (9,25,27,31). The onset of restrictions seemed to accelerate this trend, leading to a sudden and significant increase in the volume of searches in most countries, which has also been observed by similar studies (32,33). With the onset of social and movement restrictions, thousands of people were confined to their homes, in-home offices, which stimulated the access to the Internet and social network for longer periods (34–37). Moreover, in the initial months of the pandemic, little was known about the SARS-CoV-2 virus and its symptoms. This fact, combined with the overexposure of the individuals to media news (34–36), contributed to generate a state of cyberchondria (38,39), i.e., people possibly associated their dental pain with COVID-19, as observed in the rising queries.

The populations that were already more accustomed to search for toothache-related information on the Internet intensified this behavior over the period of restriction measures. However, the activity also increased in countries with lower search volumes before COVID-19. These results seemed to be not influenced by the burden of untreated dental caries, Internet penetration, and Google's market share, since these characteristics were similar in both country groups, which corroborate with the influence of social restriction measures in boosting online searches for toothache contents.

The increase observed in the volume of searches for toothache-related information probably was related to the increment of this symptom over time (9). The state of pandemic and social isolation brought changes and new demands to the general population, such as the universalized scenario of fear and uncertainty before the disease, related psychosocial burden, changes in routine and daily habits, socioeconomic impacts, financial crisis, and decrease in family income (40–42). These factors may lead individuals to reschedule their priorities, triggering negligence in seeking treatment and oral health care (9,10,27,42,43), influencing people to try solving their problems by themselves, for instance, using home remedies as painkillers (9,25).

It is noteworthy that the imposed restrictive and closing measures, the economic crisis and recession can amplify the previously existing barriers to dental

care (42,44–46). Problems related to urban mobility and transportation, lack of resources, difficult access to public and private dental care, unemployment, poverty, and social inequality are some of the difficulties that may have been aggravated with the imposition of restriction measures, service closure, and lockdown (40,42,44,47,48). Faced with the intensification of these already existing barriers, the population would have a greater tendency to search the Internet for ways of self-resolution of toothache, especially in developing countries (44), which presented significantly higher RSV values than developed ones (data not shown).

These findings are important to the encouragement and development of public policies focused on the production of health contents, avoiding delays in treatment, inadequate palliative solutions, and irreversible damage. In a situation of pandemic and confinement, it may be interesting to widely disseminate information about the opening and operation of available public dental emergency services. Similarly, it may be relevant to make available dental screening services or health care and information online or by phone (49–52), solving questions, warning about the risk or ineffectiveness of home remedies, and determining the need for immediate face-to-face care in advance, reducing the flow of patients and the risk of contamination in dental clinics. The outbreak of a pandemic seems to lead to an increased demand for dental services (53), either due to the existence of a previously repressed situations or the emergence of new needs for oral health care in the populations. Thus, our results can contribute to health planning (9,10,27), since they indirectly indicate the burden imposed on dental services. Our study also seems to be useful for the identification of the population's interests and concerns about issues and themes related to dentistry, such as the observed desire to know about the existence of a relationship between toothache and COVID-19.

There are some aspects of this study that must be considered. The data collected is limited to toothache-related searches performed in Google Search platform, not including unstructured data or other search engines existing on the web. However, Google presents a market share above 90% in most studied countries (30). Also, it is still necessary to consider that data collected from Google Trends may be subjected to the interference from national policies that restrict free access to the Internet, as occurs in Thailand, China, Egypt, Iran, Russia, and Vietnam (54). The period considered for data collection, although short, allowed us to obtain a sufficient volume of information to generate relevant analysis for this field of knowledge. In fact,

this interval was chosen to evaluate the primary impact of the pandemic context and social restrictions on people's search behavior. Moreover, although it is not possible to state categorically that people are seeking toothache-related information only when they are experiencing pain, previous studies demonstrated that those search trends were associated with national statistics related to the symptom (9).

6

Conclusões

6 CONCLUSÕES

In conclusion, the restrictive measures imposed by governments of several countries due to coronavirus seemed to influence the increase of people's interest in toothache-related digital information in different countries worldwide, with a sudden increase of queries that combined the terms toothache and COVID-19. In general, the searches were mainly related to treatment and self-resolution of pain, frequently employing home strategies. These outcomes permit the identification of possible demands of populations for dental care services, i.e., they assist in planning public health decisions, directing the development of specific policies and health educational contents to be applied during and after this pandemic period.

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