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Facebook users' engagement with dental caries misinformation in Brazilian Portuguese

Interação de usuários do Facebook com postagens falsas sobre cárie dentária em português brasileiro

Interacción de usuario de Facebook con publicaciones falsas sobre caries en portugués brasileño

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Abstract *This study analyzed dental caries-related Facebook posts in Brazilian Portuguese to identify misinformation and predict user interaction factors. A sample of 500 posts (between August 2016 and August 2021), was obtained by CrowdTangle. Two independent and calibrated investigators (intraclass correlation coefficient varying from 0.80 to 0.98) characterized the posts based on their time of publication, author's profile, sentiment, aim of content, motivation, and facticity. Most posts (90.2%) originated from Brazil, and they were predominantly shared by business profiles (94.2%). Approximately 67.2% of these posts focused on preventive dental issues, driven by noncommercial interests in 88.8% of cases. Misinformation was present in 39.6% of the posts, particularly those with a positive sentiment and commercial motivation. Business profiles and positive sentiment were identified as predictive factors for higher post engagement. These findings highlight a significant proportion of dental caries-related posts containing misinformation, especially when associated with positive emotions and commercial motivation.*
Key words *Health behavior, Infodemiology, Oral health, Communication, Social media*

Resumo *Este estudo digital analisou postagens relacionadas à cárie dentária em português brasileiro no Facebook para identificar informação falsa e prever fatores de interação do usuário. Uma amostra de 500 postagens (entre agosto de 2016 e agosto de 2021) foi obtida por meio do CrowdTangle. Dois investigadores independentes e calibrados (coeficiente de correlação intraclasse variando de 0,80 a 0,98) caracterizaram as postagens com base em seu tempo de publicação, perfil do autor, sentimento, objetivo do conteúdo, motivação e veracidade. A maioria das postagens (90,2%) originou-se do Brasil e foi compartilhada predominantemente por perfis comerciais (94,2%). Dessas postagens, 67,2% focaram questões dentárias preventivas, impulsionadas por interesses não comerciais em 88,8% dos casos. Informação falsa estava presente em 39,6% das postagens, particularmente aquelas com sentimento positivo e motivação comercial. Perfis comerciais e sentimento positivo foram identificados como fatores preditivos-chave para maior engajamento nas postagens. Esses resultados destacam uma proporção significativa de postagens relacionadas à cárie dentária contendo informação falsa, especialmente quando associadas a emoções positivas e motivação comercial.*
Palavras-chave *Comportamento de saúde, Infodemiologia, Saúde bucal, Mídias sociais, Comunicação*

Resumen *Este estudio digital analizó publicaciones relacionadas con la caries en portugués brasileño en Facebook para identificar información falsa y predecir factores de interacción del usuario. Mediante CrowdTangle se obtuvo una muestra de 500 publicaciones (entre agosto de 2016 y agosto de 2021). Dos investigadores independientes y calibrados (coeficiente de correlación intraclase que oscila entre 0,80 y 0,98) caracterizaron las publicaciones en función de su tiempo de publicación, perfil del autor, sentimiento, objetivo del contenido, motivación y veracidad. La mayoría de las publicaciones (90,2%) provinieron de Brasil y fueron compartidas predominantemente por perfiles comerciales (94,2%). Aproximadamente el 67,2% de estas publicaciones se centraron en cuestiones dentales preventivas, impulsadas por intereses no comerciales en el 88,8% de los casos. La información falsa estuvo presente en el 39,6% de las publicaciones, particularmente aquellas con sentimiento positivo y motivación comercial. Los perfiles comerciales y el sentimiento positivo se identificaron como predictores clave para una mayor participación en las publicaciones. Estos resultados resaltan una proporción significativa de publicaciones relacionadas con las caries que contienen información falsa, especialmente cuando se asocian con emociones positivas y motivación comercial.*
Palabras clave *Comportamiento de salud, Infodemiología, Salud bucal, Redes sociales, Comunicación.*

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Introduction

The emergence of social media has created an environment that is a mixture of true and false information, leading to an unprecedented amount of data on various topics, including health[1]. Policymakers and the social media industry are faced with the challenge of controlling fake news, misinformation, and hate speech. In the same vein, the medical field also grapples with the spread of false, inaccurate, or incomplete health information[2].

