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Periodontal disease is associated with poor self-rated oral health among Brazilian adults

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Abstract

Objective: The aim of this study was to investigate the association between periodontal disease and self-rated oral health among Brazilian adults.

Material and Methods: Data on 11,874 adults in 250 cities from all the Brazilian regions were analysed. The outcome investigated was self-rated oral health (dichotomized into ''Good'' and ''Poor'') and the main exposure was periodontal disease defined as the combination of periodontal pocket depth $\geqslant$4 mm and clinical attachment loss $\geqslant$4 mm. Demographic characteristics, socioeconomic conditions, clinical oral health conditions (dental caries, dental and gingival pain, tooth loss and use of prosthesis) and use of dental services were the other explanatory variables. Simple and multivariate Poisson regression was performed allowing the estimation of prevalence ratios (PRs). All analyses were adjusted for the cluster sampling design.

Results: The prevalence of periodontal disease was 8.9% ($_{95\%}$CI 7.6–10.3) and poor self-rated oral health was 23.6% ($_{95\%}$CI 21.9–25.2) which was significantly higher among those who presented periodontal disease (PR 1.4; $_{95\%}$CI 1.2–1.5), after the adjustment for possible confounders.

Conclusions: Periodontal disease was associated with poor self-rated oral health. The results of this study should be considered by population health planners in order to assess and plan periodontal services.

Key words: epidemiology; periodontal disease; self-rated oral health; survey

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Knowledge of the epidemiological pattern of health diseases and health problems is an important parameter in evaluating the health conditions of a population, and it is thus essential for the health planning services (Sheiham & Spencer 1997). Nevertheless, this parameter considers clinical indicators (normative assessment), based on a medical model that emphasizes the biological and pathological process of a disease and not the psychosocial aspects of an individual's life and its consequences in terms of their health (Leão & Sheiham 1995, Chen & Hunter 1996).

Therefore, aspects through which persons perceive and evaluate their health status, their symptoms and consequently their treatment needs (self-perceive assessment) should be incorporated into epidemiological studies as a complement to clinical measures (normative assessment), permitting a more complex evaluation of health (Chen & Hunter 1996, Gift et al. 1998).

Self-rated health is a commonly used self-perceived measurement used as a single-item question: ''*How would you rate your overall health?*'' This measurement has been widely used in health surveys to track trends in heart disease, cancer, diabetes, risk factors for obesity and other health outcomes (CDC 2001). The extensive use of self-rated health is due to its being associated with a high reliability. In addition, some longitudinal studies refer to self-rated health as a strong predictor of future mortality (Idler & Kasl 1995, Idler & Benyamini 1997, Benyamini et al. 2004).

Self-rated oral health reflects numerous aspects which are not sufficiently explained by other parameters traditionally used in normative assessments. Oral health may affect general health, functioning and quality of life, and

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result in pain and discomfort, leading to problems related to eating, communication, appearance and, consequently, may cause embarrassment, social problems and low self-esteem (Benyamini et al. 2004). In principle, self-rated oral health is a measure of ''health'' from the perspectives of individuals and society, in contrast to ''morbidity'', which is the general focus of clinical ratings (Matthias et al. 1995).

The degree of self-rated oral health is associated with socioeconomic and demographic factors, oral health conditions and use of dental services. According to the literature, socioeconomic and demographic factors (e.g. skin colour, sex, age, income, schooling and geographic location of residence) influence health behaviours, use of dental services and, consequently, oral health conditions and self-rated oral health (Matthias et al. 1995, Chen & Hunter 1996). Oral health clinical conditions, such as the presence of dental caries, tooth loss and periodontal disease, are associated with a negative impact on oral functioning, speech and appearance, and as a result, individuals report poor self-rated oral health (Reisine & Bailit 1980, Gooch et al. 1989, Atchison et al. 1993, Matthias et al. 1995, Lang et al. 1997, Locker & Jokovic 1997). Moreover, self-reported conditions, for instance perceived symptoms of periodontal disease such as dental mobility and gingival recession (Rosenberg et al. 1988, Atchison et al. 1993, Matthias et al. 1995) and dental pain (Gooch et al. 1989), have been associated with poor self-rated oral health.

The demand for dental services is, in turn, influenced by self-perceived treatment needs (Reisine & Bailit 1980) when the perceived need is converted into use of services, which can be identified by the last dental visit (Gift et al. 1998, Locker & Gibson 2005, Afonso-Souza et al. 2007). The use of dental services differentiates the individuals in terms of knowledge, perceptions and normative indicators of oral health (Gift et al. 1998). The type of dental service used (public or private) can result in differences in self-rated oral health (Hancock et al. 1999, McGrath & Bedi 2003).

The results obtained through self-perceived oral health indicators influence the effectiveness of treatments, patient following ups and the use of dental health services. Moreover, they help to develop priorities in oral health such as the establishment of specific dental services (Rosenberg et al. 1988, Chen & Hunter 1996, Sheiham & Spencer 1997, Sanders & Spencer 2005).

Despite its importance, self-rated oral health has been barely considered in nationwide population-based studies. The majority of these studies have been performed in developed countries, and they are scarce in Brazil (Matos & Lima-Costa 2006). The latest Brazilian Oral Health Survey – SB-Brazil, concluded in 2003, was the first nationwide survey to add variables related to self-rated oral health, along with socioeconomic indicators and the use of dental services.

Self-perceived indicators have been used in the area of oral health to investigate the effect of orthodontic treatment (de Oliveira & Sheiham 2003, Shaw et al. 2007), malocclusions (Peres et al. 2008), dental caries and fluorosis (Peres et al. 2003, Do & Spencer 2007) and tooth loss (Steele et al. 2004) on the oral health of an individual. However, few researchers have investigated the influence of periodontal disease on self-perceived oral health (Leão et al. 1998, Needleman et al. 2004, Ng & Leung 2006).

