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Individual and contextual factors associated with malocclusion in Brazilian children

ABSTRACT

OBJECTIVE: To assess the association between the prevalence of malocclusion in Brazilian 12 years-olds with individual and contextual variables.

METHODS: A cross-sectional, analytical study was conducted with data from the Brazilian Oral Health Survey – SBBrazil 2010. The outcome studied was malocclusion, categorized as absent, set, severe and very severe. The independent variables were classified as individual and contextual. Data were analyzed using a multilevel model with a 5% significance level.

RESULTS: It was found that the prevalence of severe and very severe malocclusion in 12-year-olds did not differ between the Brazilian regions, although variation between the cities was significant ($p < 0.001$). Male children ($p = 0.033$), those on lower income ($p = 0.051$), those who had visited a dentist ($p = 0.009$), with lower levels of satisfaction with mouth and teeth ($p < 0.001$) and embarrassed to smile ($p < 0.001$) had more severe malocclusion. The characteristics of the cities also affected the severity of malocclusion; cities with more families on social benefits per 1,000 inhabitants, with lower scores on the health care system performance index and lower gross domestic product per capita were significantly associated with malocclusion.

CONCLUSION: Significant associations between the presence and severity of malocclusion were observed at the individual and contextual level.

DESCRIPTORS: Child. Malocclusion, epidemiology. Socioeconomic Factors. Health Inequalities. Dental Health Surveys. Oral Health. Multilevel Analysis.

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INTRODUCTION

The epidemiological profile of oral health problems has changed, especially in children aged 12. In Brazil, tooth decay has shown a decrease in the DMFT index (decayed, missing and filled teeth) from 6.7 in 1986 to 2.07 in 2010 and, currently, a significant number of those children are free of caries (43.5%).[a] Therefore, other problems related to the oral cavity have begun to receive attention, among them, occlusal changes stand out.[14] Due to its high prevalence, the World Health Organization (WHO) now considers malocclusion to be the third largest public health problem in dentistry.[9,10]

National data relating to malocclusion indicate a prevalence of 40.0% for the index age of 12 years. For severe, and very severe malocclusion, the prevalence is 10.4% and 7.1% respectively.[a] In many cases, malocclusion can impact on the quality of life of this part of the population. It can produce aesthetic deviations in the teeth and/or face and functional disturbances of occlusion, chewing, swallowing, pronunciation and breathing. It can also cause psychosocial disorders with potential repercussions on the self-esteem and interpersonal relationships of severely affected individuals. [5]

In the face of this reality, there is a need for a clearer picture in order to understand the disease process in relation to malocclusion. Thus, in addition to individual factors, other factors, called modifiers or modulators (social, economic, cultural, ethnic/racial, psychological and behavioral factors), are related to the health of the population. Currently, these factors are known as social determinants of health. [12]

In contextual terms, some health indicators and social factors may contribute to better identifying groups or individuals vulnerable to diseases. Among these indicators, the Human Development Index (HDI) is a comparative measure used to rank countries by their level of "human development".[b]

Another indicator would be the "*Bolsa Família*" (BF, Family Allowance), a program of direct income transfer that benefits families (about 16 million Brazilians – 8.5% of the general population) with *per capita* income below 70 *reais per* month, based on the guaranteed income, productive inclusion and access to public services,[c] which represents the state of vulnerability directly linked to economic development. The Performance Index of the Brazilian public health system (IDSUS, *Índice de Desempenho do Sistema Único de Saúde*),[d] the score of which varies between zero to ten, evaluates the access and quality of health services. The lowest scores represent the worst performances of SUS for Brazil and for each county and state.[1]

In order to better understand the factors closely related to the problem, the aim of this study was to evaluate the association between the prevalence of malocclusion in Brazilian 12-year-olds with individual and contextual variables.

METHODS

This was a cross-sectional analytical study. Data from the national epidemiological survey of oral health (SBBrasil 2010) were used. [a] This epidemiological survey examined the oral health status of the population in different age groups in urban and rural areas. Brazil has a total of 190,755,799 individuals, 3,402,242 of those are children aged 12.[e] There were 37,519 individuals examined in the 26 state capitals, the Federal District and 150 municipalities with different population sizes.