Although the manipulation of news is not a new phenomenon, false or highly misleading political "news" stories on social media came to the forefront during the 2016 US presidential elections and the UK Brexit Referendum[3]. In 2016, the Oxford Dictionary Word of the Year was "*post-truth*," which denotes that the public is more influenced by emotional appeals rather than objective facts[4].

Defining misinformation can be a complex task, as the boundary between truth and falsehood is not always clear-cut and can shift over time with the emergence of new evidence and advancements in research methods and technologies[5]. In this sense, health misinformation can be defined as false health-related statements that lack scientific evidence[6]. It is prevalent on social media, and studies have shown a correlation between sharing misinformation and health-related knowledge, attitudes, and beliefs[1] Misinformation can take various forms, including satire, parody, false connection, misleading content, false context, and imposter, manipulated or fabricated content[7]. For instance, there is evidence of health misinformation on social media posts related to communicable diseases[8], general vaccination[9], genetically modified organisms[10], MMR vaccine[11], zika virus[12], cancer[13], inflammatory bowel disease[14], fluoride[15], and health myths[16]. The consumption of incorrect oral health information can lead to beliefs that affect individual's health practices, which can have negative consequences on oral health outcomes[17].

In Dentistry, misinformation about dental caries is prevalent on websites, and positive feelings are related to the spread of misinformation[18]. The misinformation includes a false relationship between antibiotics and dental caries, denial of the role of fluoride in preventing caries, and the disregard of sugar as a caries risk factor[15, 19]. This type of misinformation can lead to patients adopting harmful behaviors based on empirical evidence, which can damage the patient-professional relationship and oral health outcomes[17]. As such, dental professionals must pay attention to their patients' needs and produce high-quality digital materials while providing informative advice during clinical consultations[20].

In light of the lack of evidence available on social media, this study aimed to perform the content analysis of Facebook posts related to dental caries in Brazilian Portuguese. The focus was on identifying and characterizing misinformation, as well as predicting the factors that influence users' interaction. Facebook has the second-highest rate of disinformation, trailing only behind Twitter[21]. Besides, it is recognized as a social media platform where misinformation spreads more rapidly compared to others[22]. In this sense, our hypothesis (H_1) was that social media users are more likely to engage with posts that contain both misinformation and evoke positive emotions, compared to those that present only accurate information. This assumption is based on previous studies that have shown how emotional appeals can be more influential than factual information in shaping individuals' attitudes and behaviors[3,4].

Materials and methods

Study design

This digital study identified and characterized dental caries-related information from 500 posts published in Brazilian Portuguese on Facebook between August 2016 and August 2021. Two independent investigators (M.R. and O.S.J.) analyzed those posts qualitatively to define their author's profile, sentiment, aim of content, motivation, and facticity. Statistical analysis was performed regarding interaction metrics as mentioned below.

Ethics

This study did not require institutional review board approval from the Council of Ethics in Human Research of Bauru School of Dentistry, University of São Paulo because federal regulations do not apply to research using publicly available data that does not involve human subjects[23].

The raw data of this paper have been anonymized and disclosed in an open data repository[24].

Search strategy, data collection, and preprocessing dataset

To collect data, we used the Meta-owned web scrapping tool CrowdTangle™. It tracks public interaction on content from Facebook pages and groups, Instagram accounts, and subreddits. We employed a specific search strategy and ranking criterion to collect Facebook posts and their interaction related to dental caries. The search strategy ("cárie" OR "carie" OR "cáries" OR "lesões cariosas" OR "dente cariado") was developed through exploratory analyses of hashtags and terms to ensure comprehensive coverage of dental caries-related content on Facebook. A dataset of 88,134 posts was downloaded in a .csv file format on August 26, 2021, covering a specific language (Portuguese) and timeframe (August 2016 to August 2021), with posts ranked by users' total interaction. The .csv files contain the respective link to the post, which allows the complete extraction and analysis of the content posted on Facebook by the research team, and also contain information on the date of publication and interaction metrics of each post, such as total interaction and overperforming score.

