Multilevel analysis of self-perception in oral health and associated factors in Southern Brazilian adults: a cross-sectional study

Análise em multinível da autopercepção em saúde bucal e fatores associados em adultos do Sul do Brasil: um estudo transversal

Análisis multinivel de la autopercepción de la salud oral y factores asociados en adultos del sur de Brasil: un estudio transversal

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Abstract

The aim of this study was to evaluate the association between individual and contextual variables related to self-perception in oral health among residents in the municipality of São Leopoldo, Rio Grande do Sul State, Brazil. The cross-sectional design involved 1,100 adults in 38 census tracts. The self-perception was evaluated using the Oral Health Impact Profile (OHIP-14) *tool. A logistic multilevel analysis was performed. The multivariate analysis revealed that those who are of the female gender, older, with lower scores of quality of life and less social support, with poor healthy eating habits, smokers and those living in low-income census tracts presented higher odds of reporting worse oral health self-perception (OHIP-1). We concluded that individual and contextual variables are associated with oral health self-perception. This is essential information for planning health services wishing to meet the health needs of the population.*

Multilevel Analysis; Oral Health; Quality of Life

Resumo

O objetivo deste trabalho foi avaliar a associação entre aspectos individuais e contextuais com a autopercepção em saúde bucal em moradores do município de São Leopoldo, Rio Grande do Sul, Brasil. É um estudo com delineamento transversal, numa amostra probabilística de 1.100 adultos em 38 setores censitários. A autopercepção foi avaliada por meio do Oral Health Impact Profile (OHIP-14). *A análise dos dados utilizou regressão logística multinível. Na análise multivariável, indivíduos do gênero feminino, com idade avançada, piores escores de qualidade de vida e de apoio social, com hábitos alimentares ruins, fumantes e residentes em setores censitários com baixa renda apresentaram maiores chances de relatar pior autopercepção em saúde bucal (OHIP-1). O estudo identificou os fatores associados à autopercepção de saúde nos níveis individual e contextual. Essa é informação imprescindível para o planejamento de serviços de saúde que pretendam atender às necessidades de saúde da população.*

Análise Multinível; Saúde Bucal; Qualidade de Vida

Introduction

Self-perception of oral health conditions related to people's quality of life presumably incorporates distinct degrees of subjectivity on the part of the subjects involved. In order to understand the distinct implications relating to subjectivity, such as the perception of social inequities and their effects on one's health or illness, there is a need to go beyond clinical indicators of morbidities and to include multidimensional aspects of health [1,2,3,4]. With regard to general health in the Brazilian population, research has been conducted in the quest for more solid explanations about one of the aspects of this issue, i.e. the possible effects of individual and contextual variables on diverse health outcomes [5,6,7,8]. Recent contributions provide evidence of the impact of social, economic, psychosocial and other factors on health inequities [9,10,11,12].

Analyses have taken into account macro and micro considerations, and these relations and implications have also been investigated in the area of oral health [13,14,15]. The association between oral health problems and socioeconomic and geographical inequities suggests that negative determinants, acting at the individual level and at the level of people's lives, are associated with a less favourable oral health profile, although the relative weights of these determinant variables and the more precise nature of these associations may not have been fully elucidated [16,17].

It is a challenge for scientific knowledge to determine the impact that oral health problems have on people's everyday lives, including consequences on the quality of their lives [2]. This, therefore, also has implications for the evaluation of oral health needs and the organization of dentistry policies, programmes and services in general [18].

Furthermore, there is evidence that higher rates of oral diseases and complaints are related to worse social inequity indicators, thus increasing the impact of the chronic negative factor on the social determinants of health [13,19]. The findings of these studies generate new hypotheses that seek to establish how the relationship between subjective aspects and quality of life occurs, in association with the general and oral health condition of individuals and populations, in view of the lack of consensus on this issue [20,21].

The scientific debate on the concept of quality of life, as well as how it is put into practice in studies, frequently refers to its multidimensional complexity, so that it almost becomes an abstraction. The events relating to the term are predominantly subjective and, moreover, the way in which individuals perceive their quality of life can vary according to their social, cultural and political context [17,22]. The same can be observed in individuals' perception of their general state of health, since individual characteristics and the characteristics of the context in which they live appear to bear influence [23].

