UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

ANNA PAOLA STRIEDER

A influência das crenças odontológicas no tratamento odontopediátrico

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“You have so much
but are always hungry for more
stop looking at everything you don't have
and look around at everything you do”
Rupi Kaur

RESUMO

As crenças em saúde têm sido frequentemente relacionadas ao aumento do medo e ansiedade odontológica. Tais crenças são fortemente influenciadas pelo conhecimento leigo construído com base em opiniões e publicações encontradas nos meios de comunicação de massa. Este estudo foi dividido em duas fases, objetivando (1) a produção de evidência baseada em uma revisão sistemática meta-analítica sobre a relação entre as crenças negativas e o medo e ansiedade odontológica, e (2) avaliar os interesses dos usuários do Google sobre o emprego de colares de âmbar para aliviar os sintomas da erupção dentária em crianças de diferentes países. Na primeira fase, estudos observacionais foram recuperados nas bases de dados Cochrane, Embase Search, Portal BVS, Clinical Trials, Ovid, Open Grey, PubMed, Scopus e Web of Science, e foram verificados manualmente para a inclusão de artigos adicionais de interesse. A avaliação da qualidade dos estudos foi realizada pela aplicação de três diferentes versões da Escala Newcastle-Ottawa, para estudos de coorte, caso-controle e transversal. Apenas estudos com baixo ou moderado risco de viés contribuíram para metanálise. Na segunda fase, dados computacionais relacionados ao colar de âmbar gerados a partir da atividade de usuários do Google de 17 países foram coletados pela aplicação da ferramenta Google Trends. Quatro estratégias de busca foram definidas em inglês, espanhol, português e italiano, para recuperar a variação mensal do Relative Search Volume (RSV) entre janeiro de 2004 e setembro de 2018, incluindo todas as categorias e fontes de pesquisa. As tendências do volume de buscas e predições de 12 meses foram obtidas pela construção de modelos ARIMA, enquanto a influência da sazonalidade mensal e trimestral foi avaliada por modelos aditivos generalizados (GAM). Valores de $P<0,05$ foram considerados significativos. A presença de crenças negativas na saúde está diretamente relacionada ao aumento do medo e ansiedade odontológicos. No entanto, esses achados são apoiados em estudos com risco de viés indefinido ou moderado. Em relação ao interesse pelo uso do colar de âmbar, as curvas RSV foram caracterizadas por tendências de alta na maioria dos países estudados ao longo dos anos, sem a influência da sazonalidade mensal ou trimestral. As buscas foram frequentemente associadas ao desejo de informações adicionais, no que diz respeito à definição, usabilidade e alívio dos sintomas

causados pelas jóias de âmbar. Em conclusão, a presença de crenças negativas na saúde está diretamente relacionada ao aumento do medo e ansiedade odontológicos. Além disso, os resultados indicam um interesse crescente dos usuários do Google em tópicos relacionados ao colar de âmbar. Nesse sentido, a atividade da Internet pode ser usada como uma importante fonte de dados para monitorar crenças e comportamentos odontológicos de diferentes populações, orientando os formuladores de políticas e os provedores de serviços odontológicos a desenvolver e implementar intervenções focadas nas necessidades e na segurança dos usuários de saúde.

Palavras-chave: Crenças. Comportamento. Erupção dentária. Internet. eHealth.

ABSTRACT

The influence of dental beliefs on pediatric dentistry treatment

Health beliefs have often been related to the increase of dental fear and anxiety. Such beliefs are strongly influenced by lay knowledge built on the basis of opinions and publications found in mass media. This study was divided in two phases, aiming to (1) produce evidence based on a systematic meta-analytic review of the relationship between negative beliefs and dental fear/anxiety, and (2) to evaluate the interests of Google users on the use of amber necklaces to alleviate teething symptoms in children from different countries. In the first phase, observational studies were retrieved by Cochrane, Embase Search, Portal da BVS, Clinical Trials, Ovid, Open Grain, PubMed, Scopus and Web of Science, and were manually checked for inclusion of additional articles of interest. The quality evaluation of the studies was performed by applying three different versions of the Newcastle-Ottawa Scale, for cohort, case-control and cross-sectional studies. Only studies with low or moderate risk of bias contributed to meta-analysis. In the second phase, computational metadata related to the amber necklace generated from the activity of Google users of 17 countries were collected from the tool Google Trends. Four search strategies were defined in English, Spanish, Portuguese and Italian to retrieve the monthly variation of the Relative Search Volume (RSV) between January 2004 and September 2018, including all categories and sources of search. The trends of interests and their respective 12-month predictive models were constructed by ARIMA models, and monthly and quarterly seasonal influences by generalized additive models (GAM). Values of $P<0.05$ were considered significant. Based on these results, the presence of negative beliefs in health was directly related to the increase of dental fear and anxiety; however, these findings are supported in studies with unclear/moderate risk of bias. Regarding the interests on amber necklace, RSV curves were characterized by upward trends in most studied countries over the years, without the influence of seasonality. The queries were often associated with the desire for additional information, regarding the definition, usability and relief of symptoms caused by amber jewelries. In conclusion, negative health beliefs are directly related to the increase of dental fear and anxiety. Also, the results indicate an

increasing interest of Google users in topics related to the amber necklace. In this sense, Internet activity can be used as an important source of data to monitor the beliefs and behaviors of different populations, aiding policy makers and dental service providers to develop and implement interventions focused on the needs and safety of health seekers.

Keywords: Beliefs. Behavior. Tooth eruption. Internet. eHealth.

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1 INTRODUCTION

1 INTRODUCTION

All people have their own beliefs and practices about well-being and disease, and the explanation behind these social convictions is complex and multifactorial (Chhabra et al., 2012). For instance, myths are defined as stories shared by a group of people who are part of their cultural identity, exerting a strong influence on the way of life of individuals (Kushwah, 2007). Each culture has its peculiarities, its own traditions and particular convictions, which seem to be inflexible due to its nature of generational inheritance, presenting a real effect on the population and in some cases, having a significant impact on health conditions (Putland et al., 2011)

Little is known about oral beliefs and other interpersonal and cultural factors that may influence health behaviors (Kvale et al., 1997; Skaret et al., 2000). According to Milgrom et al. (1995), the understanding of dental beliefs and the reason for their occurrence can provide important information and suggestions to understand the specific desires of patients. In this regard, this study would like to draw attention to the growing popularity of amber necklaces as "amulets" that promise remission of teething symptoms, despite their risk of suffocation (Markman, et al., 2009).

Despite significant changes in dental practice and increasing awareness of the repercussions of dentist's fear, the level of dental fear in the population did not decrease significantly during decades (Smith et al., 2003). These feelings were first described by Freidson & Feldman (1958), being linked with various psychological and social factors (Abrahamsson et al., 2002). People who are extremely fearful of dentists avoid periodic dental appointments, with gaps between visits longer than 3 years, which reveal treatment delays with patients seeking treatments only in case of pain (Schüller et al., 2003). The costs and fear are the main causes of dental treatment avoidance, representing 75.4% and 36.9% respectively (Kaakko, 1999). One of the main factors that interfere with patient’s behaviors is their belief about discomfort felt during dental care (Nathan, 2001). In addition, fear of dental environments occurs due to previous negative experiences (Kleinknecht et al., 1973),

which are also related to negative dental beliefs (Moore et al., 1991). Hence, dental treatment situations need to be postioned within this cultural context, since they present a potential to trigger stress and anxiety (Poulton et al., 1998), representing important barriers to adequate care offered by dental professional teams.

2 ARTICLES

2 ARTICLES

This dissertation is presented in a format of two manuscripts, written according to the instructions and guidelines of the *Clinical Oral Investigations* and *International Journal of Paediatric Dentistry*, respectively.

- ARTICLE 1 – Is there a relationship of negative oral health beliefs with dental fear and anxiety regarding diverse dental patient groups? A systematic review and meta-analysis

- ARTICLE 2 – Digital behavior surveillance for monitoring the interests of Google users in amber necklace in different countries

Is there a relationship of negative oral health beliefs with dental fear and anxiety regarding diverse dental patient groups? A systematic review and meta-analysis

Abstract

Objectives: This systematic review and meta-analysis aimed to critically appraise the evidence on the relationship of oral health beliefs with dental fear and anxiety in distinct patient groups. **Materials and Methods:** Observational studies were retrieved by Cochrane, Embase Search, Portal BVS, Clinical Trials, Ovid, Open Gray, PubMed, Scopus, and Web of Science, and they were manually checked for the inclusion of additional articles of interest. The assessment of quality of studies was performed by the application of three different versions of the Newcastle-Ottawa Scale, for cohort, case-control, and cross-sectional studies. Only studies with low or unclear/moderate risk of bias contributed to meta-analyses, regarding the analysis of random effects of mean differences of dental beliefs scores between dental fear/anxiety and control groups, and the correlation of dental beliefs with dental fear and anxiety measures. **Results:** Of 276 articles initially retrieved, 10 were included in the systematic review, while only 6 studies with unclear/moderate risk of bias were considered in meta-analyses. The mean difference of dental beliefs effects was higher in patients with dental fear and anxiety compared to controls (1.20; 95% CI:0.27–2.14; *P*=0.01). Additionally, a moderate positive correlation was observed between dental beliefs and dental fear measures (r=0.54, 95% CI:0.47-0.60; *P*<0.001). **Conclusions:** Based on these results, the presence of negative health beliefs is directly related to the increase of dental fear and anxiety; however, these findings are supported in studies with unclear/moderate risk of bias. **Clinical Relevance:** Dental fear and anxiety is an important obstacle for the access of dental treatment and patient-dentist relationship, leading to inadequate oral health levels.

