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The Prevalence of Periodontal Diseases in Portugal and Correspondent Digital National Awareness: Analysis of Data from Global Burden of Disease, Directorate-General of Health and Google Trends for the Period 2004-2017

Vanessa Machado*[1] 0000-0003-2503-260X

João Botelho*[1] 0000-0002-1019-8263

João Albernaz Neves[1] 0000-0002-2106-9563

Luís Proença[1] 0000-0002-8482-5936

Ricardo Alves[1] 0000-0001-7184-5965

Maria Alzira Cavacas[1] 0000-0002-1790-9646

João Rua[1] 0000-0001-7659-4392

Ana Delgado[1] 0000-0003-1851-2752

José João Mendes[1] 0000-0003-0167-4077

*Equally first author

[1]Clinical Research Unit (CRU), Centro de Investigação Interdisciplinar Egas Moniz (CiiEM), Instituto Universitário Egas Moniz, Almada, Portugal

Corresponding Author:

João Botelho, MSc

Periodontology Department

Clinical Research Unit (CRU), Centro de Investigação Interdisciplinar Egas Moniz (CiiEM)

Instituto Universitário Egas Moniz, Egas Moniz Cooperativa de Ensino Superior

Campus Universitário, Quinta da Granja, 2829 - 511, Almada, Portugal

Phone: +(351) 964 805 122

Fax: not available

E-mail: jbotelho@egasmoniz.edu.pt

Summary

Background: The progression of periodontal diseases at national Portuguese level and its public awareness are of great interest, mainly due to the high burden of periodontitis.

Objectives: To evaluate the prevalence progression of periodontal diseases in Portugal and correspondent public awareness, between 2004 and 2017, by using data from the Global Burden of Disease (GBD), Directorate-General of Health (DGH) and Google® Trends (GT).

Methods: For the period 2004-2017, Portuguese national data of periodontal diseases prevalence were searched in the Institute for Health Metrics and Evaluation of GBD and DGH and for public awareness, GT comparison tool between Portuguese words for "Periodontitis", "Gingivitis", "Gums" and "Periodontal disease" trends was used.

Results: For the period 2004-2017, the overall prevalence of periodontitis slightly increased from 11.3% to 11.7%. During that period the GT search term "Gums" ("Gengivas") was the most relevant. It increased steadily over time while the search term "Periodontal disease" ("Doença periodontal") decreased, being these search trends significantly correlated ($\rho = -0.670$, P=0.009). Additionally, GT search term "Gingivitis" ("Gengivite") was significantly negatively correlated ($\rho = -0.537$, P=0.048), over time, with GBD data.

Conclusions: According to GBD data, the overall prevalence of periodontal diseases in Portugal are continuously growing and above the world average. GT data shows an apparent oral medical illiteracy related to periodontal diseases in the Portuguese population. Portuguese netizens predominantly tend to search for non-medical terms like "Gums" over more scientific terms like "Gingivitis", "Periodontitis" or "Periodontal disease". However, overall, the digital awareness for the periodontal diseases subject increased over time.

Keywords: Medical Illiteracy, Public Awareness, Periodontal Diseases, Global Burden of Disease, Google Trends

1. Introduction

The burden of periodontal diseases among the worldwide population flags a significant public health problem, and it is one of the most prevalent pathologies in the world, along with caries and has maintained continuous alarming high levels [1–6], having huge impacts on people's daily lives, being the 6th most common disease worldwide [2] Besides affecting individual's quality of life, periodontal diseases also affect the patient's aesthetic appearance and self-awareness, as the gum level is one of the items in several aesthetic self-perception studies [7–9].

In Portugal, according to the last Directorate-General of Health (DGH) Oral Health National Survey from 2015, the prevalence of periodontitis was 10.8% and 15.3% in the age groups of 35-44 and 65-74 years old, respectively [10]. However, the periodontal partial recording protocol used in this study has a high bias power as previously demonstrated by our group [11]

Global Burden of Disease (GBD) is one of the largest international scientific collaboration in the world that identifies and describes the biggest health problems worldwide. Therefore, GBD, since 1990 to the present, provides a tool to quantify health loss from hundreds of diseases, injuries and risk factors, and allows the comparisons over time, across age groups, and among populations. Moreover, this instrument helps the governments, scientists and partners in the health trends assessment globally or in particular regions and countries.