A literature review to identify the studies on periodontal disease and non-normative measures was carried out using Medline-Pubmed, *Literatura Latino-Americana e do Caribe em Ciências da Saúde* (LILACS – Latin American and Caribbean Health Sciences Literature) and BioMed Central databases, with the following terms: ''*Self Concept*'', ''*Self Reported*'', ''*Self-rated Health*'', ''*Self-perception*'', ''*Self-perceived*'', ''*Oral Health*'', ''*Quality of Life*'', ''*Periodontitis*'', ''*Periodontal Attachment Loss*'' and ''*Periodontal Diseases*''. Only three publications relating to investigations on the influence of periodontal disease on an individual's oral health and self-perceived oral health were found (Leão et al. 1998, Needleman et al. 2004, Ng & Leung 2006). The authors demonstrated that normative and self-perceived assessments of periodontal disease were associated with poor self-perceived oral health and poor quality of life. Despite the importance of these findings, the aforementioned studies were not nationwide and population based which limits the external validity of their results. Furthermore, according to some study reviews, the lack of standardized study design, clear-cut criteria for disease and health, and methods for disease detection and measurement limit the interpretation and analysis of available population-based periodontal disease data around the world (Albandar & Rams 2002, Gjermo et al. 2002). However, research suggests that advanced periodontal disease affects a relatively small percentage of adults and is more common in older people (Sheiham & Netuveli 2002). People with more severe disease may have more discomfort, social embarrassment and perceived loss of function.

The utilization of self-perceived oral health measurement allows a comprehensive diagnosis of the oral health conditions of individuals and society as a whole, which contributes to the oral health planning according to population needs. The aim of the present study was to investigate the prevalence of periodontal disease and self-rated oral health among the Brazilian adult population and answer the following questions: (a) Is periodontal disease associated with self-rated oral health among Brazilian adults? (b) If there is an association, what is its magnitude?

Methods

The cross-sectional data for this study comprised data previously gathered by the Brazilian National Oral Health Survey – SB-Brazil, conducted between May 2002 and October 2003 by the Brazilian health authorities. The pilot study was performed between August and September 2000.

SB-Brazil was a major epidemiological survey of oral health, and included individuals from different age groups, according to the World Health Organization (WHO 1997) recommendations among others: infants aged 18–36 months, pre-school children aged 5, children aged 12, adolescents aged 15–19, adults aged 35–44 and older adults aged 65–74. The total number of Brazilians examined were 108,921.

The multistage sampling design consisted of a random selection of 250 towns from all 26 Brazilian states and the Federal District, as stratified by population size, from the five macro regions of Brazil (Southeast, South, North, Northeast and Central-West) and age. Schools represented the sampling collection units for oral examination of children, and households

were the analysis unit for infants, adolescents, adults and older adults. Nearly 2,000 dental professionals participated as dental examiners and as clerks and coordinators. In each state of the Brazilian federation, instructors with previous experience in oral health surveys, following WHO guidelines, directed the training and calibration of all dentists and clerks. Further methodological information is available in the original report of the survey (Brasil 2004).

The present study analysed data from the adults aged 35–44 years who participated in the SB-Brazil, totalizing 13,431 individuals. All the edentulous adults ($n = 1{,}218$; 9.1%) were excluded due to the impossibility of evaluating the periodontal conditions in this population. Finally, the study sample considered only the individuals who gave information on the outcome measured, the self-rated oral health ($n = 11{,}874$).

In the adult population, periodontal conditions, dental caries, use and need for prosthetics and edentulism were assessed. Dental caries was measured using the DMFT index. Periodontal conditions were measured using the highest score of the Community Periodontal Index (CPI) and highest score of clinical attachment loss (CAL) (WHO 1997). Oral examinations were performed in the homes of the adults under natural illumination, using flat dental mirrors and CPI probes, according to WHO guidelines (1997), and wooden spatulas for better visualization. Information on socioeconomics, demography, use of dental services and self-perceived oral health was also collected, and all of it was self-reported.

The original report (Brasil 2004) of the survey contains comprehensive information on data reliability. Kappa statistics were calculated based on categories of periodontal pockets and CAL. Approximately 5% of the exams were carried out in duplicate in order to measure intra-observer reliability; for the assessment of the periodontal condition, the lowest kappa value observed was 0.7, which indicates an adequate intra-observer agreement (Szklo & Javier Nieto 2004).

Outcome – self-rated oral health

The outcome variable, self-rated oral health, was measured by means of the question presented in the SB-Brazil 2002/2003: ''*How would you rate your overall oral health?*'': 1: very poor; 2: poor; 3: fair; 4: good; and 5: excellent (five-point scale; ''5'' high). This variable was dichotomized into ''Good'' self-rated oral health (codes 3, 4 and 5) and ''Poor'' self-rated oral health (codes 1 and 2).

Main exposure – periodontal disease

Periodontal examinations were carried out by sextants according to the CPI and Clinical Attachment Loss Index, where six sites per tooth were assessed (mesio-buccal, mid-buccal, disto-buccal, disto-lingual, mid-lingual and mesio-lingual). Periodontal pocket depth (PPD) was measured as the distance (in mm) from the free gingival margin to the base of the gingival sulcus. SB-Brazil also measured CAL, which was defined as the distance (in mm) from the cement–enamel junction to the base of the gingival sulcus. According to the literature review carried out by Borrell & Papapanou (2005), combinations of disease indicators in epidemiological studies have also been used under the rationale that they represent both cumulative tissue destruction (CAL) and current pathology (PPD). The present study adopted the same criteria, and defined periodontal disease as PPD $\geqslant$ 4 mm (CPI code $\geqslant$ 3) and CAL $\geqslant$ 4 mm (CAL code $\geqslant$ 1). With the aim of evaluating a possible dose–response relationship between numbers of affected sextants with periodontal disease (extent of disease) and self-rated oral health, we tested a variable categorized into the following: no sextants with periodontal disease, at least one sextant with periodontal disease and two or more sextants with periodontal disease.