Keywords: Dental Fear; Dental Anxiety; Beliefs; Health Behavior

INTRODUCTION

Despite the evolution of practices and knowledge, including the awareness on the relevance of negative feelings and stress to unsuccessful dental treatments, odontophobia did not decrease significantly during the last decades [1]. Indeed, fear and anxiety are usually observed among children, adolescents and adults who need clinical interventions [2, 3], leading to the development of barriers between dentists and patients [4]; consequently, they constitute significant obstacles for the quality of dental service and dental care-seeking [5]. It is noteworthy that people with considerable dental fear and anxiety levels, and frequent avoidance of care present high risk of experiencing oral health problems with negative psychosocial consequences [6].

The genesis of dental fear and anxiety involves psychological and social factors as parts of the cultural identity of people, such as general traditions, myths and beliefs [7, 8]. For instance, lay knowledge shows a strong influence on the construction of lifestyles of individuals [9]. In this sense, decisions as how and when seeking treatment for specific oral diseases are taken within a subjective context of experiences that create “the image of dentists”, regarding some characteristics linked to communication capacity, ethics, and trust [10, 11]. However, little is known about the influence of oral health beliefs on behaviors and feelings related to health professional care, especially dental fear and anxiety [12, 13]. This also includes concerns about the risk of bias of available works, in respect to their design, sample size, selection criteria of participants, comparability of groups, and analysis of results; this information is crucial to indicate the need of new studies towards a strong body of evidence, covering relevant aspects that might be neglected in previous investigations.

The elucidation of this evidence could contribute to the recognition of patient's specific needs, reducing negative perceptions and clinical stress with the aim of improving the interaction between patients and dental team [14]. In this favorable scenario, patients are conducted through the establishment of novel routines based on health promotion and prevention, which lead to more comfortable and successful treatments [15].

Therefore, this systematic review and meta-analysis aimed to critically appraise the evidence on the relationship of oral health beliefs with dental fear and anxiety in diverse patients groups. The null hypothesis of this study is that the levels of negative

oral health beliefs are not related to the levels of dental fear and anxiety, regarding the differences of dental beliefs scores between dental fear/anxiety and controls (*H0'*), and the correlation of measures (*H0''*).

MATERIALS AND METHODS

This systematic review was registered in PROSPERO (#CRD42018091559). The authors followed the recommendations of the PRISMA statement [15] and MOOSE guidelines [16] for reporting the present results. The question of this review can be stated as *"Is there a relationship between negative oral health beliefs and dental fear/anxiety considering diverse patient groups?"*.

Bibliographic sources and search strategy

On February 08, 2018, references were retrieved from nine electronic bibliographic databases, Cochrane, Embase Search, Portal BVS, Clinical Trials, Ovid, Open Gray, PubMed, Scopus, and Web of Science. The search strategy was comprised by the combination of 13 terms as follows: ("dental beliefs" OR "dental principles" OR "dental opinion" OR "dental beliefs survey" OR "revised dental beliefs survey") AND ("dental anxiety" OR "dental fear" OR "dental phobia" OR odontophobia OR "dental concern" OR "dental apprehension" OR "dental terror" OR "dental worry").

Eligibility Criteria

The studies that followed the aspects showed below were included in this analysis.

1- Participants: any participants or population were eligible, independently of target population;

2- Intervention: all studies focused on the relationship between oral health beliefs and dental fear and anxiety;

3- Study design: observational studies;

4- Publication date: the studies were selected regardless of the date of publication;

5- Language: articles written in all languages were included in this review.

Studies were uploaded into Endnote Web® (www.myendnoteweb.com). Titles and abstracts of references retrieved were selected by two independent researchers to identify eligible documents. In cases of divergence of judgment, the reviewers discussed the inclusion until reaching a consensus. Duplicate references, literature

reviews and instrument validation articles were excluded from the analysis. To identify possible references not retrieved by databases, the references of all selected studies were checked manually.

Risk of bias

The risk of bias was assessed using three different versions of the Newcastle-Ottawa Scale [17] instrument, for cohort [18], case-control [18], and cross-sectional studies [19]. These versions are divided in three different sections: selection, comparability, and exposure/outcome. The structures of star-based scores differ from cohort and case-control studies to cross-sectional studies, with maximum scores of 9★ and 10★ respectively. For the comparison of studies, these divergences were solved considering two measures applied to the interpretation of NOS for cross-sectional studies: i) the risk of bias related to "the ascertainment of the exposure" was considered low in studies that employed validated measurement tools or non-validated measurement tools, but the tool was available or described; and ii) considering "the assessment of the outcome", studies granted with 2★ were classified as low risk of bias in exposure/outcome 1 and 2, studies granted with 1★ were classified as low risk of bias in exposure/outcome 1 and as unclear risk in exposure/outcome 2, and studies without stars in this criterion were classified as high risk of bias in exposure/outcome 1 and 2. Therefore, all included studies were evaluated by eight criteria of risk of bias, with the maintenance of the original number of stars. Studies that summed one to three stars were categorized as low quality, four to six stars were categorized as unclear/moderate quality, and seven to ten stars were categorized as high quality [17]. See more details in results.

Data extraction

Data extraction was performed by two independent reviewers, with disagreements solved by discussion. For each selected article, the following information was collected: author names, year of publication, country of studies, study design, number and age of participants, type of dental fear and anxiety measurement tool, type of dental beliefs measurement tool, study groups, and synthesis of results.

Meta-analysis

The meta-analyses were performed on the studies considered low and unclear/moderate risk of bias using the tools RevMan version 5.3 (Cochrane, London, UK) and MedCalc (MedCalc, Ostend, Belgium). For these analyses, four categories of data were collected from selected articles: a) mean dental beliefs scores for dental fear/anxiety and control groups, b) standard deviation of those dental beliefs scores, c) correlation between dental fear/anxiety and dental beliefs measures, and d) number of participants. The standard mean difference and its 95% confidence interval (CI) were defined to calculate the absolute difference between two distinct groups of cohort or case-control studies. Pearson's coefficient correlation and its 95% CI were established to show the absolute correlation found between dental beliefs and dental fear/anxiety. The random effects model was chosen, supported by both clinical differences and outcomes measures. The between-study heterogeneity/inconsistency was assessed by inspecting the forest plot and calculating Tau^2, Chi^2, and I^2 statistics.

RESULTS

Selection of articles

A total of 268 articles were retrieved from electronic bibliographic databases, as follows: PubMed (n=32), Embase (n=33), OVID (n=9), Scopus (n=42), Portal BVS (n=31), Open Gray (n=36), Cochrane (n=2), Clinical Trials (n=56), and Web of Science (n=27). The titles and abstracts of all studies were analyzed to the exclusion of duplicates (n=88) and articles not related to the present analysis (n=142). The judgment about the inclusion of 11 references was divergent between both investigators, being 9 of them subsequently included after achieving consensus.

After manually checking the references of the 38 remaining articles, 8 studies of interest not previously retrieved by databases were included in the sample. Literature reviews, letters, guidelines and experimental studies (n=24) were not considered for further analyses. Then, 22 articles were assessed for eligibility, of which 12 were excluded due to the absence of a control group for patients with dental fear and anxiety (n=6), the lack of a direct relationship with the specific objectives of this work (n=4), and the overlapping of sample (n=2). Finally, 10 studies were selected for the qualitative analysis (Figure 1).

Characteristics of included studies

The characteristics of studies analyzed qualitatively are expressed in Table 1. All articles were published in English between 1990 and 2015, reporting cohort (n=1), case–control (n=2) and cross-sectional (n=7) studies, which were developed in Europe (n=7), USA (n=1), New Zealand (n=1), and India (n=1). These studies covered 5,257 participants, with sample sizes ranging from 41 to 1,564 individuals, and ages between 3 and 80 years-old. One study assessed children, while 3 and 8 studies assessed adolescents and adults, respectively. Seven different dental fear and anxiety measurements were employed, while 4 distinct ways were adopted to analyze dental beliefs. Six studies demonstrated a positive correlation between dental beliefs and dental fear/anxiety measures, varying from weak (r=0.32) to strong (r=0.74) levels. Also, 4 studies demonstrated greater levels of negative dental beliefs among patients diagnosed with dental fear and anxiety in comparison with control groups.