The database generated in this research is in the public domain and is freely accessible on the Ministério da Saúde webpage.[e]

Data collection was performed in the home, including oral examinations and interviews using a structured questionnaire. The oral health teams were composed of an examiner – a dental surgeon, and an auxiliary note taker. For the clinical examination, instruments recommended by the WHO were used (mouth mirror and Community Periodontal Index CPI dental probe).[9]

The presence of malocclusion was recorded using the Dental Aesthetic Index (DAI), categorized as: normal, set, severe and very severe.[4] The basic principle of the DAI is a combination of measures that together express the occlusal state of the individual and the associated need for orthodontic treatment, which considers aesthetic commitment, beyond occlusion. Altogether, there are 11 steps, considering three major dimensions to be assessed: dentition, space and occlusion itself.

[a] Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Secretaria de Atenção à Saúde. Coordenação Nacional de Saúde Bucal. SB2010: Pesquisa Nacional de Saúde Bucal. Resultados principais. Brasília (DF); 2011[cited 2012 Feb 08]. Available from: http://dab.saude.gov.br/cnsb/sbbrasil/download.htm

[b] Programa das Nações Unidas para o Desenvolvimento. Desenvolvimento Humano e IDH. Brasília (DF); 2012[cited 2012 Mar 10]. Available from: http://www.pnud.org.br/idh/

[c] Ministério do Desenvolvimento Social e Combate à Fome (BR). Programa Bolsa Família. Brasília (DF); 2012 [cited 2012 Mar 15]. Available from: http://www.mds.gov.br/bolsafamilia

[d] Ministério da Saúde (BR). IDSUS - Índice de Desempenho do Sistema Único de Saúde. Brasília (DF); 2011 [cited 2012 Mar 08]. Available from: http://portal.saude.gov.br/portal/saude/area.cfm?id_area=1080

[e] Instituto Brasileiro de Geografia e Estatística (BR). Pesquisa nacional por amostra de domicílios: acesso e utilização de serviços de saúde. Rio de Janeiro; 2010 [cited 2012 Feb 15]. Available from:http://censo2010.ibge.gov.br/home/estatistica/pesquisas/pesquisa_resultados.php?id_pesquisa=40

The sampling technique used by SBBrasil 2010 was probabilistic cluster sampling. For 12-year-olds, three strata were used: the first used domains and the primary sampling units: capital and interior municipalities according to macro region. The second consisted of the subdivision of the participating municipalities: 27 capitals plus 30 municipalities in each macro region. And the third was done by random selection to ensure the representativeness of the municipalities, census tracts and households.

Between 1 and 250 participants were evaluated *per* city in 172 cities around Brazil, totaling 7,328 children aged 12, with a sample loss of 8.4 %. To calculate the sample size, the parameters used (z value, variance, mean of the DMFT, acceptable margin of error, design effect and non-response rate) were those from the SBBrasil 2003.[f]

The field teams were properly trained in workshops. The calibration technique adopted was consensus, calculating the correlation between each examiner and the results obtained by team consensus. The model proposed by the WHO was taken as a reference. The weighted kappa coefficient was calculated for each examiner, age group and health problem studied, with the minimum acceptable value of 0.65. For DAI, the WHO recommends the minimum value of 0.85 for inter-examiner and 0.95 to intra-examiner for the evaluation.[a]

The outcome studied was malocclusion, measured by DAI, calculated as follows:

$$\text{DAI} = (\text{missing teeth} \times 6) + (\text{API}) + (\text{ESP}) + (\text{DI} \times 3) + (\text{DMXA}) + (\text{DMDA}) + (\text{OMXA} \times 3) + (\text{OMDA} \times 4) + (\text{MAA} \times 4) + (\text{RMAP} \times 3) + 13$$

Codes and weights were defined as follows:

API: crowding in the incisal segment weight 1; ESP: incisal segment spacing Weight 1; DI: incisal diastema weight 3, DMXA: anterior maxillar misalignment weight 1, DMDA: anterior mandibular misalignment weight 1, OMXA: anterior maxillar overjet Weight 3, OMDA: anterior mandibular overjet weight 4, MAA: vertical anterior open bite weight 4 and RMAP: antero-posterior molar relation weight 3.