Control of confounding variables

The confounding variables were constructed from the interview and clinical examinations data of SB-Brazil 2002/2003 as follows: socioeconomic and demographic characteristics, clinical oral conditions (normative assessment) and use of dental services. The categories were divided based on theoretical reasoning (according to the Brazilian census and literature), maintained as found in the SB-Brazil database or categorized according to statistical distribution (e.g. quartiles).

Socioeconomic and demographic variables

Geographical location (urban and rural), sex (male and female) and skin colour, according to Brazilian census categories (white, lighter-skinned black, darker-skinned black, yellow-Asian descendents and indigenous), were maintained as in the original database. Age was originally collected as a discrete numeric variable and was dichotomized into two age groups based on the median interval (35–39 and 40–44 years). Per capita family monthly income in Reais (R$ – Brazilian currency) was obtained by dividing the family income (continuous variable) by the number of inhabitants per household, and was then categorized according to the following quartiles of the distribution: $\geqslant$200, 101–199, 51–100, $\leqslant$50 (1 US$ is equivalent to R$ 1.68 – exchange rate in March 2008). Schooling level compared individuals according to the number of years of study ($\geqslant$12 years, 9–11 years, 5–8 years and $\leqslant$4 years of study).

Variables of clinical oral conditions (normative assessment)

The presence of untreated dental caries was assessed from component D of the DMFT index and then categorized according to the following tertiles of the frequency distribution (0, 1–3 and $\geqslant$4 teeth). Tooth loss data was obtained from component M of the DMFT and categorized into $\geqslant$20 and $<$20 teeth, according to the shortened dental arch theory, which establishes that adults should have at least 20 functional teeth with no aesthetic blanks, in order to permit a functional and acceptable chewing ability (Käyser 1981). The DMFT index considers that the component M in adults is due to dental caries. Dental and gingival pain was evaluated using the question presented in SB-Brazil study: ''*Have you had toothache at some time in the last six months?*'' dichotomized into No and Yes. The use of prosthesis was evaluated using two variables: upper and lower use, and then divided into three categories: no use, use of partial and/or fixed prosthesis and use of complete dentures.

Use of dental services

The variable of ''self-perceived need for dental treatment'' was dichotomized into Yes and No; the variable of ''time since last dental visit'' was categorized into $<$1 year, 1 to 2 years, 3 years or more and ''have never visited'' a dentist. The type of service used in the last dental visit was dichotomized

into SUS (Unified National Health System) and private (private and health insurance).

Sample power

Considering that the study analysed secondary data, the sample power calculation was assessed *in posteriori*. In this sample size, it is possible to detect as statistically significant a prevalence ratio (PR) equal to or higher than 1.1, because the prevalence of the outcome of the non-exposed group (no periodontal disease) was 22%, with a statistical power of 80% and type I error of 5%. The sample size in the present study was sufficient to test the hypothesis that there was an association between periodontal disease and poor self-rated oral health, after the adjustment for several confounding variables.

Statistical analysis

The SB-Brazil 2002/2003 database was obtained from the Brazilian Ministry of Health website (http://dtr2004.saude.gov.br/dab/saudebucal/bancodados.php).

Statistical analysis was performed with STATA 9 software. Descriptive statistics (relative and absolute frequency) were obtained for each category of the studied variables where appropriate, using 95% confidence intervals ($_{95\%}$CIs). Bivariate and multivariate analyses were conducted using a Poisson regression model in order to produce direct estimates of all calculated PRs, using $_{95\%}$CIs, and Wald's tests for statistical significance (p-values). Poisson regression is recommended in cross-sectional studies when the frequency of the outcome measured is higher than 20%, so that the odds ratio tends to overestimate the PR (Barros & Hirakata 2003). Variables showing a p-value <0.25 in the bivariate analysis (Hosmer & Lemeshow 1989) were included in the multivariate analysis and followed the order of p-value significance. The final model of the multivariate analysis gave the association between periodontal disease and self-rated oral health ($p<0.05$), after the adjustment for confounding variables ($p<0.25$). All the analyses were adjusted for the cluster sampling design, using the command *svy* in STATA.

Ethical aspects

The protocol was approved by the National Human Research Ethics Council of Brazil, document number 581/2000, on 21 July 2000. All the participants provided written informed consents.

Results

The response rate of the adult population to the SB-Brazil survey was 85%. Table 1 shows the sample distribution and the poor self-rated oral health prevalence according to the independent variables studied and their respective $_{95\%}$CIs and p-values. The sample consisted of 66.4% females, 44.2% white people and the average age was 39. Around 40% of the population had 4 years or less of schooling while the mean family per capita monthly income was R$ 182.20 (U$ 108.45). The prevalence of poor self-rated oral health was 23.6% ($_{95\%}$CI 21.9–25.2; Table 1). Periodontal disease was present in 8.9% of the sample ($_{95\%}$CI 7.6–10.3), and was significantly more prevalent among men, lighter and darker-skinned black individuals, those with lower family per capita incomes and those with lower schooling level (Table 2).

The Poisson regression models of the association between periodontal disease and self-rated oral health are demonstrated in Table 3. In the unadjusted analysis, periodontal disease revealed a PR of 1.7 ($_{95\%}$CI 1.5–1.9), which means that the prevalence of poor self-rated oral health among those with periodontal disease was 70% higher compared with the non-exposed group. In the multivariate analysis, it could be observed that the association between periodontal disease and poor self-rated oral health was maintained, even after adjusting for potential confounding variables. However, the PR decreased from 1.7 (unadjusted) to 1.4 ($_{95\%}$CI 1.2–1.5) (after all variables were included) (Table 3). The underlined variables in Table 3 had p-values >0.25 after adjustment, and consequently they were not included in the following model.