The psychometric instrument referred to as the *Oral Health Impact Profile* (OHIP) was developed in order to evaluate the impact of the oral health condition of individuals on their quality of life. Originally with 49 questions, the profile was reduced to a 14-question version called OHIP-14 [24], which has proved to be equally robust in methodological terms [25].

Studies of greater complexity in Brazil, using multilevel analysis, have proposed the elucidation of hypotheses of association between contextual and individual factors in subjects' perception of their general [23] and oral health [26]. Their authors have compared the different geographical structures of data (administrative regions, neighbourhoods or census tracts) with the purpose of verifying the effects of individual and contextual variables on the odds of individuals having a negative or positive perception. Both suggest that there are variations in the perception of general or oral health which are dependent on aspects relating to individuals and their contexts.

Aware that individual and contextual factors may be associated with oral health outcomes with consequent implications for quality of life, this study aimed at testing in a multilevel analysis the existence of such association in individuals living in São Leopoldo, Rio Grande do Sul State, Brazil.

Methodology

This multilevel cross-sectional study was conducted in 2006-2007 in the municipality of São Leopoldo, located in the Rio dos Sinos Valley, within the metropolitan area of the state capital, Porto Alegre. It has been approved by the Universidade do Vale do Rio dos Sinos (UNISINOS) Research Ethics Committee (number 04/034). All participating subjects signed a term of informed consent.

The sample for this cross-sectional study was obtained based both on a pilot study and using customary statistical parameters. To compensate losses and to control for confounders, an increase of 20% in the sample size for the number of households was done. As a result, 1,512 households from 40 census tracts were randomly selected, in a strategy of probability proportional to size, thus we obtained a self weighted sample. A total of 38 census tracts were effectively reached, and the final sample was made up of

1,100 subjects. Only adults over the age of 18 were included. During the visits, if the respondent was absent, the interviewers returned three more times in order to attempt to collect the data [23].

The respondents answered a structured, standardized and pretested questionnaire that included all the individual variables used.

Poor self-reported oral health was assessed using the OHIP-14. The OHIP provides a comprehensive measure of self-reported dysfunction, discomfort and disability arising from oral conditions. It is an adaptation of the World Health Organisation's classification of impairments, disabilities and handicaps [27]. A shortened version (OHIP-14) was later developed based on 14 items [24]. Based on a guiding question, it asks how frequently respondents experience problems related to taste, speaking, chewing, eating, relaxing, or socializing due to their teeth, mouth or dentures. Possible replies were: never, rarely, sometimes, frequently and always. The outcome OHIP-1 represented those who replied "frequently" or "always" at least once to any of the items , whilst OHIP-0 was attributed to the remainder, that is, none of items were perceived in the worst response categories [28,29].

The individual explanatory variables were divided into categories: gender and ethnicity (skin color), dichotomized into male/female and white/non-white, respectively. Regarding ethnicity, in the questionnaire the possible self-reported skin colors were yellow, white, black and light-skinned black, as per categories used by the Brazilian Institute of Geography and Statistics (IBGE). After the initial explanation of this variable, considering the rate of each category, the dichotomization was adopted as described earlier.

Age was stratified into 10-year intervals. Family income (expressed in the currency Brazilian Reals), was categorized into: high (the highest 25% of scores), medium (the 50% of intermediary scores) and low (the lowest 25% of scores). The psychosocial variables of quality of life and social support also followed the same categorization. Data on quality of life was obtained by questions to obtain information about personal satisfaction [30]. The answers varied from "very satisfied" to "very unsatisfied", ranging from 0 to 4. The minimum and maximum scores obtained by adding the points for each answer are 0 and 32, respectively. Higher scores indicate higher quality of life. The social support followed the lines proposed by the *Medical Outcomes Study* (MOS) [31] and was collected by means of 19 questions comprising material, affective, emotional, positive social interaction and information factors. The answers range from 0 to 4 and the total possible score can range between 0 and 76. Higher scores mean a higher level of reported social support.

With regard to the behavioural variables, healthy eating habits (fruit, vegetables) were classified as: low consumption – does not eat; moderate – 1 or 2 fruits/day and 1 to 4 spoons of vegetables/day; high – ≥ 3 fruits/day and ≥ 5 spoons of vegetables/day; habit of smoking: never smoked/smokes or former smoker; alcohol consumption: no/moderate (< 8mg ♀ and < 15mg ♂/day) and yes/excessive (≥ 8mg ♀ and ≥ 15mg ♂/day) [32].