Thus, the scores are calculated and distributed according to the severity of the malocclusion and the need for orthodontic treatment as follows: absent (DAI < 25), set (DAI 26-30), severe (31-35 DAI) and very severe (DAI ≥ 36).[4]

The HDI, a measure that gathers information on longevity, income and schooling, was used for contextual characterization.[b]

BF was obtained by the number of families receiving it for every 1,000 inhabitants in the municipality, aiming to standardize and facilitate comparison with other municipalities.[c]

The IDSUS register was achieved using the score that the municipality received from the evaluation and the number of homogeneous group into which the municipality was grouped.[d]

The gross domestic product (GDP) *per capita* is the sum of the salaries of the entire population of the municipality divided by the number of inhabitants.[e] Data were dichotomized into municipalities with and without fluoride in tap water.[e]

In the descriptive analysis, the data were evaluated by the chi-squared test. The multilevel model was made up of fixed components (known variables) and random components (cities and variances at different levels).[21]

Adjustments to the multilevel model were performed using the PROC MIXED procedure from the SAS statistic program (SAS Institute Inc. 9.2, 2008) according to the methodology described in Singer[15] (1998) and Tellez et al[16] (2006).

At level 1, the variables related to individuals were considered. At level 2 the variables were those related to cities, evaluating the behavior of the variable malocclusion (level 1) as a function of the predictor variables for levels 1 and 2.

Initially, one model was adjusted only with the intercept (model 1). Then the effects of individual-level predictors (level 1) – Model 2 – and cities (level 2) – Model 3 were included. In the selection of contextual variables indicators related to access to and quality of health services (IDSUS), socioeconomic conditions (HDI and GDP *per capita*) and social vulnerability (BF) were taken into consideration.

The quality of the adjustments was evaluated using the convergence model, criteria from Akaike information criterion and Akaike information criterion corrected, and statistics – twice times the logarithm of the likelihood function. All analyses used a 5% level of significance.

The Project SBBrasil 2010 followed the standards set by the Declaration of Helsinki and was approved by the *Conselho Nacional de Ética em Pesquisa*, record no. 15,498, January 7th, 2010.

RESULTS

The prevalence of children aged 12 with malocclusion classified as "severe" and "very severe" did not show

[f] Ministério da Saúde (BR). Secretaria de Atenção à Saúde. Projeto SB Brasil 2003: condições de saúde bucal da população brasileira 2002-2003. Resultados principais. Brasília (DF); 2004[cited 2012 Feb 08]. Available from:http://dtr2001.saude.gov.br/editora/produtos/livros/pdf/05_0053_M.pdf

Table 1. Distribution of children aged 12 according to prevalence and severity of malocclusion. SBBrasil, 2010.

Region	Malocclusion				Total	p-value
	Absent	Set	Severe	Very Severe		
North	962	327	131	147	1,567	0.0176[a]
	61.4%	20.9%	8.4%	9.4%	100,0%	
Northeast	959	311	173	164	1,607	
	59.7%	19.4%	10.8%	10.2%	100,0%	
Southeast	617	245	139	97	1,098	
	56.2%	22.3%	12.7%	8.8%	100,0%	
South	330	124	68	60	582	
	56.7%	21.3%	11.7%	10.3%	100,0%	
Central-West	506	196	84	70	856	
	59.1%	22.9%	9.8%	8.2%	100,0%	
Total	3,374	1,203	595	538	5,710	
	59.1%	21.1%	10.4%	9.4%	100,0%	

[a] Chi-squared test

statistical differences between regions, ranging from 17.8% in the North to 22.0% in the South, with a national mean of 19.8%. However, there was no statistically significant difference in the distribution of percentages of categories between different macro regions of the country ($p < 0.0176$) (Table 1). Very severe malocclusion was identified in 9.4 % of the children examined.