Table 4 demonstrates the final Poisson model of the association between self-rated oral health and the independent variables. According to this table, the presence of periodontal disease, per capita monthly income (for those who receive $\leqslant$R$ 100.00 – U$ 59.52 per month), dental caries (one or more untreated dental caries), presence of dental and gingival pain in the last 6 months, absence of shortened dental arch (<20 teeth present), use of lower prosthesis (for those who were using a partial and/or fixed prosthesis), perceived need for dental treatment, last dental visit (over 3 years ago or never been), age (40–44 years old) and sex (females) were the variables associated with poor self-rated oral health ($p<0.05$).

The bivariate analysis showed no association between number of affected sextants with periodontal disease (extent of disease) and the self-rated oral health ($p=0.395$) (data not shown). Number of affected sextants presented the following frequency distribution: no sextants ($n=10.517$; 91.1%); one sextant ($n=574$; 5.0%); two sextants ($n=243$; 2.1%); three sextants ($n=118$; 1.0%); four sextants ($n=52$; 0.45); five sextants ($n=22$; 0.19%); six sextants ($n=23$; 0.2%).

When we tested the differences between the association of self-rated oral health with moderate periodontal disease and severe periodontal disease, the bivariate analysis showed that moderate periodontal disease presented a PR of 1.7 ($p<0.001$), and after the adjusted analysis, a PR of 1.4 ($p<0.001$), while severe periodontal disease presented a PR of 1.8 ($p<0.001$) in the bivariate analysis and 1.4 ($p=0.009$) after the adjustment.

Discussion

The present study investigated the association between periodontal disease and self-rated oral health in the Brazilian adult population. To the best of the authors' knowledge, the current study is the first nationwide population-based study to address this issue.

In the studied sample, poor self-rated oral health had a prevalence of 23.6%, similar to the figures reported in Australia (23.4%) in the same age group (Sanders & Spencer 2005). In the present investigation, self-rated oral health was dichotomized into ''Good self-rated oral health'' (categories: fair, good and excellent) and ''Poor self-rated oral health'' (categories: poor and very poor). A previous investigation carried out with adults in Brazil observed that in the test–re-test reliability study, some individuals who first reported their oral health as ''Fair'' tended to report it as ''Good'' in the re-test. This trend suggests that the ''Fair'' status is

Table 1. Sample distribution and poor self-rated oral health prevalence according to independent variables in Brazilian adults aged 35–44, Brazil, 2002–2003 ($n = 11{,}874$)

Variables	Sample distribution		Poor self-rated oral health	*p*-value
	n	%	Prevalence ($_{95\%}$CI)	
Poor self-rated oral health	2799	23.6	23.6 (21.9–25.2)	
Sex				0.133*
Male	3994	33.6	22.6 (20.5–24.9)	
Female	7880	66.4	24.0 (22.4–25.8)	
Age				0.098*
35–39	6677	56.2	23.0 (21.2–24.9)	
40–44	5197	43.8	24.3 (22.5–26.2)	
Skin colour				<0.001*
White	5338	44.2	19.7 (17.6–22.0)	
Lighter-skinned black	5007	42.3	27.2 (25.4–29.0)	
Darker-skinned black	1097	9.3	27.7 (24.6–31.1)	
Yellow-Asiatic	379	3.2	16.4 (12.5–21.2)	
Indigenous	126	1.1	24.6 (16.9–34.4)	
Schooling level (years)				<0.001**
⩾12	1372	11.6	14.8 (12.5–17.5)	
9–11	2160	18.2	18.9 (16.8–21.3)	
5–8	3628	30.5	22.8 (20.7–25.1)	
⩽4	4714	39.7	28.8 (26.8–31.0)	
Per capita monthly income (Reais)				<0.001**
⩾200	2756	23.4	14.2 (12.2–16.4)	
101–199	3008	25.6	21.1 (19.1–23.5)	
51–100	3053	25.9	26.1 (24.0–28.3)	
⩽50	2955	25.1	32.1 (29.5–35.0)	
Geographic location				0.477*
Urban	10,506	88.5	23.4 (21.7–25.2)	
Rural	1361	11.5	24.9 (20.9–29.4)	
Periodontal disease				<0.001*
No	10,517	91.1	21.9 (20.3–23.6)	
Yes	1032	8.9	38.0 (34.2–42.0)	
Dental caries				<0.001**
0	3864	32.5	11.3 (9.6–13.1)	
1–3 teeth	4382	36.9	21.0 (19.5–22.7)	
⩾4 teeth	3628	30.6	39.7 (37.2–42.4)	
Dental and gingival pain				<0.001*
No	7536	63.5	16.1 (14.9–17.8)	
Yes	4337	36.5	36.2 (33.9–38.6)	
Tooth loss				<0.001*
⩾20 present teeth	2612	22.0	15.9 (13.5–18.6)	
<20 present teeth	9262	78.0	25.7 (24.1–27.5)	
Use of upper prosthesis				0.044*
No use	6682	56.5	24.4 (22.4–26.5)	
Use of partial and/or fixed prosthesis	2893	24.5	22.4 (20.5–24.4)	
Use of complete denture	2245	19.0	22.2 (20.2–24.4)	
Use of lower prosthesis				<0.001*
No use	10,731	90.8	24.4 (22.7–26.1)	
Use of partial and/or fixed prosthesis	1057	8.9	14.4 (13.3–16.7)	
Use of complete denture	35	0.3	20.0 (8.6–39.8)	
Do you perceive need for dental treatment?				<0.001*
No	1990	16.8	8.3 (6.4–10.7)	
Yes	9848	83.2	26.7 (25.1–28.3)	
How long since your last visit to a dentist?				<0.001**
<1 year	4783	40.5	16.8 (15.0–18.7)	
1–2 years	2787	23.6	21.1 (19.2–23.2)	
3 years or more	3938	33.3	32.2 (30.1–34.4)	
Never been to a dentist	315	2.7	40.0 (34.6–45.6)	
Type of service				<0.001*
Private	5393	48.8	19.5 (17.9–21.2)	
SUS public	5669	51.2	26.0 (23.9–28.2)	

$_{95\%}$CI, 95% confidence intervals adjusted for the cluster sampling design.
*p-value: Wald's test for heterogeneity.
**p-value: Wald's test for trend.

closer to ''Good'' rather than ''Poor'' (Afonso-Souza et al. 2007).