Google® Trends (GT) is a unique, powerful and considerably interesting online search trends feature that allows the user to see how frequently a specific keyword, subjects, and phrases have been queried over a specific period of time. This tool can be used for comparative keyword research and to discover event-triggered spikes in keyword search volume, and consequently, the database may be very useful investigate population. Google® Trends uses a portion of specific term search ("keyword" or ''search term'') and then analyses the Google® search result through a given geographical location and a defined timeframe. Then, a Google® Trends Index is then assigned to the keyword (from 0 to 100), where 100 represents the highest share of the term over a time series. The epidemiologic potentialities of Google Trends has been studied in a wide variety of medical areas, from an assessment of epidemic peaks and outbreaks to monitoring [12–18]. Regarding oral health, Google trends and public awareness are topics that have gained interest, however but periodontal diseases have never been addressed within.

This study will pay heed to the prevalence progression of periodontal diseases in Portugal and correspondent digital national awareness, between 2004 and 2017, using data from the Global Burden of Disease, Directorate-General of Health, and Google® Trends.

2. Methods

2.1. Definitions and data extraction

2.1.1. Global Burden of Disease data

In order to obtain Portuguese national data, the GBD tools of the Institute for Health Metrics and Evaluation (IHME) (http://ghdx.healthdata.org) was used based on the following parameters (Table 1). Search was made on the 8th of November 2018. A stable link with specific parameters was generated to perpetuate the research carried out: http://ghdx.healthdata.org/gbd-results-tool?params=gbd-api-2017-permalink/61cb17b687216830e3c9975ae2ec3151

Table 1. Search parameters used on GBD tools of IHME.

Search Parameter	Used criteria
Base	Single
Location	Portugal
Context	Cause
Age	All ages; 15-19; 20-24; 25-29; 30-34; 35-39; 40-44; 45-49; 50-54; 55-59; 60-64; 65-69; 70-74; 75-79; 80-84; 85-89; 90-94; 80+; 15-49 years; 50-69 years; 70+ years
Metric	Number; Percent; Rate
Measure	Prevalence; Incidence
Sex	Both sexes
Cause	B.10.4.3 Periodontal diseases

2.1.2. Google® Trends data

To appraise public awareness for search terms related to periodontal diseases we used Google® Trends comparison tool through the strategy: https://trends.google.pt/trends/explore?cat=45&date=2004-01-01%202018-10-31&geo=PT&q=periodontite,gengivite,gengivas,doen%C3%A7a%20periodontal. The search was performed in Portuguese (Table 2).

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Table 2. Search parameters used on Google® Trends.

Search Parameter	Used criteria
Location	Portugal
Period	01/01/2004-31/10/2018
Category	"Saúde" ("Health")
Search	Pesquisa na Web ("Web search")
Terms	"*Periodontite*" ("Periodontitis"), "*Gengivite*" ("Gingivitis"), "*Gengivas*" ("Gums"), "*Doença Periodontal*" ("Periodontal Disease")

2.1.3. Directorate-General of Health National Surveys

Directorate-General of Health (*Direção-Geral de Saúde*, DGS) National Surveys were obtained from the official oral health website of DGH (https://www.dgs.pt/pns-e-programas/programas-de-saude/saude-oral.aspx).

2.2. Statistics

Data analysis was performed using IBM SPSS Statistics version 25.0 for Windows (IBM Corp., Armonk, NY, USA). Bivariate analysis, by using the Spearman rank correlation coefficient, was conducted in order to assess the correlation, over time, between GT search terms and GT vs. GBD data. The level of significance was set at 5%.