The descriptive analysis of the independent variables (frequency and percentage) can be seen in Table 2. Most of those examined (76.1%) lived in the capitals, while there was a balance between the different genres examined, basically half (51.3%) needed some kind of treatment, 75 % came from families with incomes below R$1,500, less than 5% came from families where the head of the household was attending a university course or had a university degree. As regards health variables, 23.7% reported having had toothache in the last six months, 81.6% had access to a dentist, the majority (60.1%) were satisfied with their teeth, while problems related to difficulty, discomfort or embarrassment related to the teeth and oral environment had little prevalence. Regarding contextual variables, the majority of participants (62.5%) lived in cities with high levels of socioeconomic development and 79.3% lived in cities with fluoridated tap water.

The cities of the participants had, on average, 54.56 families receiving benefits per 1,000 households. While the mean IDSUS was 5.68 (as a reference, 7 would be the limit for adequate performance according to the SUS), the mean *per capita* GDP was R$17,517 and mean HDI was 0.79, which is considered good (Table 3).

As for the multilevel analysis, Model 1 shows that the average index score for malocclusion in cities was 1.68 with a standard error of 0.03 (Table 4). The malocclusion variation between cities was significant ($p < 0.001$), but the variation between participants within cities was about 15 times larger than the variation between cities. According to the intra-class correlation coefficient, it can be affirmed that the variation between cities represented approximately 6.0% of the total variation.

Table 2. Frequency and percentage by category of qualitative independent variables. SBBrasil, 2010.

Variable	Frequency	Percentage (%)
Demographic		
Domain		
Capital	5,578	76.12
Interior	1,750	23.88
Region		
North	1,743	23.79
Northeast	2,041	27.85
Southeast	1,342	18.31
South	1,010	13.78
Central-West	1,192	16.27
Sex		
Male	3,639	49.66
Female	3,689	50.34

Continue

Continuation

Skin color		
White	2,897	39.53
Brown	712	9.72
Yellow	144	1.97
Dark brown	3,513	47.94
Indigenous	62	0.85
Oral health problems		
Trauma		
No trauma	5,630	78.11
Enamel Fracture	1,282	17.79
Enamel/dentine fracture	262	3.63
Fracture with pulp exposure	21	0.29
Absence due to trauma	13	0.18
Treatment necessity		
Not necessary	3,528	48.68
Necessary	3,719	51.32
Socioeconomic		
Number of Individuals		
0	1	0.01
1	11	0.15
2	235	3.21
3	1,079	14.76
4	2,264	30.97
5	1,745	23.87
6	889	12.16
7	477	6.52
8	258	3.53
9	141	1.93
> 10	211	2.89
Number of rooms		
0	2	0.03
1	539	7.37
2	2,560	35.02
3	1,931	26.42
4	778	10.64
5	602	8.24
6	397	5.43
7	231	3.16
8	121	1.66
9	68	0.93
>10	81	1.08
Number of consumer goods		
0	042	0.58
1	105	1.45
2	138	1.90
3	390	5.37
4	877	12.07
5	1,102	15.17
6	1,070	14.73
7	989	13.61
8	852	11.73
9	528	7.27
10	394	5.42
11	779	10.72