The prevalence of periodontal disease among Brazilian adults was 8.9%. In other studies, it was found that a relatively small subset of the population in the USA, Central and South America, Europe, Africa, Asia and Oceania exhibit severe forms of periodontal diseases (Albandar & Rams 2002). However, Latin American countries, such as Argentina and Chile, show a higher prevalence of destructive periodontal disease in middle-aged individuals (>30%), while Uruguay and El Salvador show an intermediate prevalence (between 10% and 29%) in the same age group (Gjermo et al. 2002). When European countries are considered as a whole, the prevalence of severe periodontal diseases is low (14%), ranging from 2% in the UK to 31% in Belarus (Sheiham & Netuveli 2002).

In the present investigation, the prevalence of poor self-rated oral health was significantly higher among those who presented periodontal disease. One of the first studies to investigate the association between normative assessment and self-rated oral health was developed by Reisine & Bailit (1980) in the USA. The researchers demonstrated the association between the presence of periodontal problems and poor self-perceived oral health. This association was later supported by the study of Gooch et al. (1989) in the USA and Rosenberg et al. (1988) in Israel. Additionally, Atchison et al. (1993) and Matthias et al. (1995), in Los Angeles, USA, found the association between poor self-rated oral health and dental mobility, taken as a sign of periodontal disease, in elderly people. CAL of 4–5 mm was associated with poor self-rated oral health in a study performed among individuals aged 18–93 living in Detroit, USA, (Lang et al. 1997). Locker & Jokovic (1997), in their longitudinal study in Canada, identified that self-rated oral health was worst among those who presented higher prevalence of periodontal disease, suggesting the causality between exposure and outcome. However, it can be observed that the majority of the above-referenced studies did not include only adults and were not nationwide population-based which inhibits comparison with the present study. Moreover, our study considered the prevalence of periodontal disease, while the studies mentioned evaluated the severity of the disease.

Table 2. Prevalence of periodontal disease (PD) according to demographic and socioeconomic characteristics of Brazilians aged 35–44, Brazil, 2002–2003 ($n = 11{,}874$)

Variables	Prevalence of PD		$_{95\%}$CI	*p*-value
	n	%		
Periodontal disease	1032	8.9	7.6–10.3	
Sex				<0.001*
Male	433	11.1	9.3–13.1	
Female	599	7.8	6.6–9.2	
Age				<0.001*
35–39	509	7.8	6.6–9.2	
40–44	523	10.4	8.8–12.2	
Skin colour				<0.001*
White	368	7.2	5.8–8.9	
Lighter-skinned black	494	10.1	8.6–12.1	
Darker-skinned black	128	12.0	9.2–15.5	
Yellow-Asiatic	33	8.8	4.9–15.1	
Indigenous	9	6.6	2.8–14.7	
Schooling level (years)				<0.001**
⩾12	66	4.9	3.6–6.5	
9–11	154	7.3	5.9–8.9	
5–8	336	9.5	7.8–11.5	
⩽4	476	10.5	8.9–12.4	
Per capita monthly income (Reais)				<0.001**
⩾200	167	6.1	4.8–7.8	
101–199	245	8.4	6.8–10.3	
51–100	308	10.4	8.6–12.4	
⩽50	306	10.8	9.0–13.0	
Geographic location				0.343
Urban	896	8.8	7.5–10.2	
Rural	136	10.4	7.3–14.4	

$_{95\%}$CI, 95% confidence intervals adjusted for the cluster sampling design.
*p-value: Wald's test for heterogeneity.
**p-value: Wald's test for trend.

Sheiham & Netuveli (2002) noted that a Public Health problem will present high prevalence in the population and limited availability of Public health services will have a serious impact on individuals and society. In addition, effective preventive and treatment measures should be available. Periodontal disease, such as that assessed in this study, does not show high prevalence; however, it requires costly treatment and organization of dental services, which qualify it as a Public Health problem (Sheiham 2001). Moreover, some studies have demonstrated that signs and symptoms of periodontal disease, such as bad breath, bleeding, gingival recession, dental mobility and tooth loss, cause discomfort and affect functioning, promoting a negative impact on an individual's life (Leão et al. 1998, Needleman et al. 2004, Ng & Leung 2006). However, initial signs and symptoms of periodontal disease are asymptomatic, and it thus negatively influences oral health only when it causes pain, or affects functioning and appearance, i.e. when the disease is in a more advanced stage.

We defined periodontal disease as PPD⩾4 mm (CPI code⩾3) and CAL⩾4 mm (CAL code⩾1). A pre-

Table 3. Association between poor self-rated oral health and periodontal disease in Brazilian adults