Two independent investigators (M.R. and O.S.J.) pre-processed the raw dataset before analyzing 783 posts in full to obtain a sample of 500 posts containing dental caries-related content. We excluded posts that were unrelated to dental caries (n = 36), duplicated posts (n = 225), and posts with unavailable links (n = 22) (Figure 1). The selected posts were then printed, and anonymized by blacking out names, profiles, and people's eyes in images. To ensure standardization and prevent inconsistencies, the posts were numbered and saved in sequence in Google Slides (Google, Mountain View, CA, USA), which was later converted to a .pdf file. This systematic process allowed for ethical analysis of messages by different investigators at different times.

Total interaction represents the sum of all reactions, shares, and comments on a post on Facebook, while the overperforming score indicates the diffusion performance of a post relative to the interaction of the last 100 posts on the same account at the same time. The platform's algorithm disregards the top and bottom 25% of posts and determines the average number of interactions for the remaining middle 50% of posts across various time intervals (such as 15 minutes old, 60 minutes old, 5 hours old, etc.). Later, when the account under consideration uploads a new post, the platform contrasts its metrics with the calculated average and applies the corresponding weights from each dashboard to the difference obtained[15,25].

Data analysis

Qualitative analysis

Dental caries-related posts were characterized by passive qualitative analysis[26], examining information patterns and interaction metrics. Two trained and calibrated investigators (M.R. and O.S.J.) classified the posts independently, according to the following criteria: author's profile (regular users, business, dental office, or news agency), sentiment (negative, neutral or positive), the aim of content (prevention or treatment), motivation (commercial or non-commercial), and facticity (information or misinformation). For the training process, several publications about dental caries were reviewed along with a third investigator (T.C.) for discussion and to learn the criteria for evaluation. Afterward, 10% of the sample (50 posts) was evaluated until the desired level of intra-examiner agreement was obtained (greater than 0.8). The posts that investigators divergently qualified were re-accessed until consensus.

Facebook profiles and pages were categorized based on their descriptions into regular users (including digital influencers), business pages, dental offices, or news agencies. The aim of content was determined by its perceived intention to control risk factors of the disease (prevention) or treat its clinical consequences (treatment). Posts were classified as commercial if they were published by profiles of stores and companies with an explicit sales intention. The sentiment of posts was categorized as positive if they contained signs such as smiles, motivational ideas, and/or happy emojis. Rational posts, such as journalistic news and scientific results, were classified as neutral, while negative sentiment posts were those that presented sad people, texts with words loaded with negative connotations, and conspiracy theories.

In terms of identifying the intentionality of a message, this study considered misinformation to be a broad term encompassing false or misleading content, regardless of whether or not there was intent to deceive or cause harm. This umbrella term includes two types of information disorders: misinformation *per se* and disinformation, as outlined by several sources[7,27,28]. To assess the accuracy of the content, the study relied on current scientific evidence from