3. Results

3.1 Global Burden of Disease

Figure 1 represents the periodontal disease prevalence evolution over the last fourteen years (2004-2017). Overall, the periodontitis prevalence it has been increasing slightly in the Portuguese population from 11.3% to 11.7% during this period. With regard to age ranges, the prevalence of periodontitis has been decreasing for 50-69 years, while 15-49 and 70+ years remained similar. When comparing these data with global values, the Portuguese periodontitis prevalence has been higher than the world average for the past fourteen years, and the most recent, in 2017, the Portuguese prevalence was 8.5% above (Figures 2-3).
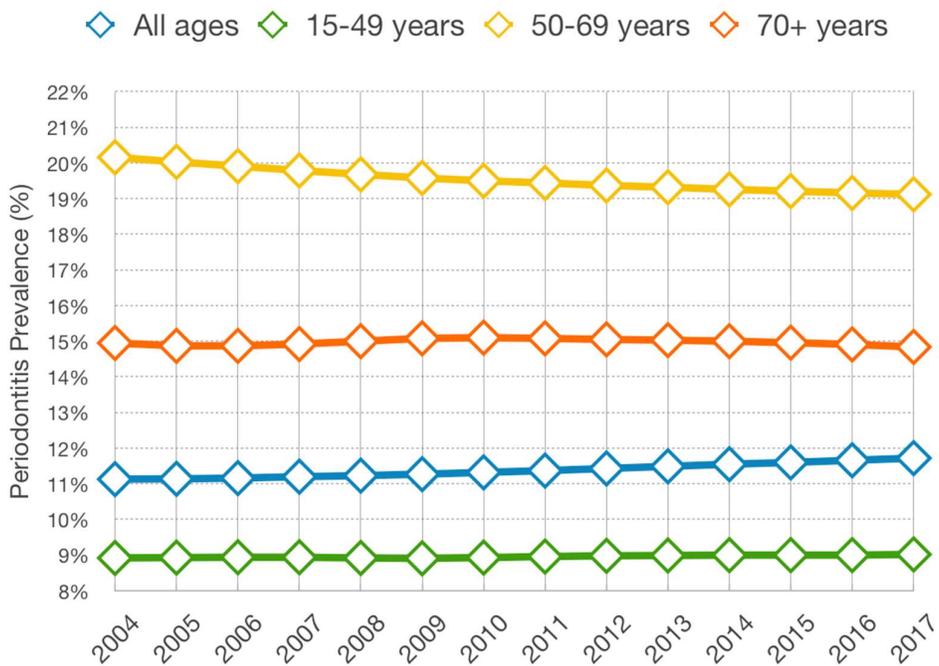
Figure 1. Periodontal disease prevalence evolution, between 2004 and 2017, in Portugal, according to the Global Burden of Disease.
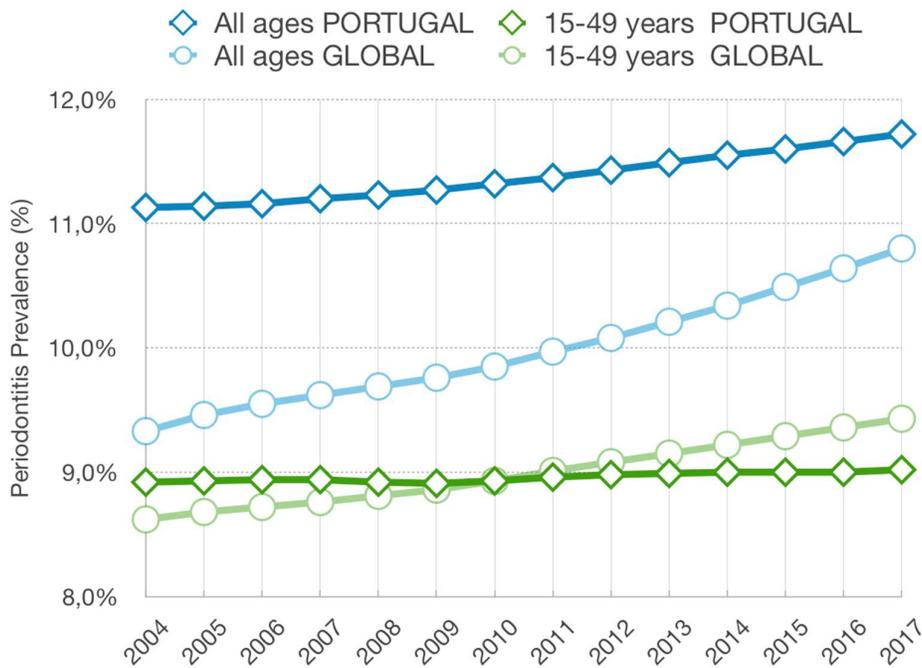