No.	Model	PR ($_{95\%}$CI)	*p*-value
1	Periodontal disease	1.7 (1.5–1.9)	<0.001
2	Periodontal disease+skin colour	1.7 (1.5–1.9)	<0.001
3	Periodontal disease+skin colour+schooling	1.7 (1.5–1.9)	<0.001
4	Periodontal disease+skin colour+schooling+per capita monthly income	1.6 (1.4–1.8)	<0.001
5	Periodontal disease+*skin colour*+schooling+per capita monthly income+dental caries	1.5 (1.3–1.6)	<0.001
6	Periodontal disease+schooling+per capita monthly income+dental caries+dental and gingival pain	1.4 (1.3–1.6)	<0.001
7	Periodontal disease+schooling+per capita monthly income+dental caries+dental and gingival pain+tooth loss	1.4 (1.3–1.6)	<0.001
8	Periodontal disease+schooling+per capita monthly income+dental caries+dental and gingival pain+tooth loss+use of **lower** prosthesis	1.4 (1.3–1.6)	<0.001
9	Periodontal disease+schooling+per capita monthly income+dental caries+dental and gingival pain+tooth loss+use of **lower** prosthesis+perceived need for dental treatment	1.4 (1.3–1.5)	<0.001
10	Periodontal disease+*schooling*+per capita monthly income+dental caries+dental and gingival pain+tooth loss+use of **lower** prosthesis+perceived need for dental treatment+last dental visit	1.4 (1.2–1.5)	<0.001
11	Periodontal disease+per capita monthly income+dental caries+dental and gingival pain+tooth loss+use of **lower** prosthesis+perceived need for dental treatment+last dental visit+type of service	1.3 (1.2–1.5)	<0.001
12	Periodontal disease+per capita monthly income+dental caries+dental and gingival pain+tooth loss+use of **lower** prosthesis+perceived need for dental treatment+last dental visit+*use of **upper** prosthesis*	1.4 (1.2–1.5)	<0.001
12	Periodontal disease+per capita monthly income+dental caries+dental and gingival pain+tooth loss+use of **lower** prosthesis+perceived need for dental treatment+last dental visit+age	1.4 (1.2–1.5)	<0.001
13	Periodontal disease+per capita monthly income+dental caries+dental and gingival pain+tooth loss+use of **lower** prosthesis+perceived need for dental treatment+last dental visit+age+sex	1.4 (1.2–1.5)	<0.001

Poisson regression models.
p-value adjusted for the cluster sampling design.
The underlined variables presented *p*-value >0.25 after the adjustment and were not included in the following model.
PR, prevalence ratio; $_{95\%}$CI, 95% confidence intervals; Upper, superior or maxillary; Lower, inferior or mandibulary.

Table 4. Association between the independent variables and self-rated oral health – final Poisson regression model

Variables	Adjusted PR ($_{95\%}$CI)	*p*-value
Periodontal disease		<0.001
No	1.0	
Yes	1.4 (1.2–1.5)	
Per capita monthly income (Reais)		<0.001
⩾200	1.0	
101–199	1.2 (1.1–1.3)	
51–100	1.2 (1.1–1.4)	
⩽50	1.3 (1.1–1.5)	
Dental caries		<0.001
0	1.0	
1–3 teeth	1.6 (1.4–1.8)	
⩾4 teeth	2.5 (2.2–2.8)	
Dental and gingival pain		<0.001
No	1.0	
Yes	1.8 (1.7–2.0)	
Tooth loss		<0.001
⩾20 teeth present	1.0	
<20 teeth present	1.4 (1.3–1.6)	
Use of lower prosthesis		0.009
No use	1.0	
Use of partial and/or fixed prosthesis	0.8 (0.7–0.9)	
Use of complete denture	1.3 (0.6–2.5)	
Do you perceive need for dental treatment?		<0.001
No	1.0	
Yes	2.0 (1.6–2.6)	
How long since your last visit to a dentist?		<0.001
<1 year	1.0	
1–2 years	1.2 (1.0–1.3)	
3 years or more	1.5 (1.4–1.6)	
Never been	1.7 (1.4–2.0)	
Age (years)		0.013
35–39	1.0	
40–44	1.1 (1.0–1.2)	
Sex		<0.001
Male	1.0	
Female	1.1 (1.1–1.2)	

PR, prevalence ratio; $_{95\%}$CI, 95% confidence intervals;
p-value adjusted for the cluster sampling design.

vious study used the same definition (Peres et al. 2007). The measurement of CAL is important to evaluate the severity and extension of periodontal tissue loss, and may indicate a previous destructive disease process (past disease activity), while PPD provides useful information regarding the present inflammatory status of the periodontal tissue, and may also be indicative of chronic local inflammation (Susin et al. 2005). Before the use of the definition above, different cut-off points of the combination of PPD and CAL were tested in order to evaluate differences between the association of self-rated oral health with moderate periodontal disease (PPD 4–5 mm+CAL 4–8 mm) and with severe periodontal disease (PPD⩾6 mm+CAL⩾9 mm). However, it was not possible to evaluate this properly due to the small number of persons with severe periodontal disease in the study sample ($n = 85$; 0.74%), which was a limitation of this study. Probably, individuals with severe periodontal disease would rate their oral health even worse when compared with the results reported here. The methodological criterion used in the SB-Brazil survey to assess periodontal diseases – the CPI – also has some limitations. This hinders comparisons because only the worse situation found in each sextant is registered, and the presence of calculus masks signs of inflammation, such as the prevalence of bleeding. The presence of periodontal pockets also leads to underestimates in the registering of calculus. As a result, as regards comparative studies, recordings of prevalence should be made and reported separately for later inclusion in the standards of the respective indices. Another limitation relates to the exclusion of sextants when the index teeth recommended by WHO (WHO 1997) are not present, which may have led to an underestimation of the prevalence of periodontal diseases. Some ways to overcome this limitation have been proposed, such as to examine randomly two mouth quadrants, one maxillary and one mandibular, or even to examine all teeth present, which would give more precise data on the prevalence of the disease (Borrell & Papapanou 2005). However, it is important to differentiate between the objectives of etiological studies and surveys. In the former, a more detailed examination is mandatory, i.e. all or most of the teeth must be examined. On the other hand, in a survey context a cost-benefit evaluation needs to be taken into account. However, the CPI has been extensively used in developing countries (Gjermo et al. 2002), and it is recommended by the World Health Organization (WHO 1997).