Risk of bias

The assessment of risk of bias of individual studies is depicted in Figure 2. The quality scores varied between 2★ and 6★, with 4 studies classified as high risk of bias and 6 studies classified as unclear/moderate risk of bias. An overview of authors' judgments concerning each risk of bias is presented in Figure 3. The criteria that were predominantly rated as high risk of bias (≥50%) were selection 2 and 3, and exposure/outcome 3, i.e., related to selection of the non-exposed cohort (for cohort studies), selection of controls and non-response rate (for case-control studies), and sample size, non-respondents information and statistical test description (for cross-sectional studies).

Meta-analysis

Only the 6 studies classified as unclear/moderate risk of bias were included in the meta-analyses, of which 1 cohort, 2 case-control and 3 cross-sectional studies. Figure 4a summarizes the mean effect of dental beliefs scores comparing dental fear/anxiety and control groups of 3 studies. The standardized mean difference of dental beliefs effects was higher in patients with dental fear and anxiety compared to controls (1.20; 95% CI: 0.27-2.14; P=0.01). The analysis of heterogeneity between studies showed values of Tau^2= 0.62, Chi^2= 39.62, and I^2=95% (P<0.001). A

sensitivity analysis was performed without the observation of a considerable reduction of the heterogeneity (I^2 index varied from 86% to 96%).

Figure 4b shows the absolute correlation between dental fear and dental beliefs measures of 3 studies. The correlation coefficient was 0.54 (95% CI: 0.47-0.60; *P*=0.03). The analysis of heterogeneity between studies showed values of Chi^2= 7.28 and I^2=72.5% (*P*<0.001).

DISCUSSION

These findings indicate that patients with negative oral health beliefs are more prone to be diagnosed with dental fear and anxiety (effect size=1.20). Moreover, a moderate positive correlation was observed between dental beliefs and dental fear measures (r=0.54). However, this evidence was determined through a heterogeneous sample of studies, classified as unclear/moderate risk of bias. To our knowledge, this is the first systematic review that supported the relationship of oral health beliefs with dental fear and anxiety.

Indeed, dental fear and anxiety are different reactions distinguished by the strong desire to escape the fearful stimulus against to a tendency to worry about dental treatment [25]. Despite that, they can be originated from the subjective views of incapacity to cope with the negative outcomes of anticipated physical or psychosocial danger [20]. These catastrophizing thoughts may be more important to the onset of a cyclical pathway of fear and anxiety than the occurrence of a specific event, leading individuals to avoid dental treatment. In this situation, the insufficient preventive care can trigger invasive and discomfort appointments, exacerbating fear/anxiety and avoidance of treatment [24]. Some beliefs-related factors are considered predictors to dental fear and anxiety, such as the perceptions of lack of control and painful treatments [25], longer intervals between treatment [24], poor dentist-patient relationship [23], and perceived negative behavior of the dentist [28]. From this perspective, the self-instructional training could be a beneficial approach to prevent negative beliefs of dental patients [29].

Although these results indicate a unanimous relationship of oral health beliefs with dental pain and anxiety, two different levels of heterogeneity emerged from these meta-analyses: a considerable level for differences between dental fear/anxiety and control groups (I^2>75%), and a substantial likelihood of heterogeneity (I^2=50%-90%) for correlations between oral health beliefs and dental fear measures [30]. These

results could be explained by a greater number of methodological similarities detected among aggregated correlation outcomes, such as design (cross-sectional studies), age group (adolescents) and measurement tools (Dental Fear Scale and Dental Beliefs Survey) [24, 27, 28]. On the other hand, different cultures and designs (cohort *vs.* case-control studies), vast age ranges (3-73 yrs.), and varied measurement scales (Dental Anxiety Scale *vs.* open direct questions) and sample sizes (from 41 to 1,037 participants) contributed to increase the true difference in effect sizes between groups of patients with and without dental fear and anxiety. Additionally, the sensitivity analysis performed by the systematic exclusion of references [20, 23, 25] was not able to sufficiently decrease the heterogeneity. Other factors could justify these findings, such as the diversity of sociodemographic characteristics and psychological factors. In this sense, 4 out of 10 studies revealed a gender-dependency of dental fear, with higher scores detected in female group [5, 26-28], while 2 out of 10 studies showed greater oral health beliefs scores among males [22, 24]. Also, the increment of age may be associated with the decrease of dental fear levels [26]. Finally, two studies showed that the general fear outcomes were positively related to dental fear and anxiety levels [27, 28]. In these cases of non-identical designs and interventions between studies, the employment of random-effects models are preferred since they account by spurious and real dispersion, summarizing their results by an estimation of the average treatment effect with the consideration of its heterogeneity in uncertainty levels [31].

The six references included in meta-analyses were classified as overall unclear/moderate risk of bias, varying from 4 to 6 stars, i.e., it was not possible to provide sub-analyses of exclusively high quality studies. Alternatively, these comparisons could be performed regarding individual criteria of measurement tools, since 55.2% of all items of Newcastle-Ottawa Scales were evaluated as low risk of bias. This percentage represents that at least two studies were classified as sound in each criterion. Notwithstanding, as results invariably demonstrated a positive relationship between oral health beliefs and dental fear/anxiety, an extensive overview of data is unnecessary for the establishment of an adequate synthesis of evidence.

Two aspects deserve attention. First, the secondary results of a cross-sectional study that investigated the factors related to dental avoidance was considered in this meta-analysis [27]. The interpretation of secondary results could be problematic because

the possible differences of sample, groups and interventions found between specific and non-specific studies, although the exclusion of those data also could inadvertently weaken this evidence. This decision was corroborated by the observation that the heterogeneity of correlation analysis was not significantly increased with this inclusion. Second, these findings are almost totally based on researches performed in developed countries before the advent of information and communication technologies (ICTs), presenting only one study in a developing country [22] and two studies that were published in the last 10 years [26, 28]. The consumption of misleading knowledge on the Internet could deteriorate the patient-dentist relationship, which could contribute to the increase of dental fear and anxiety. This problem could be especially accentuated in countries with social inequalities, with a great number of people under risk of low health literacy [32].

Some recommendations can be illustrated with basis on the aforementioned findings: a) additional studies should be performed in developing countries to confirm the validity of these outcomes, which were essentially obtained in developed countries; b) novel studies should consider the investigation of the influence of ICTs on the binomial oral health beliefs/dental fear-anxiety; c) new prospective cohort studies should be designed considering the evaluation of oral health beliefs before the onset of dental fear/anxiety; d) the authors should attempt to the criteria presented by Newcastle-Ottawa Scales [17-19], to reduce the risk of bias mainly related to sample selection, sample size, non-respondents information and detailed description of statistics; e) oral health beliefs and dental fear/anxiety should be scored by the application of culturally adapted and validated measurement tools instead of the use of open questions.

Taking into account the differences between groups and the correlation of measures, negative oral health beliefs seemed to influence directly the levels of dental fear and anxiety; therefore, the hypotheses *H0'* and *H0''* were rejected. However, the quality of observational studies included in this review was generally considered as unclear or moderate. Further high-quality studies are needed to elucidate the present relationship under effect of relatively new technological and cultural changes.

Compliance with Ethical Standards

Conflict of Interest: Author Anna Paola Strieder declares that she has no conflict of interest. Author Thaís Marchini Oliveira declares that she has no conflict of interest. Author Daniela Rios declares that she has no conflict of interest. Author Agnes Fátima Pereira Cruvinel declares that she has no conflict of interest. Author Thiago Cruvinel declares that he has no conflict of interest.

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TABLES

Table 1. Characteristics of all included studies

Study ID (Country)	Design	Age (years)	Sample size	Dental Fear and anxiety measures	Dental Beliefs measures	Groups	Synthesis of results
de Jongh et al., 1994 [20] (Netherlands)	Case-control	18-73	n=41	DAS*, PAQ†	DCI‡	Low-anxiety (n=17) High-anxiety (n=24)	Mean score for negative cognition was significantly greater in high anxiety group (14.0±4.0) in comparison with low anxiety group (4.4±3.8) (*P*<0.001)
de Jongh et al., 1995 [21] (Netherlands)	Cross-sectional	18-45	n=224	DAS	a tool containing statements such as expectations about pain, possible trauma, difficulty to treat, and feelings of nervousness during treatment	Group R - always having been relaxed about dental treatment (n = 106). Group A→R - once anxious about dental treatment but being relaxed (n=45) Group R→A - once relaxed about treatment but feeling anxious (n=28) Group A - always having been anxious about dental treatment (n=45)	Highly significant correlation between total number of negative thoughts and DAS scores (r=0.74, *P*<0.001).
Hathiwala et al., 2015 [22]	Cross-sectional	15-17	n=198	TIPI§	a psychological trait that indicates fear preventing dental visits	Participants with fear preventing a dental visit Participants without fear preventing a dental visit	MDBS mean score of participants with fear (37.6±8.5) was significantly higher than participants without fear (34.8±10.9) (*P*=0.047)