The contextual explanatory variable, i.e. those relating to the census tract in which the sample subject lived, were grouped into sociodemographic and infrastructure variables, these being collected based on the IBGE demographic census available at the time the study was prepared (2000) (IBGE. Cidades@. http://www.ibge.gov.br/cidadesat/topwindow.htm?, accessed on 17/Aug/2008). The demographic variables at this level were: residents (or population resident in the census tract), average monthly income of the heads of the permanent private households and the average number of years of schooling of the heads of the permanent private households. Infrastructure was evaluated based on the following information: permanent private households with garbage collection, bathroom or toilet and sewage collection via general sewer or rainwater networks. These variables were then categorized into: high (the highest 25% of scores within the census tracts), medium (the 50% of intermediary scores) and low (the lowest 25% of scores).

For the purposes of the statistical analysis, the variables of the original database obtained through the application of the questionnaire in the cross-sectional study were included in the IBGE secondary database mentioned above.

The chi-square test (p < 0.05) was used in the bivariate analysis in order to identify significant associations between the explanatory variables and their ability to predict the outcome of interest, i.e. OHIP. Analyses at this stage were performed using SPSS version 15.0 (SPSS Inc., Chicago, USA).

Multilevel logistic regression with a second order predictive quasi-likelihood (PQL) approach was used, with the aim of estimating the odds ratios and their 95% confidence intervals (95%CI). The adoption of this model was primarily based on the response variable used in this manuscript that is dichotomous.

Two levels were incorporated into the model. The first level included the context variables (variables attributed to the census tract) whilst the second level included the individual variables. Initially the null model was adjusted. Fol-

lowing this the model in which the census tract variables were included was adjusted. Census tract variables having significance in Model 1 were included in Model 2, as well as the individual variables. Finally, Model 3 was comprised of the variables found to be significant in Model 2. This analysis was performed using MLwiN 2.24 (Centre for Multilevel Modelling, Bristol, UK). A 5% significance level was used to detect associations between outcome and exposure.

Results

71.8% of the participating individuals were women and 83.8% were white. Average age was 44.2 years (SD = 15.8), the maximum age being 90 and the minimum 18. Average time of schooling was 8.2 years (SD = 4.1). The prevalence of the worst classification (OHIP-1) was approximately 16%.

With regard to the contextual characteristics, the average census tract population was 746 inhabitants (SD = 358), whilst average income was R$ 955.00 (SD = 586) and average length of schooling was 8 years (SD = 3). The average frequency of households with garbage collection and which were also connected to the sewerage network was 41%.

Under the bivariate analysis, the odds of individuals of the female gender having the worst oral health condition classification was 2.5 times higher (OR = 2.53; 95%CI: 1.63-3.93) than for males. Similarly, older individuals showed the same behaviour, with greater impacts in those aged 40 and over (p < 0.001). Low levels of schooling also showed themselves to be a variable favouring the perception of bad oral health conditions (OR = 2.73; 95%CI: 1.48-5.03). The psychosocial, quality of life and social support variables also had significant association with the outcome studied, whereby individuals who reported lower scores for these conditions were more subject to a worse oral health classification. Similarly, those who smoked also provided worse reports (OR = 2.22; 95%CI: 1.53-3.21) (Table 1).

With regard to the contextual level, when considering the census tracts those with larger populations had lower OHIP-1 prevalence (OR = 0.53; 95%CI: 0.32-0.88). The same occurred with those living in low-income census tracts (OR = 0.30; 95%CI: 0.15-0.58) (Table 2).

At this stage of the analysis, no significant differences were found in relation to the individual variables of skin color, healthy eating habits and alcohol consumption, nor as to the census tract variables of schooling and garbage collection/connection to the sewerage network (Tables 1 and 2).

Under the multivariate analysis, the null model indicated that the census tracts differ in relation to the probability of the outcome being classified as OHIP-1 (worst condition). In Model 1, in which the variables were adjusted by each other, low income in the tracts was associated with the outcome (OR = 0.26; 95%CI: 0.07-0.96). When this variable was adjusted for the individual variables (Model 2) statistical significance was maintained (OR = 0.23; 95%CI: 0.09-0.60). In the final model (Model 3) the variable maintained this behaviour, whereby the odds of the OHIP-1 condition was 0.24 higher among those living in low-income census tracts than among those living in moderate to high-income census tracts. The gender, age, quality of life, social support and smoking habit variables also presented statistical significance in this model. The individual healthy eating habit variable was significant in Models 2 and 3, having odds of 0.51 (95%CI: 0.31-0.84) in the latter model (Table 3).