Another limitation relates to the cross-sectional study design which did not permit a verification of the causal relation between the outcome and the independent variables. For instance, in the association between poor self-rated oral health and use of dental services, temporal ambiguity can occur. The present investigation used secondary data on the subgroup of SB-Brazil consisting of adults aged 35–44. The study sample included 11,874 subjects, of which 8096 (66%) were females and 4117 (34%) were males, while in the latest Brazilian census carried out in 2000, there were 52% of females and 48% of males in the same age group. However, similarities between the mean schooling level (6.1 years of study) in our study and in the Brazilian census (6.6 years of study) carried out in 2000 IBGE (2003) could be observed, which reinforces the external validity of the study. Additionally, the SB-Brazil 2002/2003 sample produced a wide range of information on Brazilian oral health. The main strength of this study lies in the fact that it comprises an assessment of a large population-based dataset, representative of all Brazilian regions, including towns of different sizes. In addition, the intra-examiner reliability was satisfactory; SB-Brazil was the first oral nationwide population-based study to incorporate a self-perceived oral health assessment. SB-Brazil was not designed to investigate the hypothesis and objectives of the present study, and because the examiners and interviewers were

unaware of the aims of this study, a misclassification due to an interviewer bias is unlikely to have occurred.

Understanding the influence of periodontal health on individuals is important for directing the planning of services, along with prevention and health promotion actions, towards individual treatment needs. We identified a need for studies to assess the sensitivity of self-rated oral health in epidemiological studies, and also the impact of periodontal disease throughout the life course. Moreover, further investigations on the effects of signs and symptoms of periodontal destruction on day-to-day life and the overall quality of life should be carried out.

The present study concluded that poor self-rated oral health was significantly higher among Brazilian adults who presented periodontal disease compared with those who did not. These findings should be discussed in a Public Health perspective in order to assess and plan periodontal services and actions according to population needs.

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References

Afonso-Souza, G., Nadanovsky, P., Chor, D., Faertein, E., Werneck, G. L. & Lopes, C. S. (2007) Association between routine visits for dental checkup and self-perceived oral health in an adult population in Rio de Janeiro: the Pró-Saúde Study. *Community Dentistry and Oral Epidemiology* **35**, 393–400.

Albandar, J. M. & Rams, T.F (2002) Global epidemiology of periodontal diseases: an overview. *Periodontology 2000* **29**, 7–10.

Atchison, K. A., Matthias, R. E., Dolan, T. A., Lubben, J. E., De Jong, F., Schweitzer, S. O. et al. (1993) Comparison of oral health ratings by dentists and dentate elders. *Journal of Public Health Dentistry* **53**, 223–230.

Barros, A. J. & Hirakata, V. N. (2003) Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BioMedCentral Medical Research Methodology* **3**, 21–33.

Benyamini, Y., Leventhal, H. & Leventhal, E. (2004) A. Self-rated oral health as an independent predictor of self-rated general health, self-esteem and life satisfaction. *Social Science & Medicine* **59**, 1109–1116.

Borrell, L. N. & Papapanou, P. N. (2005) Analytical epidemiology of periodontitis. *Journal of Clinical Periodontology* **32** (Suppl. 6), 132–158.

Brasil, SB 2000 Minist ério da Sa úde (2004) *Relatório Projeto SB Brasil 2003 - Condições de saúde bucal da população brasileira 2002–2003: Resultados Principais*. Brasília-DF: Ministério da Saúde, Secretaria de Atenção à Saúde, Departamento de Atenção Básica, Coordenação Nacional de Saúde Bucal.

Centers for Disease Control and Prevention (2001) *Behavioral Risk Factor Surveillance* (BRFSS) [WWW document]. URL http://www.cdc.gov/brfss [accessed on 10 July 2007].

Chen, M. S. & Hunter, P. (1996) Oral health and quality of life in New Zealand: a social perspective. *Social Science & Medicine* **43**, 1213–1222.

de Oliveira, C. M. & Sheiham, A. (2003) The relationship between normative orthodontic treatment need and oral health-related quality of life. *Community Dentistry and Oral Epidemiology* **31**, 426–436.

Do, L. G. & Spencer, A. (2007) Oral health-related quality of life of children by dental caries and fluorosis experience. *Journal of Public Health Dentistry* **67**, 132–139.

Gift, H. C., Atchison, K. A. & Drury, T. F. (1998) Perceptions of the natural dentition in the context of multiple variables. *Journal of Dental Research* **77**, 1529–1538.

Gjermo, P., Rösing, C. K., Susin, C. & Opermann, R. (2002) Periodontal diseases in Central and South America. *Periodontolgy 2000* **29**, 70–78.

Gooch, B. F., Dolan, T. A. & Bourque, L. B. (1989) Correlates of self-reported dental status upon enrollment in the rand health insurance experiment. *Journal of Dental Education* **53**, 629–637.

Hancock, M., Calnan, M. & Manley, G. (1999) Private or NHS general dental service care in the United Kingdom? A study of public perceptions and experiences. *Journal of Public Health Medicine* **21**, 415–420.

Hosmer, D. W. & Lemeshow, S. (1989) Model-building strategies and methods for logistic regression. Advisory editors, *Applied Logistic Regression*, p. 87. New York: John Wiley & Sons, 83–133.

IBGE. Instituto Brasileiro de Geografia e Estadística (2003) *Pesquisa Nacional por Amostra de Domicílio 2001: síntese de indicadores*. Rio de Janeiro: IBGE.

Idler, E. L. & Benyamini, Y. (1997) Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health Social Behavior* **38**, 21–37.

Idler, E. L. & Kasl, S. V. (1995) Self-ratings of health: do they also predict change in functional ability? *Journal of Gerontology Series B: Psychological Sciences* **50**, 344–353.

Käyser, A. F. (1981) Shortened dental arches and oral function. *Journal of Oral Rehabilitation* **8**, 457–487.