Johansson et al., 1993 [23] (Sweden)	Case-control	20-70	n=145	DAS	DBS¶	Emergency patients (n=69) Fear patients (n=76)	Dental anxiety (men 8.3±3.5; women 10.3±5.2) and dental beliefs scores (men 28.9±9.2; women 31.2±12.2) of participants from emergency clinic were statistically lower than those of participants from dental fear clinic (men 16.1±3.1; women 17.4±2.7 for dental anxiety; men 42.0±11.1; women 44.4±11.8 for dental beliefs)
Kunzelmann et al., 1990 [5] (Germany)	Cross-sectional	18-80	n=474	DAS	DBS	Pain patients (n=231) No pain patients (n=202) Not answer (n=41)	Dental anxiety and dental beliefs were weakly correlated (rs=0.39, *P*<0.001)
Milgrom et al., 1992 [24] (USA)	Cross-sectional	13-15	n=1564	DFS**	DBS	Singaporean children from six secondary schools	DBS and DFS scores were moderately correlated (r=0.58, *P*=0.0001)
Poulton et al., 2001 [25] (New Zealand)	Cohort	3-15, 18, 21 & 26	n=1037	Questions about feelings linked to dental fear and anxiety	MHLoC‡‡	Psychological and medical measures were obtained at 2 yrs. Interval from age 3 to 15 (n=1037), and subsequently at age 18 (n=993), 21 (n=992) and 26 (n=980)	Participants without dental fear presented a slightly higher MHLoC mean score (7.74±0.35) compared to participants with dental fear (7.64±0.32)

Raciene et al., 2003 [26] (Lithuania)	Cross-sectional	12-15	n=557	CDAS§§, DFS	DBS	Low fear (CDAS 4 - 8, DFS 24 - 55) Moderate fear (CDAS 9 - 14, DFS 56 - 88) High fear (CDAS 15 - 20, DFS 89 - 120)	DFS was weakly correlated with DBS (r=0.32, *P*<0.001)
Skaret et al., 1999 [27] (Norway)	Cross-sectional	12-20	n=754	DFS, GFS¶¶	DBS	High dental anxiety (n=169) High frequency of missed/cancelled appointments between 12-18 *yrs.* (n=124)	The correlation between DFS and DBS was moderate (r=0.50, *P*<0.001)
Stenebrand et al., 2013 [28] (Sweden)	Cross-sectional	15	n=263	DFS, GFS	DBS	Dental anxiety (n=14) No dental anxiety (n = 202)	DFS was correlated with DBS moderately (r=0.51, *P*<0.001)

*Dental Anxiety Scale
†The Photo Anxiety Questionnaire
‡Dental Cognitions Inventory
§Ten-Item Personality Inventory
¶Dental Beliefs Survey
**Dental Fear Survey
††Diagnostic Interview Schedule
‡‡Multidimensional Health Locus of Control Scale
§§Corah Dental Anxiety Scale
¶¶Geer Fear Scale

FIGURES

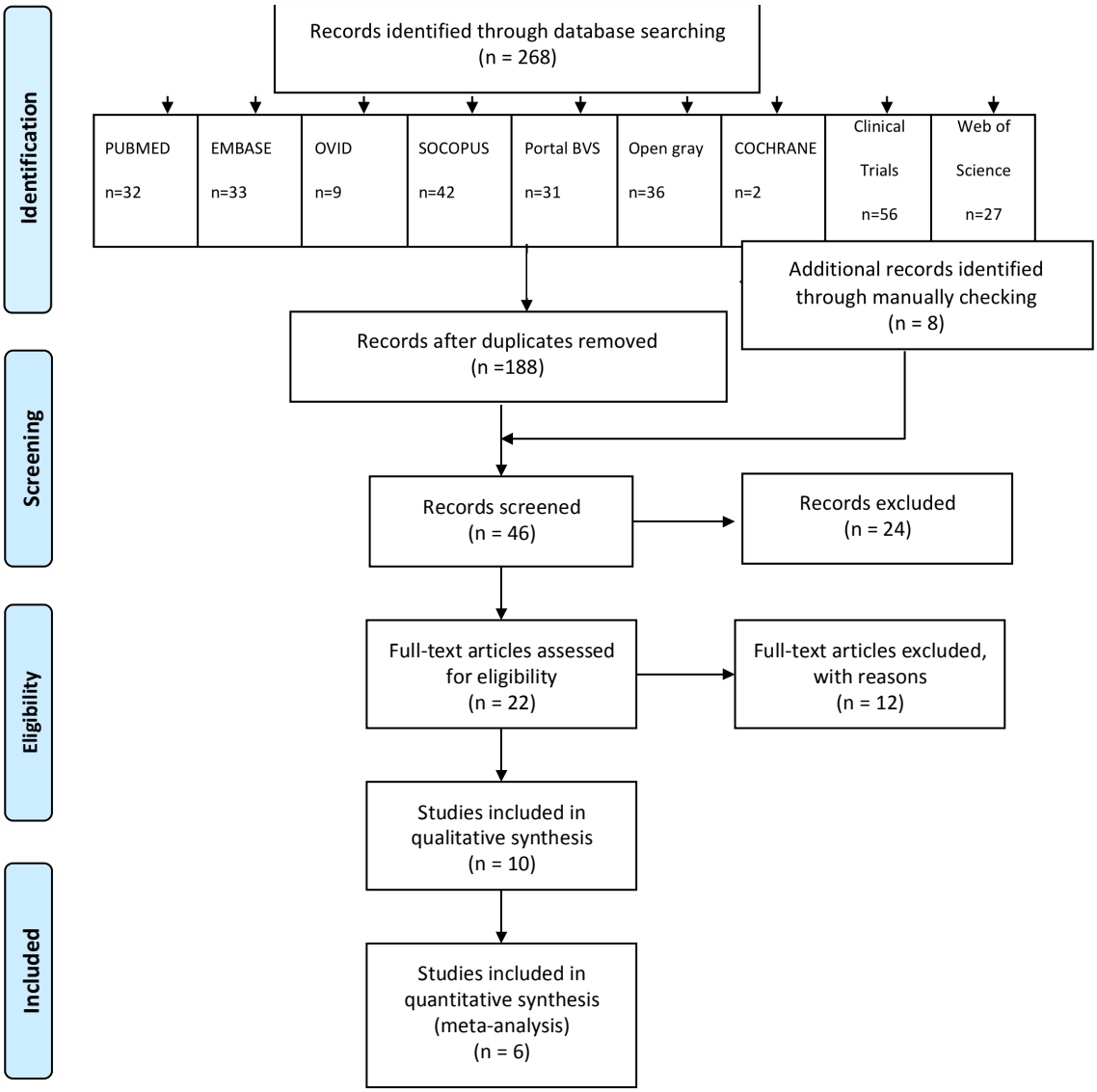


Fig. 1. Systematic review flow diagram.