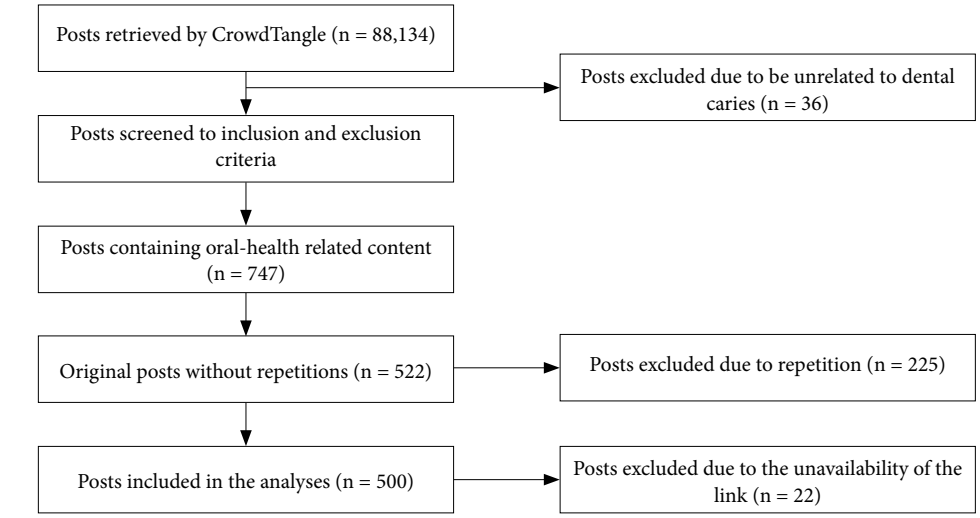

Figure 1. Flowchart depicting the process of selection of post.

Source: Authors.

guidelines, consensuses, and systematic reviews on the management of dental caries[29-31]. A post was considered to contain misinformation only if it presented obvious false or misleading information that could potentially harm Facebook users.

Statistical analysis

The Statistical Package for Social Sciences (v. 28.0, IBM Inc., Armonk, NY, USA) was used for the statistical analysis. The variables were initially dichotomized based on specific criteria. These included time of publication (≤ 1,479 days or > 1,479 days), author's profile (regular users or business/dental office/news agency), sentiment (negative/neutral or positive), aim of content (prevention or treatment), motivation (commercial or noncommercial), facticity (information or misinformation), total interaction (≤ 1,659 or > 1,659), and overperforming score (≤ 8.61 or > 8.61). The continuous variables were dichotomized based on their median values. In author's profile, dental offices, news agencies, and business profiles were grouped together due to their financial background. The choice to split sentiment into two categories was warranted based on prior studies indicating a link between positive emotions and higher social media user engagement rates[32]. This was done to examine if comparable results would be found for false messages concerning dental caries.

The inter-examiner agreement was determined by the Intraclass Correlation Coefficient (ICC), with values varying from 0.80 to 0.98.

The Kolmogorov-Smirnov and Levene tests were conducted to assess the normality and homogeneity of the data, respectively. Since the data were non-normally distributed, the Mann-Whitney U test was used to compare the total interaction and overperforming scores of the dichotomized variable groups.

Finally, the distribution of dichotomized variables based on the aim of content and facticity was evaluated using the chi-square Pearson test.

Multiple logistic regression models were created to investigate the possible association of distinct factors with misinformation, total interaction, and overperforming scores. Factors with Wald statistics with $P < 0.20$ in the simple models were included in the multiple models. Statistical significance was considered when P values < 0.05 for all analyses.

Results

As expected, most posts came from Brazil (n = 451; 90.2%), although posts from 12 other countries were also identified. The majority were from business profiles (n = 471; 94.2%) with noncommercial motivation (n = 444; 88.8%, e.g. "*End of the little motor? It is already possi-*

ble to remove cavities with laser"). Additionally, most posts were about prevention (n = 336; 67.2%, e.g. "*On this world cavity day, advise your patients to increase the age at which sugar is introduced into their children's lives, as this is one of the most effective ways of prevention*") and expressed positive sentiment (n = 327; 65.4%, e.g. "*Home remedy to eliminate tartar forever*"). A significant proportion of posts (n = 302; 60.4%) contained accurate information about dental caries (e.g. "*Dentists recommend that parents brush their children's teeth until they are 9 years old*"). The overperforming scores were significantly higher in posts from business profiles, posts expressing positive sentiment, and posts with commercial motivation (Table 1).