Discussion

This study investigated the association between individual and contextual variables and oral health self-perception in adults. The instrument chosen for the study, OHIP, is referred to as a relevant oral health measure since it considers the social consequences of oral health problems that are important to individuals [2]. The literature also reveals consistency as to people's self-reported oral health alterations [33].

The results show that the worst reports of oral health conditions were made by individuals of the female gender, older people, those with less schooling, lower quality of life and social support scores, as well as smokers.

With regard to gender, the findings are consistent with the literature showing higher poor oral health perception in women compared to men [17,34].

With regard to increased age, this variable was inversely associated with oral health perception in all stages of analysis, i.e. increased age is associated with a worse perception of oral health whereby oral disorders are more prevalent [34,35]. Despite only having been significantly associated with the outcome in the bivariate analysis, family income may favour worse perceptions [36,37]. The loss of this variable's explanatory capacity may have occurred as a result of other variables being more determinant; e.g. gender, which may serve as a proxy for material conditions, i.e. gender in some way reflecting socioeconomic inequities, which the income variable on its own is not able to capture.

Table 1

Oral Health Impact Profile (OHIP-1) distribution, prevalence and unadjusted and adjusted odds ratio (OR) according to individual variables (N = 1,100).

Variables	n	OHIP-1 n (%)	OR (95%CI)
Gender			
Male	309	26 (8.4)	1.00
Female	790	149 (18.9)	**2.53 (1.63-3,93)**
Skin color (ethnicity)			
White	922	144 (15.6)	1.00
Non-white	175	31 (17.7)	1.16 (0.76-1.78)
Age (years)			
18-29	247	20 (8.1)	1.00
30-39	182	23 (12.6)	1.64 (0.87-3.09)
40-49	258	46 (17.8)	**2.46 (1.41-4.30)**
50-59	217	48 (22.1)	**3.22 (1.84-5.63)**
≥ 60	196	38 (19.5)	**2.75 (1.54-4.90)**
Family income (BRL) *			
High (≥ 3,185)	282	35 (12.8)	1.00
Moderate (1,050-3,184)	590	75 (14.6)	1.17 (0.76-1.80)
Low (≤ 1,049)	227	61 (21.0)	**1.81 (1.15-2.85)**
Schooling (years)			
High ≥ 12	166	16 (9.6)	1.00
Moderate 5-11	697	105 (15.1)	1.66 (0.95-2.90)
Low ≤ 4	204	46 (22.5)	**2.73 (1.48-5.03)**
Quality of life			
High (≥ 33)	239	21 (8.8)	1.00
Moderate (27-32)	627	78 (12.4)	1.47 (0.89-2.45)
Low (≤ 26)	233	76 (32.6)	**5.03 (2.97-8.49**)
Social support			
High (≥ 95)	381	42 (11.0)	1.00
Moderate (75-94)	437	74 (16.9)	**1.65 (1.10-2.47)**
Low (≤ 74)	277	59 (21.3)	**2.18 (1.42-3.36)**
Healthy eating habits			
High (≥ 3 fruits/day; ≥ 5 spoonfuls of vegetables/day)	128	26 (20.3)	1.00
Moderate (1-2 fruits/day; 1-4 spoonfuls of vegetables/day)	907	139 (15.3)	0.71 (0.45-1.13)
Low (no consumption)	64	10 (15.6)	0.73 (0.33-1.62)
Smoking			
Nonsmoker	605	77 (12.7)	1.00
Former smoker	232	34 (14.7)	1.18 (0.76-1.82)
Smoker	262	64 (24.4)	**2.22 (1.53-3.21)**
Alcohol intake			
None/moderate (< 8mg ♀ e < 15mg ♂/day)	1,036	165 (15.9)	1.00
Yes/excessive (≥ 8mg ♀ e ≥ 15mg ♂/day)	60	10 (16.7)	1.06 (0.52-2.12)

95%CI: 95% confidence interval

* US$ 1 = BRL 2 (in 2006).

Note: bold values are statistically significant (p < 0.05).