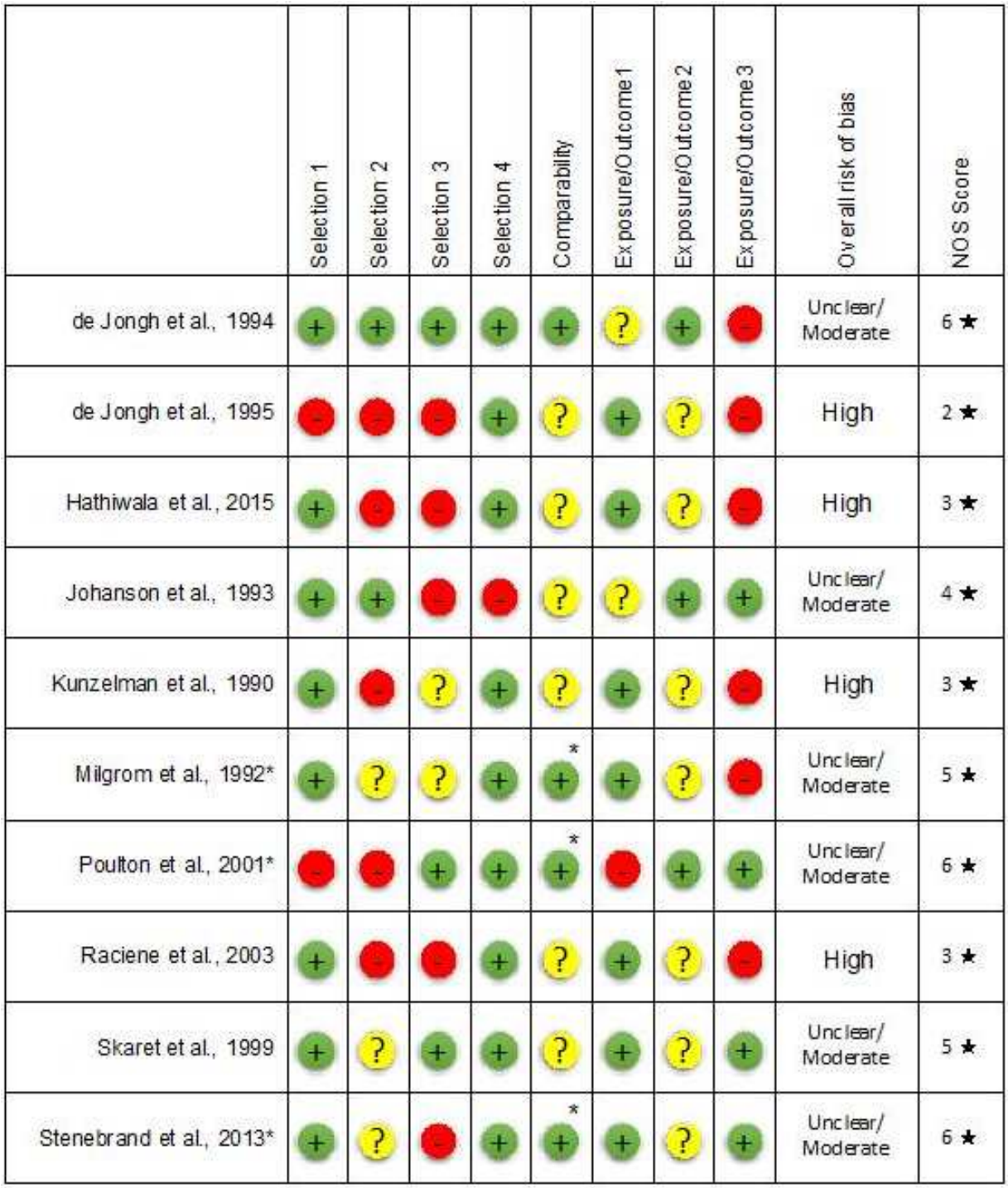


Fig. 2. Summary of risk of bias of all included studies. The qualitative analyses of studies were performed using three different versions of the Newcastle-Ottawa Scale for cohort, case-control and cross-sectional studies. Green signals indicate low risk of bias, yellow signals indicate unclear risk of bias, and red signals indicate high risk of bias. (*) represents criteria granted with two stars.

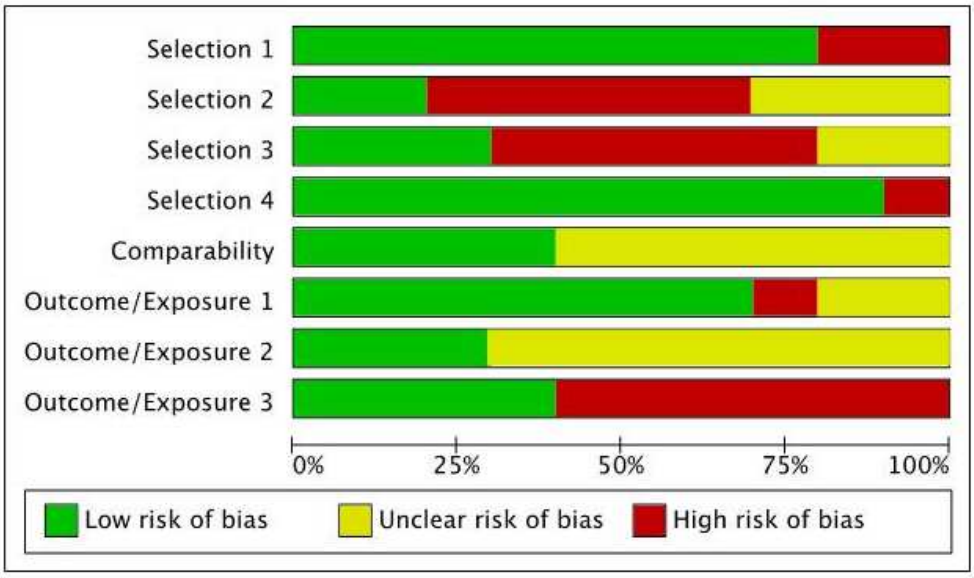
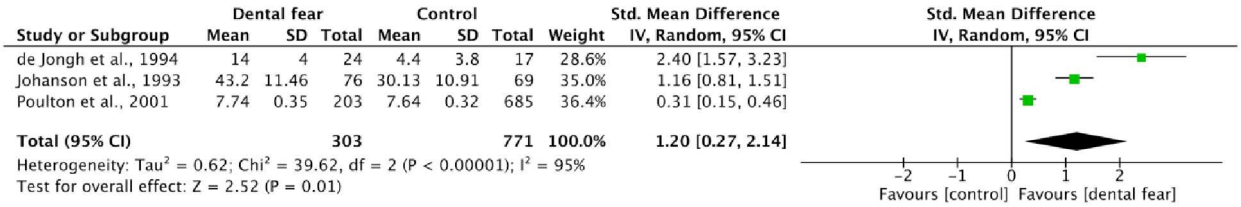


Fig. 3. Risk of bias. Review author's judgments about each risk of bias item presented as percentage across all included studies.

(a) Forest plot for mean differences between groups



(b) Forest plot for correlation between dental fear and dental beliefs measures

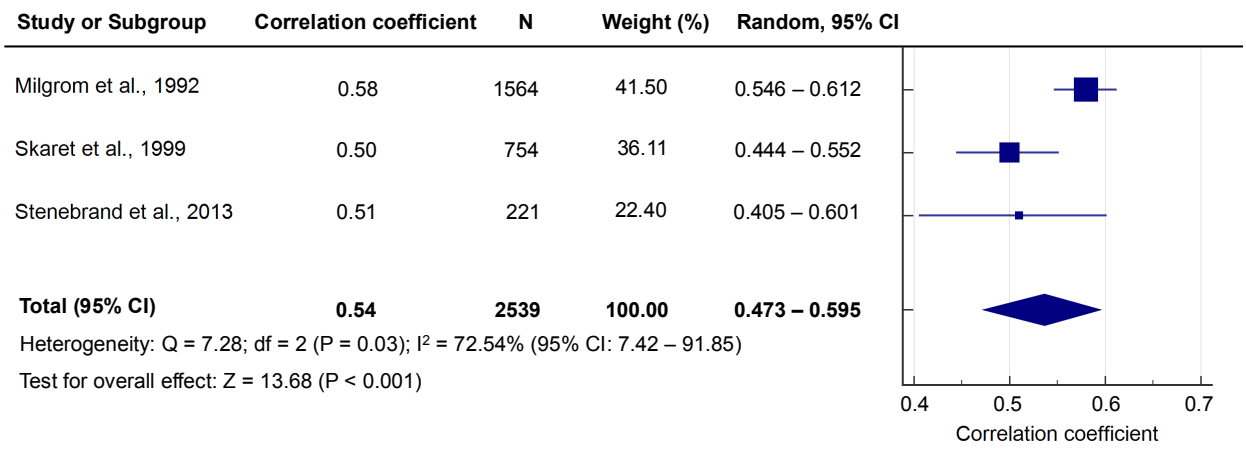


Fig. 4. (a) Forest plot for the overall mean difference of dental beliefs scores between dental fear/anxiety and control groups. (b) Forest plot for the overall correlation between dental fear and dental beliefs measures.

Digital behavior surveillance for monitoring the interests of Google users in amber necklace in different countries

ABSTRACT

Aim: To determine the interests of Google users in information about amber necklace in distinct countries over time.

Design: This longitudinal retrospective study analyzed the amber necklace-related computational data generated from the activity of Google users of 17 countries, by the application of Google Trends. Four search strategies were defined in English, Spanish, Portuguese and Italian, for retrieving the monthly variation of Relative Search Volume (RSV) between January 2004 and September 2018, including all categories and sources of search. Trends and 12-month predictive interests of users were analyzed by forecasting ARIMA models, while the influences of seasonality were evaluated by generalized additive models (GAM). The most popular queries employed for Google users were determined to qualitative analysis. *P* values < 0.05 were considered significant.

Results: In general, RSV curves were characterized by uptrends in most studied countries over the years, without the influence of monthly or quarterly seasonality. The queries were frequently associated with a desire for additional information, in respect to the definition, usability, and teething symptoms relief promoted by amber jewelries.

Conclusions: These findings indicate an increasing interest of Google users in amber necklace related topics in different countries.

Keywords: Beliefs, Behavior, Tooth Eruption, Primary Dentition, Telehealth, eHealth

INTRODUCTION

The personal lifestyles is strongly influenced by lay knowledge [1], constructed with basis on opinions and pieces of publications found in news media. Individuals commonly accept provided messages as true, even they are not necessarily compromised with accuracy [2], presenting a harmful tendency of repeating remarkable contents, which contribute to the increase of propagation and persuasion of information [3].

Parents are convinced that symptoms as drooling, appetite and sleep disturbance, agitated sleep, fever and diarrhea are caused by teething [4, 5], although manifestations related to tooth eruption are controversy [6]. In this sense, they are commonly interested in alternative strategies to decrease the suffering of their children, such as teething rings, gels, gum massage with herbal medicines [7], and even the administration of homeopathic medicines [8].