Tables 2 and 3 provide an overview of the distribution of dichotomized variable groups according to the aim of content and facticity. The findings indicate that posts from regular users were more prevalent in treatment-related posts as opposed to preventive content. Conversely, preventive content was found to be more frequently associated with commercial motivation than its opposite. Moreover, posts containing misinformation (e.g. "Aspirin may regenerate teeth after decay, scientists say.") tended to have positive sentiment and commercial motivation more frequently than posts with only accurate information.

Table 4 displays the positive associations of misinformation with positive sentiments (OR = 1.778; $P = 0.005$) and commercial motivation (OR = 1.846; $P = 0.038$) (model 1). Similarly, it summarizes the significant positive associations of the overperforming score (> 8.61) with positive sentiment (OR = 1.992; $P < 0.001$) and a business profile (OR = 3.020; $P = 0.014$) (model 2). Total interaction was not associated with any factor significantly.

Discussion

To our knowledge, this is the first study to examine Facebook posts about dental caries in Brazilian Portuguese, specifically focusing on misinformation and interaction metrics. The majority of the posts were originated from Brazil and were linked to business profiles that featured preventive content with noncommercial motivation. In addition, a high percentage of posts presented misinformation, which were closely linked to positive sentiment and commercial

Table 1. Comparison of averages (±SD) and medians (IQR) of total interaction and overperforming score regarding time of publication, author's profile, sentiment, aim of content, motivation, and facticity (Mann-Whitney *U* test, $P < 0.05$).

	n (%)	Total Interactions		*P*	Overperforming score		*P*
		Average (±SD)	Median (IQR)		Average (±SD)	Median (IQR)	
Time of publication							
≤ 1,479 days	250 (50.0%)	2795 (±5087)	1643 (1290)	0.351	24.32 (±43.75)	7.39 (23.85)	0.145
> 1,479 days	250 (50.0%)	3602 (±8964)	1696 (1953)		33.75 (±62.80)	9.15 (37.71)	
Author's profile							
Regular users	29 (5.8%)	2922 (±2842)	1973 (2608)	0.758	7.18 (±19.71)	2.80 (6.74)	< 0.001*
Business	471 (94.2%)	3215 (±7481)	1654 (1547)		30.38 (±55.43)	9.16 (35.69)	
Sentiment							
Negative/Neutral	173 (34.6%)	3284 (±8568)	1818 (1356)	0.457	16.84 (±32.88)	5.60 (14.12)	0.001*
Positive	327 (65.4%)	3153 (±6531)	1638 (1693)		35.49 (±61.78)	11.18 (43.21)	
Aim of content							
Prevention	336 (67.2%)	2945 (±1610)	1610 (1310)	0.125	28.60 (±49.42)	7.94 (35.95)	0.825
Treatment	164 (32.8%)	3718 (±1831)	1831 (2238)		29.92 (±63.21)	9.13 (23.94)	
Motivation							
Noncommercial	444 (88.8%)	3185 (±1657)	1657 (1561)	0.092	27.05 (±53.46)	7.81 (24.30)	0.028*
Commercial	56 (11.2%)	3301 (±1670)	1670 (2397)		44.80 (±58.44)	20.89 (65.23)	
Facticity							
Information	302 (60.4%)	2981 (±1706)	1706 (1427)	0.362	28.09 (±52.39)	8.01 (29.59)	0.323
Misinformation	198 (39.6%)	3530 (±1643)	1643 (1816)		30.47 (±57.12)	9.05 (35.57)	

Source: Authors.

Table 2. Distribution of the dichotomized categories of total interaction, overperforming score, time of publication, author's profile, sentiment, motivation, and facticity according to the dichotomized categories of the aim of content (chi-square test, $P < 0.05$). Distinct superscript lowercase letters indicate significant statistical differences between categories.