Figure 2. Global and Portuguese periodontitis prevalence evolution, between 2004 and 2017, for all ages and 15-49 years, according to the Global Burden of Disease.
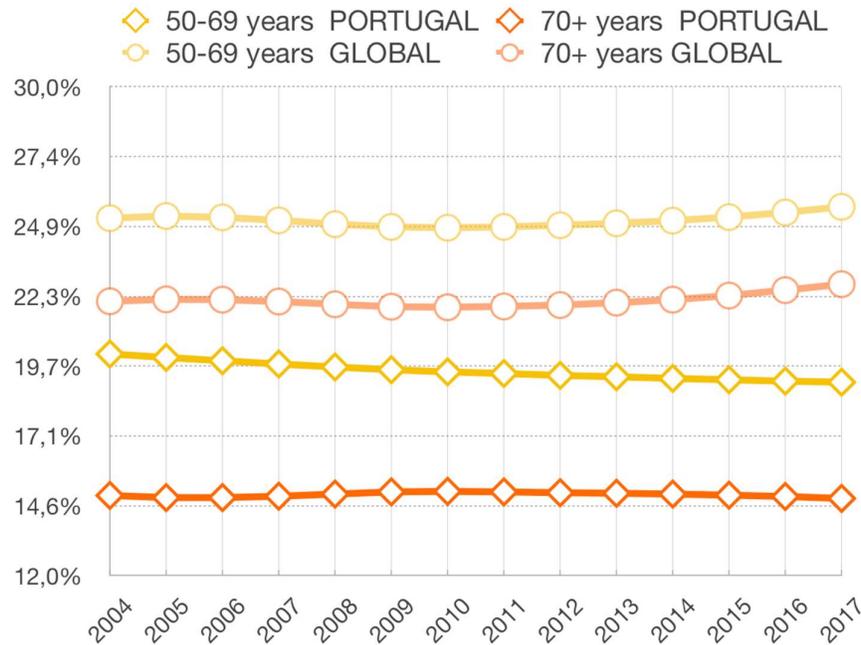
Figure 3. Global and Portuguese periodontitis prevalence evolution, between 2004 and 2017, for 50-69 and 70+ years, according to the Global Burden of Disease.

3.2 Google® Trends

Figure 4 represents the Portuguese trends evolution of the periodontal diseases-related terms searched on Google® Trends. Over the last years, Portuguese netizens have tended to search a non-medical term, "Gums" ("*Gengivas*") over more specific and scientific terms such as "Periodontitis" ("*Periodontite*") and "Gingivitis" ("*Gengivite*"). Moreover, the term "Periodontal disease" ("*Doença Periodontal*") was the least trendy and has a significant negative correlation with the term "Gums" (ρ=–0.670, *P*=0.009) (Table 3).

Table 3. Correlation between Google® Trends searches terms, over the period 2004-2017.

	"*Periodontite*" ("Periodontitis")	"*Gengivite*" ("Gingivitis")	"*Gengivas*" ("Gums")	"*Doença Periodontal*" (Periodontal Disease)
"*Periodontite*" ("Periodontitis")	-	0.209 (*P*=0.474)	0.386 (*P*=0.173)	-0.073 (*P*=0.805)
"*Gengivite*" ("Gingivitis")	-	-	0.029 (*P*=0.923)	-0.187 (p=0.522)
"*Gengivas*" ("Gums")	-	-	-	**-0.670** (*P*=0.009)

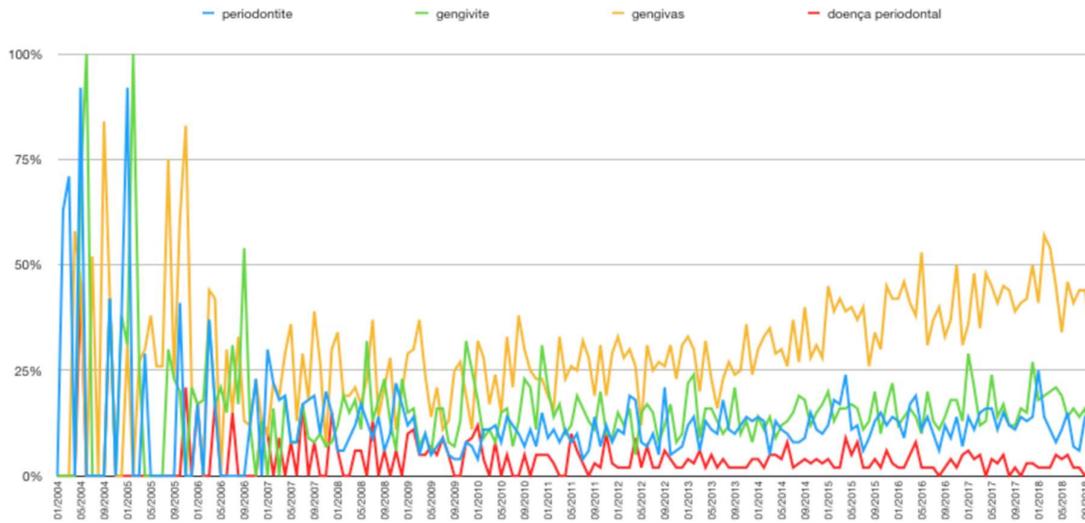Spearman's rank correlation coefficient, (*) *P* < 0.05.