Within this context, some groups are advocating that amber bracelets or necklaces should be worn by children to relieve teething symptoms [9]. Amber is a natural resin, supposedly with a healing potential attributed to the succinic acid, as described by manufacturers: "*as the necklace warms with the body's natural temperature, amber releases its healing oils containing succinic acid, which are easily absorbed into the skin and then into the bloodstream. Baltic amber has some of the highest concentrations of succinic acid found in nature. Succinic acid is a natural component of plant and animal tissues, and its presence in the human body is beneficial in many ways"* [10]; however, there are no scientific reports supporting the effectiveness of amber necklaces to decrease teething discomfort. To make matters worse, the use of those necklaces can predispose children to strangulation and allergic reactions [11, 12].

Taking into account the influence of misinformation on the genesis of health beliefs that negatively impact on individuals' behaviors [13], and the utility of the interpretation of computational data to clarify population needs and attitudes [14, 15], the aim of this study was to evaluate the interests of Google users on the employment of amber necklaces to relieve teething symptoms in different countries. We hypothesize that the surveillance of digital activity of health seekers could contribute to the better understanding of parents' concerns and demands linked to tooth eruption, supporting the development and implementation of awareness

campaigns about this process, to minimize the diffusion of fake news and possible accidents caused by wearing these jewelries.

MATERIALS AND METHODS

The present study did not require institutional review board approval from the Council of Ethics in Human Research of the Bauru School of Dentistry, since federal regulations consider that research using publicly available data does not involve human subjects.

Study design

This longitudinal retrospective study analyzed the amber necklace-related structured computational data in different countries between January 2004 and September 2018, using the online tool Google Trends. Search strategies were defined in 4 distinct languages, permitting the inclusion of 17 countries with sufficient Relative Search Volume (RSV) values. These data were analyzed quantitatively and qualitatively, by the determination of trends and seasonality of RSVs, and the top queries employed by information seekers.

Search strategies and determination of RSV

Google Trends is an online tool that presents the weekly and monthly variation of RSV values for searches performed on Google Search during a period of time. These values are normalized in function of the maximum value of the time series (RSV=100), varying from 0 (zero) to 100. The RSVs indicate the ratio between the search volume of specific Google queries and the search volume of overall Google searches performed. This platform also provides a list of the most popular queries used in specific countries/regions to find information about a topic of interest.

Different search strategies were defined based on four languages, English ("amber necklace" + "amber teething necklace"), Spanish ("collar de ambar"), Portuguese (Brazilian: "colar de âmbar"; European: "colar de ambar"), and Italian ("collana di ambra"). These strategies were constructed considering the maximum recovering of amber-related data, permitting the adequate analysis of behavior patterns of different populations in relation to digital information consumption.

The RSV data were collected for all available countries on September 25, 2018, adopting the inclusion criteria of “all categories and sources”.

Countries selection criteria

The countries were selected according to (i) their language, and (ii) sufficiency available data on Google Trends. A total of 17 countries were included in these analyses: Argentina (ARG), Australia (AUS), Brazil (BRA), Canada (CAN), Chile (CHL), Colombia (COL), India (IND), Italia (ITA), Mexico (MEX), New Zealand (NZL), Peru (PER), Portugal (PRT), South Africa (ZAF), Spain (ESP), United Kingdom (UK), United States (USA) and Uruguay (URY).

Data analysis

All data were analyzed with the Statistical Package for Social Science (version 21.0; SPSS, Chicago, USA), based on the methodology described in previous studies [16, 17]. The collected data were evaluated in accordance to the following aspects: (1) test-retest reliability, (2) trends, (3) seasonality, and (4) forecasting models.

1. *Test-retest reliability*: intraclass correlation coefficient was determined to assess the stability of data in two different times. For that, RSVs were also retrieved in December, 2018.
2. *Trends*: the autocorrelation (ACF) and partial autocorrelation (PACF) plots were used to evaluate the trends of time series for each country. Also, the curves originated from ARIMA models were heuristically analyzed to observe their variations over time.
3. *Seasonality*: the influence of seasonality was evaluated by generalized additive models (GAM), with a previous detrending of each long-term curve by its lag-1 difference, and subsequent application of generalized linear models to evaluate the effect of monthly and quarterly seasonality on time series.
4. *Forecasting models*: the data collected were used to construct 12-month forecasts for RSV amber necklace-related values. For this purpose, autoregressive integrated moving average (ARIMA) models were chosen by the lowest values of normalized Bayesian information criteria (Normalized BIC).

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

RESULTS

Test-retest reliability

The data collected for most countries achieved good and excellent levels of stability (0.72-1.00), except for IND, ITA and MEX.

Search volume trends

Figure 1 depicts four representative time series of all studied countries. The analysis of ACF and PACF did not demonstrate clear trends of curves for any studied countries. Significant positive autocorrelations were detected in USA (lag 5), ARG and UK (lag 6), COL and ESP (lag 10), and BRA (lag 17 and 24), whereas significant negative autocorrelations were detected in NZL (lag 4 and 20), COL and PRT (lag 5), URY (lag 6), and AUS (lag 18). The heuristic analysis of time series denotes a general increase of the interests in amber necklace-related information. ARG, UK and URY presented increased RSV values in the last years, similar to Brazil. More stable trends were observed in COL, ITA, NZL, PER, PRT and ZAF, as demonstrated by Spain. India did not present a clear trend of values, with the observation of stable RSVs. The values of AUS, CAN and CHL behaved as those of the United States, reaching a peak of searches and declining until a stable level, which is still higher than that observed at the baseline.

Seasonality

The variation of means of monthly-detrended RSV values is represented in a heat map (Fig. 2). According to GAM analysis, the results did not show significant effect of monthly or quarterly seasonality on the interests of Google users. However, it was observed a lower Web search activity in May and October when compared to the other months. Besides, the interests about amber necklace of UK, IND, URY, USA and ZAF increased on January.

Forecasting models

Table 1 summarizes the fit statistics of 12-month forecasting models for amber necklace-related interests. The chosen ARIMA models demonstrated Normalized BIC values varying from 1.88 to 3.23. The curves originated from this analysis permitted the observation of trends in the variation of data, as aforementioned.

Most popular queries

The list of most popular queries employed in each country is showed in Table 2. The Google users from AUS, CAN, ESP, NZL, UK and USA usually searched the term ‘amber necklace’ associated with the words ‘teething’ and ‘baby’, distinctly of those users from BRA and CHL, which presented searches associated with ‘what is it for’ and ‘how do it work?’.

DISCUSSION

These findings indicate an increase of interests of the Internet users on amber necklace-related information over the years, without the influence of monthly or quarterly seasonality. In most cases, the Internet is used for searching on how to diminish teething symptoms in babies, denoting the emergence of uncomfortable feelings linked to negative beliefs of disturbances caused apparently by the dental eruption process. To our knowledge, this is the first study that demonstrates the utility of Google-based data to improve the understanding of dental beliefs of parents/caretakers, in respect to the development of primary dentition in distinct countries.

Three patterns of volume increases of amber necklace-related searches were observed among countries: (a) an upward trend of RSV values in the last years (see Fig. 1, Brazil), (b) a transitory increase to a peak RSV with a subsequent decline until a plateau higher than those values found at baseline (see Fig. 1, USA), and (c) a discrete increase of values along time (see Fig. 1, Spain). In general, developed countries showed peaks of interests in amber necklace through 2009 to 2014, while these peaks were detected in developing countries between 2017 and 2018. Hypothetically, it is expected that the pattern (a) will resemble the pattern (b) over time. This conjecture is confirmed by the qualitative analysis of queries, since Google users from AUS, CAN, ESP, NZL, UK and USA performed Web searches on amber necklace with the association of tooth eruption, such as "teething" and "baby", while the users from BRA and CHL sought for the definition and usability of these jewelries in babies. It suggests that people from developed countries were first informed about the “benefits” and “functions” of amber necklace for tooth eruption, because their searches were related to the consumption of additional knowledge instead of the sense of discovery found in developing countries. These findings can be explained with basis on the theory of diffusion of innovation described by Everett Rogers [18],

when a market share of a novelty eventually reach a saturation level after its adoption for successive groups of consumers, being reasonable to realize the decrease of the interest of people in that innovation along time. Other important component influencing these outcomes is the difference in the Internet penetration between developed and developing countries, with the observation of a consistent digital expansion among low income populations over time [19, 20].

Definitely, the activity of celebrities on the Internet, detected by opinions posted in blogs and social media, can present a significant impact on the consumer's decisions and actions of population [21]. It is corroborated by the first peak of Web searches in Brazil in 2014. The date coincides with an Instagram post containing a photo of the Brazilian supermodel Gisele Bündchen holding her daughter, whom wearing an amber necklace. Indeed, this publication influenced the list of top queries performed in Brazil related to the jewelry usage, being the term "amber necklace gisele" found among those most popular ones.

Even with little evidence to support the presence of symptoms during tooth eruption [7], people of different ethnics, socioeconomic classes and educational levels still believe that teething causes discomfort and pain [22]. Even parents who recognize that it is part of a natural process of human development, they refer apprehension about the possibility of the appearance of symptoms [23]. Although these parental false beliefs may seem harmless, they can interfere with the prompt diagnosis and management of a range of serious illnesses [8].