In relation to the psychosocial variables, quality of life considered to be less favourable leads to a worse perception of oral health [38,39]. Consistent conclusions are not found in the literature on this issue as it is a factor characterized by multidimensional complexity, as well as being

Table 2

Oral Health Impact Profile (OHIP-1) distribution, prevalence and unadjusted and adjusted odds ratio (OR) according to contextual variables (N = 1,100).

Variables	Census tract n (%)	Individual n (%)	OHIP-1 n (%)	OR (95%CI)
Population (inhabitants) *				
Low (≤ 510)	9 (23.7)	305 (27.8)	44 (14.4)	1.00
Moderate (511-908)	20 (52.6)	548 (49.9)	103 (18.8)	1.15 (0.78-1.69)
High (≥ 909)	9 (23.7)	246 (22.4)	28 (11.4)	**0.53 (0.32-0.88)**
Income (BRL) *,**				
High (≥ 1,362)	9 (23.7)	248 (22.6)	47 (18.9)	1.00
Moderate (509-1,361)	20 (52.6)	666 (60.6)	116 (17.4)	0.90 (0.62-1.31)
Low (≤ 508)	9 (23.7)	185 (16.8)	12 (6.5)	**0.30 (0.15-0.58)**
Schooling (years) *				
High (≥ 9.61)	9 (23.7)	292 (26.5)	57 (19.5)	1.00
Moderate (5.61-9.6)	20 (52.6)	592 (53.9)	89 (15.0)	0.73 (0.51-1.05)
Low (≤ 5.6)	9 (23.7)	215 (19.5)	29 (13.5)	0.64 (0.40-1.05)
Garbage collection and sewerage *				
High (≥ 51.71)	9 (23.7)	255 (23.3)	47 (18.4)	1.00
Moderate (4-51.7)	20 (52.6)	611 (55.5)	91 (14.9)	0.77 (0.53-1.14)
Low (≤ 3.9)	9 (23.7)	233 (21.2)	37 (15.9)	0.84 (0.52-1.34)

95%CI: 95% confidence interval

* Data from Brazilian Institute of Geography and Statistics (IBGE. http://www.ibge.gov.br);

** US$ 1 = BRL 2 (in 2006).

Note: bold values are statistically significant (p < 0.05).

Table 3

Multilevel analysis for poor self oral health perception *Oral Health Impact Profile* (OHIP-1) according to individual and contextual variables (N = 1,100).

Variables	Model 1 * OR (95%CI)	Model 2 ** OR (95%CI)	Model 3 *** OR (95%CI)
Contextual			
Population (inhabitants)			
Low (≤ 510)	1.00		
Moderate (511-908)	1.50 (0.86-2.63)		
High (≥ 909)	1.17 (0.43-3.18)		
Income(BRL)			
High (≥ 1,362)	1.00	1.00	1.00
Moderate (509-1,361)	1.26 (0.55-2.87)	0.87 (0.49-1.55)	0.87 (0.49-1.53)
Low (≤ 508)	**0.26 (0.07-0.96)**	**0.23 (0.09-0.60)**	**0.24 (0.10-0.61)**
Schooling (years)			
High (≥ 9.61)	1.00		
Moderate (5.61-9.6)	0.66 (0.29-1.46)		
Low (≤ 5.6)	1.35 (0.41-4.44)		
Garbage collection and sewerage			
High (≥ 51.71)	1.00		
Moderate (4-51.7)	0.89 (0.50-1.56)		
Low (≤ 3.9)	0.98 (0.48-2.00)		

(continues)

Table 3 (continued)