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Figure 4. Web search trends evolution, in Portugal, between 2004 and 2017, on the following periodontal diseases terms: "*Periodontite*" ("Periodontitis"), "*Gengivite*" ("Gingivitis"), "*Gengivas*" ("Gums") and "*Doença Periodontal*" ("Periodontal Disease"), according to Google® Trends.

3.3 Directorate-General of Health National Surveys

Three national surveys from the Oral Health Promotion National Program, from 2005, 2008 and 2015, respectively, were included [10,19,20]. The 2005 and 2008 OHPNP surveys had no information regarding periodontal diseases. The 2015 OHPNP survey investigated the periodontal status of participants aged 18, 35-44 and 65-74 years old. The 18-year-old participants did not present a prevalence of periodontal diseases while participants aged 35-44 and 65-74 years old had a prevalence of 10.8% and 15.3%, respectively. Due to the lack of previous data from the 2005 and 2008 surveys, a comparative analysis was not possible.

3.4 Correlation between Google® Trends and Global Burden of Disease data

Table 4 represents the correlation between Google® Trends and GBD data, over the period 2004-2017. No significant correlation was found between GBD data and GT search terms, except for the term "Gingivitis", which was significantly negatively correlated ($\rho = -0.537$, $P=0.048$).

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Table 4. Correlation between GT and GBD data, for the period 2004-2017.

	Google® Trends			
	"*Periodontite*" (Periodontitis)	"*Gengivite*" (Gingivitis)	"*Gengivas*" ("Gums")	"*Doença Periodontal*" ("Periodontal Disease")
GBD	-0.232 (P=0.426)	**-0.537** * (P=0.048)	0.314 (P=0.274)	-0.095 (P=0.748)

Spearman's rank correlation coefficient, (*) $P < 0.05$.

Discussion

Google® Trends is a reliable epidemiologic tendency research tool of specific diseases or groups of symptoms [12] and has been investigated for surveillance of disease outbreaks like Dengue, Malaria, Enteric fever and the Flu [13–17]. Furthermore, Google® Trends has also been used to examine the impact of HIV/AIDS news coverage on web search in Hong Kong [18] and to investigate and monitorin the interests on toothache information of Google® users from the United States, United Kingdom, Australia, and Brazil [21,22]. Nevertheless, this is the first study that uses Google® Trends to analyze the population awareness/interest for periodontal diseases terms in the web.

Periodontal diseases are of great clinical and symptomatic variety [23–25], have a great impact on quality of life [26] and are a serious public health dilemma. Over the last two decades, the burden of periodontal diseases increased by 57.3% worldwide [2,27,28]. Although the results of this study report a low prevalence of periodontal diseases in Portugal, people tend to appear already in moderate to severe states [29]. Besides, periodontal diseases have not figured in the most disabling diseases top rank, according to the 2017 Portugal GBD data, which in our opinion reflects the lack of public consciousness of the oral well-being status [30].

According to the available GBD data, Portuguese periodontal disease prevalence has been increasing in recent years and is above the global average, although the three age groups studied (15-49, 50-69 and 70+ years) presented a consecutive decrease in the last decade. On the other hand, these results are in line with the conclusions of the 2015 DGH National Oral Survey [10] and a recent open-cohort study with over twenty thousand patients from a private Portuguese rehabilitation center [31]. Notwithstanding, there are still some reservations about these data, since it clearly contradicts global GBD forecasts [2], and alternative studies show that this prevalence may be higher [32,33]. This matter is of particular relevance since it warns of the urgent need to investigate prevailing data on the prevalence of periodontal diseases since these data remain unclear, not only for Portugal but in a global way.

Additionally, our data point to a scarcity of medical literacy related to periodontal diseases in the Portuguese population since they prefer the term "Gums", a more common-sense keyword, rather than "Gingivitis", "Periodontitis", and/or "Periodontal disease". These results show an apparent low oral health literacy by the Portuguese population for periodontal diseases. Research exploring the relationship between health literacy and health outcomes found that subjects with low health literacy or health illiteracy contribute to a variety of adverse health behaviors and outcomes [34–37]. Therefore, future research is necessary to study the degree of oral health illiteracy among our population in order to guide future periodontal diseases awareness campaigns and public health interventions.

Conclusion

According to the Global Burden of Disease data, the overall prevalence of periodontal diseases in Portugal is continuously growing and above the world average. Google® Trends data shows an apparent oral medical illiteracy related to periodontal diseases in the Portuguese population. Portuguese netizens predominantly tend to search for non-medical terms like "Gums" over more scientific terms like "Gingivitis", "Periodontitis" or "Periodontal disease". However, overall, the digital awareness for the periodontal diseases subject increased over time.

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