In this sense, the Internet is being used as a source of information to the self-resolution of teething problems, through the recommendation of home therapies and/or remedies by digital influencers, vendors and laypersons with market interests [10]; however, there is no scientific evidence to support the effectiveness of amber necklaces in relieving teething discomfort. Additionally, these ornaments represent a significant risk for child's health, evidenced by recent reports of strangulation [11], suffocation [24] and death associated with their utilization [25]. As a consequence of the increasingly interest of individuals in seeking for Web information about the diagnosis and treatments of their own conditions [26], which also contribute to the increment of the use of amber jewelries for babies, official health organizations as the Health Canada published warnings in relation to this issue, as follows: *"Never place a necklace, teething necklace, string, ribbon or chain around the neck of a child under three. These products can be strangulation and choking hazards"* [27]. Also, the

American Academy of Pediatrics share a safety concern about the use of teething necklaces, showing safer ways to promote comfort for babies [28].

The employment of this methodological approach presents advantages. The useful data can be collected in a near-real time manner, anonymously and periodically, contributing to the decrease of reporting bias, and to the increase of cost-effectiveness and standardization of analysis [17, 29]. Additionally, it can aid in the planning and implementation of specific health programs, through the determination of health behavioral of individuals into the context of their genuine lives. On the other hand, this novel approach makes difficult the definition of identities and sociodemographic characteristics of remote Internet users. Also, it is impossible to affirm that all searches were performed by parents/caretakers/relatives directly interested in preventing teething symptoms in their babies or children; i.e., the collection and interpretation of computational *Big Data* based on the Web activity cannot replace traditional epidemiological methods.

In conclusion, the searches on amber necklace are becoming increasingly popular in many countries, even with the advertence of health organizations and lack of scientific evidence to confirm its efficacy against teething symptoms. These findings indicate that parents need more information about tooth eruption, to avoid the propagation of fake news and the establishment of negative beliefs that can interfere with the prompt management of oral conditions. Therefore, pediatric dentists should be responsible in disseminating the dangerous consequences of amber necklace usage, in order to demystify and discourage the use of this ineffective and unsafe product. These attitudes also aim to improve the relationship between caretakers and dental professionals, since they avoid conflicts of opinions and conducts between both parts.

Why this paper is important to pediatric dentists?

This study demonstrates the increase interests of people on alternative ways to prevent teething symptoms, especially amber necklace. It is an important indicator that parents/caretakers need more information about tooth eruption. Pediatric dentists should alert their patients in respect to the risks and ineffectiveness of home strategies against teething discomfort found on the Internet.

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TABLES

Table 1. ARIMA model fit statistics

Country ARIMA model	Normalized BIC	MAPE	Ljung Box	Model parts	Lag	Estimate	SE	*p*
ARG								
(0,1,1) (0,1,0)	4.27	47.68	0.23	Diference		1.00		
				MA	Lag 1	0.68	0.06	<0.001
				Seasonal Diference		1.00		
AUS								
(0,1,10)(0,0,0)	4.34	25.26	0.28	Diference		1.00		
				MA	Lag 1	0.58	0.06	<0.001
					Lag 10	_0.23	0.06	<0.001
BRA								
(0,1,11)(0,0,0)	3.18	35.40	0.56	Constant		0.58	0.25	0.022
				Diference		1.00		
				MA	Lag 1	0.44	0.07	<0.001
					Lag 11	_0.16	0.07	0.035
CAN								
(0,1,1) (0,0,0)	4.58	27.34	0.08	Diference		1.00		
				MA	Lag 1	0.68	0.06	<0.001
CHL								
(0,1,4) (1,0,0)	4.60	34.20	0.84	Diference		1.00		
				MA	Lag 1	0.34	0.07	<0.001
					Lag 4	0.22	0.07	0.002
				AR, Seasonal	Lag 1	0.21	0.08	0.007
COL								
(1,0,1) (0,0,0)	5.51	52.18	0.03	AR	Lag 1	0.10	0.02	<0.001
				MA	Lag 1	0.86	0.08	<0.001
ESP								
(0,1,1) (0,1,1)	4.21	42.82	1.00	Diference		1.00		
				MA	Lag 1	0.86	0.04	<0.001
				Seasonal Diference		1.00		
				MA, Seasonal	Lag 1	0.83	0.08	<0.001
IND								
(0,0,0) (0,0,0)	4.21	42.82	1.00	Constant		2.17	0.61	<0.001
ITA								
(0,0,0) (0,0,0)	6.054	40.81	<0.001	Constant		20.84	1.52	<0.001
MEX								
(0,1,1) (0,0,0)	5.45	37.00	0.65	Constant		0.33	0.13	0.012
				Diference		1.00		
				MA	Lag 1	0.90	0.04	<0.001
NZL								
(0,1,1) (0,0,0)	5.50	39.16	0.10	Diference		1.00		
				MA	Lag 1	0.78	0.48	<0.001
PER								
(1,0,1) (0,0,0)	5.55	60.90	0.10	AR	Lag 1	0.10	0.03	<0.001
				MA	Lag 1	0.87	0.07	<0.001
PRT								
(1,1,2) (0,1,1)	4.66	49.97	0.10	AR	Lag 1	0.82	0.06	<0.001
				Diference		1.00		
				MA	Lag 2	0.69	0.08	<0.001
				Seasonal Diference		1.00		
				MA, Seasonal	Lag 1	0.54	0.09	<0.001

UK								
(0,1,1) (1,0,1)	5.05	24.31	0.31	Diference		1.00		
				MA	Lag 1	0.69	0.05	<0.001
				AR, Seasonal	Lag 1	0.91	0.36	0.013
				MA, Seasonal	Lag 1	0.88	0.40	0.031
URY								
(1,0,1) (0,1,1)	4.97	39.85	0,81	AR	Lag 1	0.62	0.62	<0.001
				Diference		1.00		
				Seasonal Diference		1.00		
				MA, Seasonal	Lag 1	0.40	0.13	0.003
USA								
(0,1,1) (1,0,1)	3.29	22.46	<0.001	Diference		1.00		
				MA	Lag 1	0.37	0.73	<0.001
				AR, Seasonal	Lag 1	0.77	0.12	<0.001
				MA, Seasonal	Lag 1	0.40	0.16	0.015
ZAF								
(0,1,1) (0,0,1)	4.97	39.85	0.81	Diference		1.00		
				MA	Lag 1	0.87	0.04	<0.001
				MA, Seasonal	Lag 1	0.29	0.07	<0.001

Table 2. Amber necklace-related queries and their respective RSV for each country

Argentina		Australia		Brazil		Canada		Chile		Italy	
collar de ambar bebes	100	amber necklace australia	100	colar de ambar bebe	100	amber necklace canada	100	collar de ambar para bebes	100	collana di ambra per bambini	100
collar de ambar para bebes	100	baltic amber necklace	99	colar de ambar comprar	67	baltic amber	92	collar de ambar bebe	44	collana di ambra per neonati	88
collar de ambar para bebe	44	baltic amber	93	colar de ambar para bebe	60	baltic amber necklace	86	collar de ambar para que sirve	27		
		baltic amber teething necklace	76	colar para bebe	56	amber teething necklace canada	82	collar de ambar para bebe	22		
		amber teething necklace australia	56	para que serve colar de ambar	38	amber necklace for teething	65	collares de ambar	17		
		amber necklace for teething	51	colar de ambar onde comprar	35	baltic amber teething necklace	58	para que sirve el collar de ambar	17		
		amber necklace for babies	40	onde comprar colar de ambar	35	amber necklace babies	53	collar de ambar para adultos	15		
		amber teething necklaces	36	colar de ambar beneficios	31	amber necklace for baby	26	collar de ambar para niños	12		
		amber beads	29	colar de ambar verdadeiro	19	amber necklace for babies	24	collar de ambar para bebes chile	10		
		amber teething necklace review	23	colar de ambar preço	16	hazelwood necklace	20				
		amber teething beads	23	colar de ambar bebe onde comprar	15						
		amber necklace death	18	colar de ambar baltico	14						
		amber necklace for baby	16	colar de ambar funciona	12						
		sids amber necklace	10	colar de ambar original	11						
		amber teething	8	colar de âmbar	10						

		necklace safety teething symptoms	5	colar de ambar adulto	9						
		signs of teething	5	para que serve o colar de ambar	8						
				colar de ambar gisele	7						
				colar de ambar para bebe pra que serve	6						
				colar da amizade	6						
Mexico		**New Zealand**		**South Africa**		**Spain**		**UK**		**USA**	
collar de ambar para bebe	100	amber teething necklace nz	100	baltic amber teething necklace	100	collar de ambar para bebes	100	amber necklace baby	100	baltic amber	100
collar de ambar baltico	60			teething beads	57	collar de ambar bebe	75	amber necklace uk	79	baltic amber necklace	98
collar de ambar para bebes	53			amber teething necklace dischem	43	collar de ambar para los dientes	19	amber necklace for teething	76	baltic amber teething	67
collar de ambar para bebes precio	13							baltic amber necklace	56	baby necklace	65
								baby teething	56	amber baby necklace	63
								amber teething necklace uk	54	amber necklace for teething	45
								baltic amber	53	amber necklace babies	34
								amber necklace babies	40	baby teething necklace	31
								baltic amber teething necklace	38	amber necklace for babies	24
								amber necklace for	32	amber necklace for baby	17

babies			
amber beads	27	amber necklaces	15
amber bracelet	27	raw amber necklace	13
amber necklace for baby	24	best amber teething necklace	12
amber jewellery	24	teething necklaces	12
amber teething anklet	23	best teething necklace	11
amber teething bracelet	21	amber necklace for babies teething	11
amber teething beads	18	amber necklace amazon	11
teething beads	16	amber teething necklaces	11
amber pumpkin	10	teething necklace for babies	11
amber necklace for adults	6	raw amber teething necklace	10
teething remedies	5	amber necklace adults	9
		amber necklace for baby teething	9
		amber jewelry	9
		amber necklace benefits	9
		amber necklace for adults	8