	Aim of content		X^2	P
	Prevention	Treatment		
	n = 336	n = 164		
Total interaction				
≤ 1,659	176 (70.4%)[a]	74 (29.6%)[a]	2.323	0.127
> 1,659	160 (64.0%)[a]	90 (36.0%)[a]		
Overperforming score				
≤ 8.61	171 (68.1%)[a]	80 (31.9%)[a]	0.197	0.657
> 8.61	165 (66.3%)[a]	84 (33.7%)[a]		
Time of publication				
≤ 1479 days	175 (70.0%)[a]	75 (30.0%)[a]	1.778	0.182
> 1479 days	161 (64.4%)[a]	89 (35.6%)[a]		
Author's profile				
Regular users	10 (34.5%)[a]	19 (65.5%)[b]	14.951	<0.001*
Business	326 (69.2%)[a]	145 (30.8%)[b]		
Sentiment				
Negative/neutral	110 (63.6%)[a]	63 (36.4%)[a]	1.569	0.210
Positive	226 (69.1%)[a]	101 (30.9%)[a]		
Motivation				
Noncommercial	283 (63.7%)[a]	161 (36.3%)[b]	21.547	<0.001*
Commercial	53 (94.6%)[a]	3 (5.4%)[b]		
Facticity				
Information	202 (66.9%)[a]	100 (33.1%)[a]	0.340	0.854
Misinformation	134 (67.7%)[a]	64 (32.3%)[a]		

Source: Authors.

motivation. Concomitantly, business profile and positive sentiment were predictors of higher engagement of Facebook users. These findings support our hypothesis that social media users are more likely to engage with dental caries-related posts that express positive sentiment.

A previous systematic review[33] showed that social media platforms contain an average of 36.5% of health misinformation, which is similar to our findings (39.6%). According to Grinberg *et al.*[4], misinformation spreads 70% more than true news. This means that people are more likely to believe in misinformation than accurate information, particularly when the false news is consistent with their political opinions[34]. This phenomenon aligns with the theory of innovations, which describes how new behaviors, practices, opinions, conventions, or technologies spread from person to person through social relationships[35]. Other factors that contribute to the spread of misinformation include individuals' lack of reflexivity regarding the accuracy of the information[3], and overconfidence that prevents people from slowing down and engaging in reflective reasoning[36]. Additionally, belief in fake news is also associated with delusionality, dogmatism, religious fundamentalism[38], bullshit receptivity, and overclaiming[38].

One important factor to consider is the confirmation bias that people experience, which is the tendency to favor information that confirms their pre-existing beliefs and to reject information that contradicts them[39]. As a result, individuals may be more inclined to believe poorly supported claims that align with their strongly held beliefs[40]. Moreover, the availability heuristic is also relevant, as it involves the likelihood of believing information based on previous exposure to it[41]. In fact, a single exposure to a headline containing misinformation can increase people's later belief in the headline[42].

Based on our study, it can be inferred that people tend to believe information from profiles they consider trustworthy, which is consistent with previous research indicating that users perceive business pages on Facebook as high-

Table 3. Distribution of the dichotomized categories of total interaction, overperforming score, time of publication, author's profile, sentiment, aim of content, and motivation, according to the dichotomized categories of facticity (chi-square test, $P < 0.05$). Distinct superscript lowercase letters indicate significant statistical differences between categories.

	Facticity			
	Information	Misinformation	X^2	P
	n = 302	n = 198		
Total interaction				
≤ 1,659	150 (60.0%)[a]	100 (40.0%)[a]	0.033	0.855
> 1,659	152 (60.8%)[a]	98 (39.2%)[a]		
Overperforming score				
≤ 8.61	156 (62.2%)[a]	95 (37.8%)[a]	0.646	0.421
> 8.61	146 (58.6%)[a]	103 (41.4%)[a]		
Time of publication				
≤ 1,479 days	149 (59.6%)[a]	101 (40.4%)[a]	0.134	0.715
> 1,479 days	153 (61.2%)[a]	97 (38.8%)[a]		
Author's profile				
Regular users	18 (62.1%)[a]	11 (37.9%)[a]	0.036	0.850
Business	284 (60.3%)[a]	187 (39.7%)[a]		
Sentiment				
Negative/neutral	122 (70.5%)[a]	51 (29.5%)[b]	11.327	< 0.001*
Positive	180 (55.0%)[a]	147 (45.0%)[b]		
Aim of content				
Prevention	202 (60.1%)[a]	134 (39.9%)[a]	0.034	0.854
Treatment	100 (61.0%)[a]	64 (39.0%)[a]		
Motivation				
Noncommercial	278 (62.6%)[a]	166 (37.4%)[b]	8.114	0.004*
Commercial	24 (42.9%)[a]	32 (57.1%)[b]		