Continue

Continuation

Income *per capita* (R$)		
Below 250.00	313	4.52
251.00 to 500.00	1,084	15.64
501.00 to 1,500.00	3,694	53.31
1,501.00 to 2,500.00	1,082	15.62
2,501.00 to 4,500.00	494	7.13
4,501.00 to 9,500.00	196	2.83
over 9,500.00	66	0.95
Years of Schooling		
0	19	0.26
1	42	0.58
2	75	1.03
3	235	3.22
4	727	9.95
5	1,432	19.61
6	2,241	30.69
7	1,503	20.58
8	625	8.56
9	202	2.77
10	85	1.16
11	49	0.67
12	34	0.47
13	7	0.10
14	5	0.07
15	22	0.30
Schooling, morbidity and use of orthodontic services		
Self-perception and impact on health		
Perception of need for treatment		
No	2,228	32.07
Yes	4,720	67.93
Toothache (last 6 months)		
No	5,559	76.29
Yes	1,728	23.71
Severity of pain (intensity – from 1 to 5)		
1	244	14.49
2	323	19.18
3	485	28.8
4	277	16.45
5	355	21.08
Dentist appointment		
No	1,337	18.43
Yes	5,918	81.57
Frequency of appointments		
Less than one year	3,570	61.19
From 1 to 2 years	1,669	28.61
3 years or more	595	10.20
Where was your last dental appointment?		
Public Service	3,207	54.59
Private Service	1,898	32.31
Health plan/Agreements	690	1.74
Other	80	1.36
Reason for appointment		
Check-up	2,172	37.05
Pain	748	12.76
Extraction	708	12.08
Treatment	2,082	35.52
Other	152	2.59

Continue

Continuation		
Level of satisfaction with teeth		
Very satisfied	798	11.10
Satisfied	3,522	49.01
Neither satisfied nor dissatisfied	1,215	16.91
Dissatisfied	1,540	21.43
Very Dissatisfied	111	1.54
Difficulty eating		
No	6,067	83.26
Yes	1,220	16.74
Discomfort when brushing		
No	6,382	87.54
Yes	908	12.46
Nervousness and irritation		
No	6,513	89.46
Yes	767	10.54
Influence on leisure		
No	6,860	94.05
Yes	434	5.95
Influence on sport		
No	6992	95.82
Yes	305	4.18
Difficulty talking		
No	6,959	95.42
Yes	334	4.58
Embarrassed to smile		
No	6,297	86.40
Yes	991	13.60
Difficulty working/studying		
No	6,920	94.85
Yes	376	5.15
Difficulty sleeping		
No	6,653	91.26
Yes	637	8.74
Contextual		
Homogenous groups		
High IDSE[1] and High MAC[2]	4,581	62.51
High IDSE and Medium MAC	1,297	17.70
Medium IDSE and Low MAC	436	5.95
Low IDSE and Low MAC	394	5.38
Medium IDSE and No MAC	277	3.78
Low IDSE and No MAC	343	4.68
Fluoridated tap water		
No	1,433	20.67
Yes	5,501	79.33

IDSE: index of socioeconomic development: per capita income and the percentage of families with family allowance; MAC: intermediate and highly complex care or structure of specialized care, outpatient and inpatient.

When the individual level variables (model 2) were included, it was observed that male children (p = 0.03), with lower income (p = 0.05), who visited the dentist (p = 0.01), showing less satisfaction with mouth and teeth (p < 0.001) and feeling embarrassed to smile (p < 0.001) had the highest average index score for malocclusion. All these significances were controlled by the other predictors in the model.

In model 3 the variables of the second level (cities) were included in order to evaluate their influence in explaining the variability of malocclusion. It was found that the characteristics of the cities with the highest number of families receiving BF *per* 1,000 inhabitants, the worst scoring IDSUS and those with lower GDP *per capita* were associated with severity of malocclusion. All these significances were controlled by the significant predictor variables of the individual and cities.

DISCUSSION

Knowing the oral health status of population groups through epidemiological surveys is critical to the development of proposed actions appropriate to their needs and risks, as well as the possibility of comparisons that, retrospectively, allow the impact of these actions to be assessed, to plan and run services with equity.

The decline in dental caries, still the most prevalent oral health problem, allowed a new planning for oral health by health managers, bringing a new look at other problems, mainly due to increased awareness and expectations regarding oral health or increased availability of dental treatment.[2] In this context, orthodontics was deemed eligible to access both the private and the public sector, due to its high prevalence, impact on aesthetics and influence on some respiratory problems, for example.

In Brazil, the most recent epidemiological studies concerning the population's oral health, which took place in 2003 and 2010, showed a 19.3% reduction in the frequency of malocclusion, ranging from 58.1% to 38.8% at 12 years of age. In relation to severity, in 2003 the prevalence of the severe condition was 15.7% and very severe 20.7%. In 2010, for the same conditions, there was a reduction of 5.3% and 13.6%, respectively.[a,f] Even with a decline in the prevalence of malocclusion in children aged 12, this involvement can still be considered a public health issue.