Lang, W. P., Borgnakke, W. S., Taylor, G. W., Woolfolk, M. W., Ronis, D. L. & Nyquist, L. V. (1997) Evaluation and use of an index of oral health status. *Journal of Public Health Dentistry* **57**, 233–242.

Leão, A., Cidade, M. & Varela, J. (1998) Impactos da saúde periodontal na vida diária. *Revista Brasileira de Odontolologia* **5**, 238–241.

Leão, A. & Sheiham, A. (1995) Relation between clinical dental status and subjective impacts on daily living. *Journal of Dental Research* **74**, 1408–1413.

Locker, D. & Gibson, B. (2005) Discrepancies between self-ratings of and satisfaction with oral health in two older adult populations. *Community Dentistry and Oral Epidemiology* **33**, 280–288.

Locker, D. & Jokovic, A. (1997) Three-year changes in self-perceived oral health status in an older Canadian population. *Journal of Dental Research* **76**, 1292–1297.

Matos, D. L. & Lima-Costa, M. F. (2006) Self-rated oral health among Brazilian adults and older adults in Southeast Brazil: results from the SB-Brasil Project, 2003. *Reports in Public Health* **22**, 1699–1707.

Matthias, R. E., Atchison, K. A., Lubben, J. E., De Jong, F. & Schweitzer, S. O. (1995) Factors affecting self-ratings of oral health. *Journal of Public Health Dentistry* **55**, 197–204.

McGrath, C. & Bedi, R. (2003) Dental services and perceived oral health: are patients better off going private? *Journal of Dentistry* **31**, 217–221.

Needleman, I., McGrath, C., Floyd, P. & Biddle, A. (2004) Impact of oral health on the life quality of periodontal patients. *Journal of Clinical Periodontology* **31**, 454–457.

Ng, S. K. & Leung, W. K. (2006) Oral health-related quality of life and periodontal status. *Community Dentistry and Oral Epidemiology* **34**, 114–122.

Peres, K. G., Barros, A. J. D., Anselmi, L., Peres, M. A. & Barros, F. C. (2008) Does malocclusion influence the adolescent's satisfaction with appearance? A cross-sectional study nested in a Brazilian birth cohort. *Community Dentistry and Oral Epidemiology* **36**, 137–143.

Peres, K. G., Latorre, M. R., Peres, M. A., Traebert, J. & Panizzi, M. (2003) Impact of dental caries and dental fluorosis on 12-year-old schoolchildren's self-perception of appearance and chewing. *Reports in Public Health* **19**, 323–130.

Peres, M. A., Antunes, J. L. F., Boing, A. F., Peres, K. G. & Bastos, J. L. D. (2007) Skin colour is associated with periodontal disease in Brazilian adults: a population-based oral heath survey. *Journal of Clinical Periodontology* **34**, 196–201.

Reisine, S. T. & Bailit, H. L. (1980) Clinical oral health status and adult perceptions of oral health. *Social Science & Medicine* **14**, 597–605.

Rosenberg, D., Kaplan, S., Senie, R. & Badner, V. (1988) Relationships among dental functional status, clinical dental measures, and

generic health measures. *Journal of Dental Education* **52**, 653–657.

Sanders, A. E. & Spencer, A. J. (2005) Why do poor adults rate their oral health poorly? *Australian Dental Journal* **50**, 161–167.

Shaw, W. C., Richmond, S., Kenealy, P. M., Kingdon, A. & Worthington, H. (2007) A 20-year cohort study of health gain from orthodontic treatment: psychological outcome. *American Journal of Orthodontics and Dentofacial Orthopedics* **132**, 146–157.

Sheiham, A. (2001) Public health approaches to promoting periodontal health. *Revista Brasileira de Odontololgia e Saúde Coletiva* **2**, 61–82.

Sheiham, A. & Netuveli, G. S. (2002) Periodontal diseases in Europe. *Periodontology 2000* **29**, 104–121.

Sheiham, A. & Spencer, A. J. (1997) Health needs assessment. In: Pine, C. B. (ed.) *Community Oral Health*, pp. 39–54. Oxford: Wright.

Steele, J. G., Sanders, A. E., Slade, G. D., Allen, P. F., Lahti, S., Nuttal, N. & Spencer, A. J. (2004) How do age and tooth loss affect oral health impacts and quality of life? A study comparing two national samples. *Community Dentistry and Oral Epidemiology* **32**, 107–114.

Susin, C., Valle, P., Opermann, R. V., Haugejorden, O. & Albandar, J. M. (2005) Occurence and risk indicators of increased probing depth in an adult Brazilian population. *Journal of Clinical Periodontology* **23**, 123–129.

Szklo, M. & Javier Nieto, F. (2004) Quality assurance and control. In: Chambers Moore (ed.) *Epidemiology: Beyond the Basics*, p. 377. Sudbury, MA: Jones & Bartlett Publishers, 343-404.

World Health Organization WHO (1997) *Oral Health Surveys: Basic Methods*, 4th edition. Geneve: WHO.

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Clinical Relevance

Ideally, the way in which individuals perceive and evaluate their health, their symptoms and consequently their treatment needs should be included in individual and population health diagnostics.

Scientific rationale for the study: Self-rated oral health is used to measure the concept of health, and it is influenced by socioeconomics, demography, cultural context and oral health conditions. Therefore, investigating the association between periodontal disease and subjective assessment, such as self-rated oral health, constitutes an important approach for health-oriented decision makers in the periodontal health services.

Principal findings: Periodontal disease is associated with poor self-rated oral health among Brazilian adults. The prevalence of poor self-rated oral health was 40% higher among those who presented periodontal disease, after adjustment for possible confounders.

Practical implications: The prevention of periodontal disease includes knowledge and understanding of the influence of periodontal health in individuals and society. The association between periodontal disease and poor self-rated oral health should be considered in planning and organizing periodontal health services in populations.