Source: Authors.

Table 4. Multiple logistic regression models for facticity and overperforming score.

	B[a]	S.E.[b]	Wald	P	OR[c]	95%IC	
						LCI	UCI
Model 1: Facticity (misinformation)							
Sentiment (positive)	0.575	0.206	7.817	0.005	1.778	1.188	2.661
Type of content (commercial)	0.613	0.295	4.321	0.038	1.846	1.036	3.292
Constant (y-intercept)	-0.880	0.167	27.806	< 0.001	0.415		
Model 2: Overperforming score (> 8.61)							
Sentiment (positive)	0.689	0.194	12.658	< 0.001	1.992	1.363	2.912
Profile (business)	1.105	0.449	6.063	0.014	3.020	1.253	7.279
Constant (y-intercept)	-1.509	0.452	11.119	< 0.001	0.221		

[a] Unstandardized coefficient. [b] Standard error. [c] Odds ratio.

Source: Authors.

ly reliable[43]. Furthermore, our findings suggest that positive sentiment is a significant predictor of higher diffusion of posts and that misinformation tends to be emotionally evocative, eliciting strong reactions, as reported by Kozyreva[44]. This is in line with previous studies that have shown that individuals who experience more emotions, both positive and negative, are more likely to believe in false news[45]. The prevalence of positive emotions observed in our study may be attributed to the diverse range of content, including prevention and seemingly miraculous

treatments, which is reminiscent of previous research on cancer-related misinformation[16].

The association between commercial motivation and misinformation is worth considering, as social media engagement metrics such as likes and shares have been found to enhance the credibility of news content, particularly when it comes to misinformation[46]. This means that popular commercial pages with high engagement rates can leverage their social media popularity to sell questionable products (such as fluoride-free dental products, purportedly to prevent cavities), which may still attract a high rate of consumers who believe in the veracity of the information presented[47].

Some limitations to this study should be considered. Firstly, we limited our analysis to posts written in Brazilian Portuguese. As a result, it is possible that the cultural nuances and characteristics unique to this language and region could have impacted the factors linked to the dissemination of information on dental caries. Secondly, although videos are known to have high engagement rates similar to photos[48], we did not include them in this investigation due to the challenges associated with obtaining and analyzing the full-length content available on this media accurately. In addition, the sample size of our study was restricted due to the difficulties that arise when conducting content analysis through human evaluation. We had to take into account the feasibility of manually classifying datasets, which is in line with the methodology adopted in previous investigations[15, 49].

In conclusion, these results indicate a significant proportion of dental caries-related posts containing misinformation, particularly those associated with positive emotions and commercial motivation. Moreover, positive emotions and business profiles are significant predictors of higher post dissemination. Thus, it is crucial to implement specific policies aimed at ensuring quality information on social media. This can be achieved through various measures, such as developing appropriate content, promoting critical thinking when consuming health-related information, and filtering information using technology-based solutions.

Collaborations

Conceptualization: T Cruvinel; data curation: M Remiro; formal analysis: M Lotto; investigation: M Remiro and OS Jorge; methodology: T Cruvinel; project administration: T Cruvinel; supervision: T Cruvinel; visualization: M Lotto and T Cruvinel; writing – original draft: M Remiro; writing – review and editing: OS Jorge, M Lotto, TM Oliveira, MAAM Machado and T Cruvinel.

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