Furthermore, the influence of lifestyle on levels of health and the quality of life of different population groups, including children and adolescents, is widely documented in the literature of health area.[8] In this sense, the survey, monitoring and intervention concerning health risk behaviors are considered public health priorities by various health agencies.[3]

The results obtained in this study show an association of individual level variables with the severity of malocclusion. Males presented a higher severity of malocclusion compared with females, corroborating other findings in the literature that revealed gender exerted a significant influence on the severity of the disease.[2,8] It is believed that this has happened due to the fact that women are more determined when treating health problems.

There was a higher severity of malocclusion observed in those children who claimed to be less satisfied with their mouth and teeth and feel embarrassed to smile. However, it seems reasonable that self-perception does not coincide with the actual situation of malocclusion, because the problem is not impacting on cultural precepts but seen as an attribute of beauty and masculinity or femininity, as observed in occidental culture.[19] So the influence of these factors depends on the cultural and social characteristics of each population group.

These findings suggest that, according to the severity of the malocclusion, self-perceived need for orthodontic treatment among children can be predicted. Namely, the self-perception in children should be seen as fundamentally important in understanding the impact of malocclusion on daily life, especially in relation to functional limitations and psychosocial well-being, since it greatly values the physical appearance.[19]

With regard to access, the results of this study show greater severity of malocclusion in those children who have visited the dentist at least once in their lives. According to Peres et al[11] (2008), there is an increased

Table 3. Mean, standard deviation, median, minimum and maximum value of quantitative contextual variables. SBBrasil, 2010. (In R$)

Contextual	Mean	Standard Deviation	Median	Minimum value	Maximum value
Family Allowance[a]	54.56	33.82	55.81	3.59	189.10
IDSUS	5.68	0.80	5.76	3.12	7.63
GDP *per capita*	17,517.13	12,558.34	14,095.00	1,721.00	71,407.00
HDI[c]	0.79	0,06	0.80	0.80	0.89

[a] Number of beneficiary households for every 1,000 inhabitants.
IDSUS: development index of the Unified Health System (note given to each municipality); GDP: Gross Domestic Product; HDI: Human Development Index.

Table 4. Multi-level models for individual and contextual variables for malocclusion in adolescents aged 12. SBBrasil, 2010.

	Model 1		Model 2		Model 3	
	Intercept only		Level 1 variables		Complete model	
	Estimate (Standard error)	p-value	Estimated (Standard error)	p-value	Estimated (Standard error)	p-value
Level 1 variables (individual)						
Intercept	1.689 (0.029)	< 0.001	1.425 (0.077)	< 0.001	0.955 (0.193)	< 0.001
Sex						
(Ref[a] Female)			0.056 (0.026)	0.033	0.059 (0.026)	0.032
Income (Ref. more than R$ 9,500.00)			0.026 (0.013)	0.051	0.025 (0.013)	0.005
Consultation[b] (Ref. Yes)			-0.090 (0.034)	0.009	-0.881 (0.034)	0.011
Satisfaction (Ref. Very satisfied)			0.115 (0.014)	< 0.001	0.114 (0.014)	< 0.001
Ashamed to smile (Ref. No)			0.267 (0.042)	< 0.001	0.267 (0.042)	< 0.001
Level 2 variables (cities)						
Family Allowance (Ref. less allowance)					0.001 (0.001)	0.018
IDSUS (Ref. higher IDSUS)					0.054 (0.028)	0.054
GDP per capita (Ref. higher PIB)					5.89×10^{-6} (3.04×10^{-6})	0.052
Variances						
Variance between cities	0.062 (0.015)	< 0.001	0.058 (0.014)	< 0.001	0.053 (0.014)	0.001
Variance between participants in city	0.945 (0.028)	< 0.001	0.921 (0.018)	< 0.001	0.921 (0.018)	< 0.001

[a] Ref: reference
[b] Appointment: Have you ever visited a dentist?
IDSUS: development index of the Unified Health System (Note given for each county); GDP: gross domestic product.

use of dental services and a reduction in the proportion of people who had never consulted a dentist. Although different health needs cannot be fully eliminated only with the use of health services, they can facilitate qualified access and reduce health inequalities.[12] It is probable that those with access to a dentist usually have a higher need for treatment, including orthodontic.