FIGURE LEGENDS

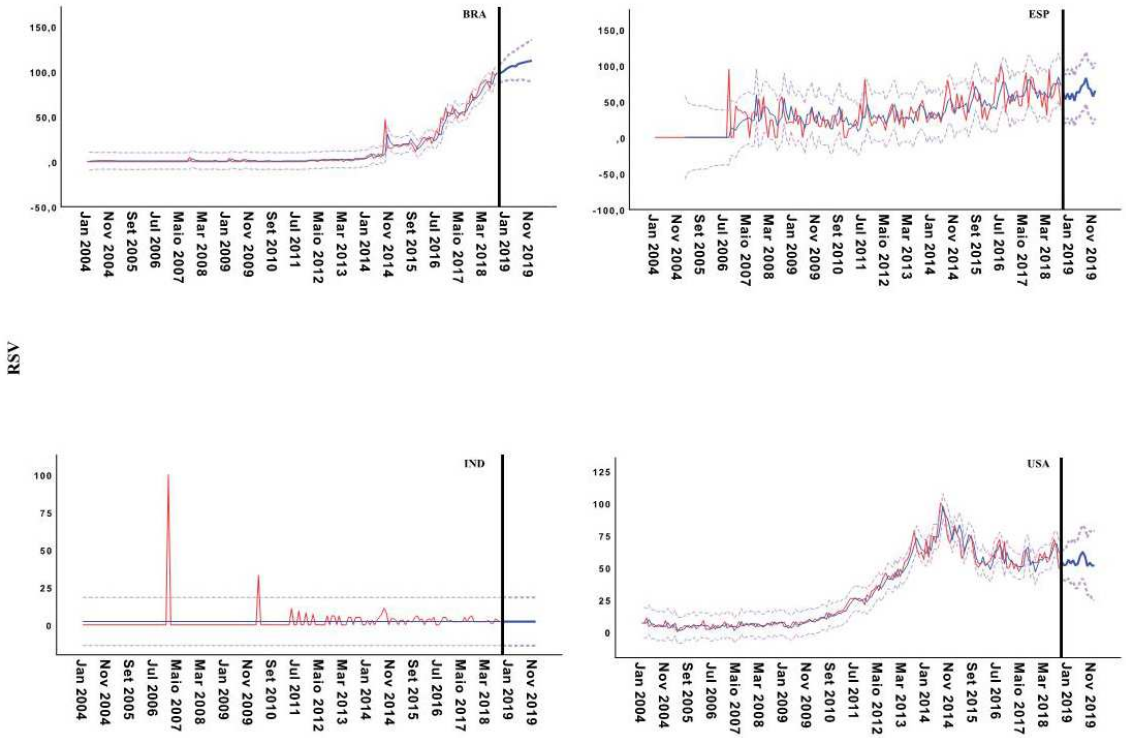

Fig. 1 Predictive charts of Relative Search Volume values for amber necklace-related searches performed in Spain, India, Brazil and USA. The curves of observed data (red lines), fitted and forecast values (blue lines), and upper and lower bound of confidence intervals (lilac lines) are depicted from January 2004 through September 2018. The RSV values presented after September 2018 (black line) represent 12-month predictive values.

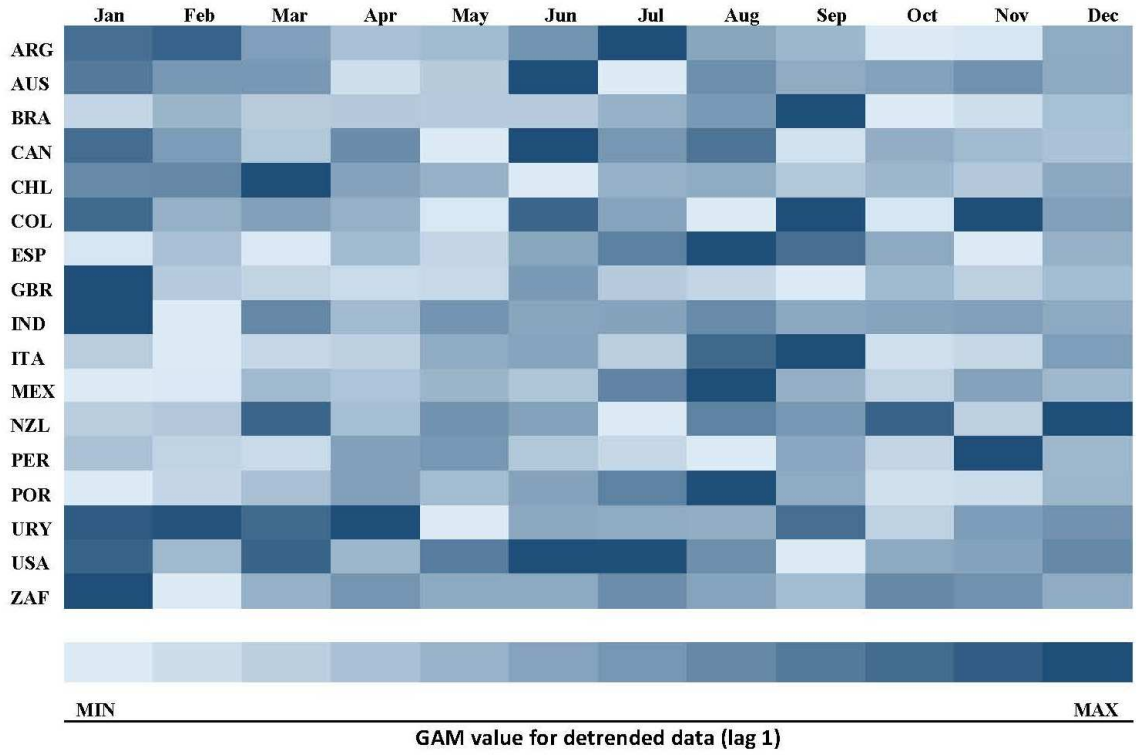

Fig. 2 Seasonality of the interests of Google users in amber necklace. The seasonality was estimated by fitting a generalized additive model (GAM) to the detrended Google Trends data (lag-1 difference). GAM values using monthly RSV as a predictive variable for Google data are represented in a heat map.

3 DISCUSSION

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This chapter is presented as five remarkable considerations about the manuscripts aforementioned, as follows:

1. People with negative oral health beliefs are more likely to be diagnosed with dental fear and anxiety, although this evidence is based on studies of unclear or moderate quality;

2. Consumption of Web misinformation could deteriorate the patient-dentist relationship, which could contribute to increased fear and dental anxiety. This problem may be particularly important in countries with greater levels of social inequalities, with a large number of people at risk of low health literacy;

3. The interests on amber necklace is becoming increasingly popular in several countries, even with the lack of scientific evidence to confirm its effectiveness against teething symptoms, and after warnings published by health organizations;

4. Although the collection and interpretation of computational Big Data based on Web activity cannot replace traditional epidemiological methods, these findings indicate that parents need more information about dental eruption, to prevent the spreading of fake news and the establishment of negative health beliefs;

5. Pediatric dentists should alert their patients about the risks and ineffectiveness of domestic strategies found on the Internet, such as the use of amber necklace for preventing teething discomfort. This practice can contribute to the increase of health literacy and, in theory, to the decrease of dental fear and anxiety.

4 CONCLUSION

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Based on these results, we can conclude that:

- Negative oral health beliefs seemed to influence directly the levels of dental fear and anxiety. However, the quality of observational studies included in this review was generally considered as unclear or moderate. Further high-quality studies are needed to elucidate the present relationship under effect of relatively new technological and cultural changes.

- The searches on amber necklace are becoming increasingly popular in many countries, even with the advertence of health organizations and lack of scientific evidence to confirm its efficacy against teething symptoms. These findings indicate that parents need more information about tooth eruption, to avoid the propagation of fake news and the establishment of negative beliefs that can interfere with the prompt management of oral conditions.

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