The results showed that, within the individual context, children in the group with the lowest incomes had a higher severity of malocclusion, corroborating reports in the literature regarding the influence of socioeconomic factors in determining malocclusion.[6,12,17]

Using multilevel analysis was due to the importance of investigating interactions between variables on different levels (individual and contextual), which showed greater statistical efficiency, more power and less bias than the one contained in a multivariate analysis as the logistic regression.[7]

The study highlighted the influence of variables related to the socioeconomic context on the severity of malocclusion. Cities with more families receipients of BF, with lower IDSUS and lower GDP *per capita* were associated with severe malloclusion. Over the past two decades, social inequalities in health have become, one of the most important issues in public health, both in rich countries and those with medium or low economic income.[12] Some authors have emphasized that the most vulnerable households are more susceptible to malocclusion.[17]

Specifically in relation to malocclusion, Tomita et al[18] (2000) developed a theoretical model that posits the influence of socioeconomic factors on malocclusion through oral habits psychological factors and general patterns of disease. Conceptual models allow us to clarify that socioeconomic factors and access-to-service factors can influence exposure to and development of oral health problems.[1,20]

Although the design of the SBBrasil was robust, the study has some limitations. A weakness of cross-sectional studies is the difficulty in establishing causal relationships based on a cross section of time, limiting confidence in establishing the direction of the association. The design of the study and the evaluation tool used to quantify malocclusion do not identify for how long the individuals surveyed have suffered from the disease.

This information may be helpful in better understanding the role of individual variables and contextual influences concerning malocclusion as an individual, episodic or cyclic condition. Thus, longitudinal studies are needed to allow a better understanding of the association between malocclusion and individual and contextual variables. Another limitation is tooth decay, which was not used in the model due to it being a confounding factor in the study, especially in the question ascertaining whether adolescents have already been to the dentist.

Although there are data available on the prevalence and severity of malocclusion, the sample calculation was based on parameters for dental caries, which is

kept as a benchmark as it is among the most significant diseases of the oral cavity. Moreover, it is the only one that has available data for all age groups, and its prevalence and severity generate sample sizes that permit proper inferences for other health problems.[a]

Despite significant advances in recent years in improving health indicators, Brazil is still among the countries with the greatest inequalities, in other words health inequalities between population groups are systematic and significant, but avoidable, unfair and unnecessary. These health inequalities are the product of great inequalities between different social and economic stratum of Brazilian population.[11] The main challenges for the future will be translating existing knowledge and experiences of effective prevention and health promotion programs into strategic action, in order to achieve sustainable advances in oral health, thereby reducing inequalities.[13]

Based on the contextual variables, it is suggested, therefore, that government incentives could be aimed at cities with the worst SUS structuring and with greater vulnerability, using, for example, the Ministerial Decree no. 718/SAS from 20/12/2010, which differentiates funding for specialized procedures in orthodontics.[g]

Identification of risk factors for malocclusion must take into account individual variables together with the contextual variables, building a clearer epidemiological picture capable of planning actions in oral health.

Significant associations between the presence and severity of malocclusion were observed at the individual and contextual level, those being important parameters that can assist in the planning of public policies under the reference of the constitutional principles of comprehensiveness and equity.

[g] Ministério da Saúde (BR). Secretaria de Atenção a Saúde. Portaria nº 718, de 20 de dezembro de 2010. *Diario Oficial Uniao*. 31 dez 2010 [cited 2012 Apr 23];Seção1:100-3. Available from: http://bvsms.saude.gov.br/bvs/saudelegis/sas/2010/prt0718_20_12_2010.html

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