Variables	Model 1 * OR (95%CI)	Model 2 ** OR (95%CI)	Model 3 *** OR (95%CI)
Individual			
Gender			
Male		1.00	1.00
Female		**2.82 (1.66-4.79)**	**2.71 (1.62-4.55)**
Skin colour (ethnicity)			
White		1.00	
Non-white		1.07 (0.65-1.77)	
Age (years)			
18-29		1.00	1.00
30-39		1.55 (0.77-3.14)	1.58 (0.79-3.18)
40-49		**2.14 (1.14-4.05)**	**2.16 (1.15-4.06)**
50-59		**2.67 (1.36-5.23)**	**2.80 (1.47-5.32)**
≥ 60		**2.54 (1.23-5.22)**	**2.59 (1.31-5.14)**
Family income (BRL)			
High (≥ 3,185)		1.00	
Moderate (1,050-3,184)		0.89 (0.52-1.52)	
Low (≤ 1,049)		0.92 (0.51-1.67)	
Schooling (years)			
High (≥ 12)		1.00	
Moderate (5-11)		1.00 (0.49-2.01)	
Low (≤ 4)		1.09 (0.47-2.53)	
Quality of life			
High (≥ 33)		1.00	1.00
Moderate (27-32)		1.08 (0.60-1.97)	1.06 (0.59-1.90)
Low (≤ 26)		**3.03 (1.59-5.79)**	**2.94 (1.57-5.51)**
Social support			
High (≥ 95)		1.00	1.00
Moderate (75-94)		**1.71 (1.07-2.75)**	**1.71 (1.07-2.73)**
Low (≤ 74)		**1.94 (1.18-3.21)**	**1.94 (1.18-3.20)**
Healthy eating habits			
High (≥ 3 fruits/day; ≥ 5 spoonfuls of vegetables/day)		1.00	1.00
Moderate (1-2 fruits/day; 1-4 spoonfuls of vegetables/day)		**0.49 (0.28-0.85)**	**0.50 (0.29-0.86)**
Low (no consumption)		0.52 (0.20-1.37)	0.52 (0.20-1.36)
Smoking			
Nonsmoker		1.00	1.00
Former smoker		1.25 (0.75-2.07)	1.27 (0.77-2.10)
Smoker		**2.34 (1.51-3.65)**	**2.44 (1.57-3.77)**
Alcohol intake			
None/Moderate (< 8mg ♀ e < 15mg ♂/day)		1.00	
Yes/Excessive (≥ 8mg ♀ e ≥ 15mg ♂/day)		1.77 (0.77-4.07)	

95%CI: 95% confidence interval.

* Model 1: tract variables adjusted by each other;

** Model 2: tract income variable adjusted for individual variables;

*** Model 3: tract income variable adjusted for the Model 2 significant individual variables.

Note: bold values are statistically significant (p < 0.05).

of a subjective nature and liable to the action of the social, cultural and political context in which individuals find themselves [17,22].

Regarding social support, there is evidence of the effects generated by the links between people providing a favourable psychosocial environment, culminating in positive or negative behaviours or choices, influencing the absence or presence of diseases in adult life [8,9,40]. Deleterious habits, such as smoking, consuming alcohol or using other drugs, were associated with worse oral health conditions relating to quality of life [41]. In this study impacts were most reported by smokers. On the other hand, in the multilevel analysis healthy eating habits had significant association with the outcome and this may have resulted in the majority of the individuals being concentrated in the moderate consumption category.

The adjustments made during the multilevel analysis for the individual variables revealed that only the census tract income variable was associated with higher odds of reporting the worse oral health condition (OHIP-1). Other reports, aimed at verifying the effects of contextual variables on the odds of the individuals' negative perception of oral health, with control of individual dimension factors, have concluded that individual socio-economic attributes have greater explanatory power as to the variation in perceived oral health than the socioeconomic contexts of the areas of residence, when comparing the different geographic structures of the data, such as administrative regions, neighbourhoods and census tracts [26,39].

Another line of study provides evidence of the existence of an association between the environment in which individuals live and their exposure to greater risks [10]. A study with the same database used in the present study, but with the outcome of interest geared to the perception of general health conditions, revealed a high prevalence of worse classification in places with larger populations and lower levels of income and schooling, confirming the influence of the living environment on people's health [23].

Brazilian studies also indicate the influence of the context in which people live on their health conditions. Places with less favourable conditions appear to influence the way in which individuals perceive their health, in keeping with the findings of this study. Census tracts with smaller populations and lower income show a greater perception of bad oral health conditions [5,6,7].

The bivariate analysis in this study found that a larger population was associated with a worse perception of oral health. Studies indicate that this variable may bear influence since a large number of individuals, concentrated in the same census tract, suffer from similar problems and this produces effects on their perception of their health [42,43].

The option for the method of using the census tracts as units of analysis is a useful resource for elucidating the influence of the structural and surrounding environmental characteristics on the outcome to be studied. This strategy, referred to in other studies as "neighbourhood", has been used in other research related to health conditions [39,42,43,44,45].

The limitations of this study may be related to the design adopted and the non-inclusion of clinical variables. The former is a limiting factor in that cross-sectional designs do not express with a high degree of certainty whether or not the relationship found is a causal one. The latter is due to the fact of the possible association between clinical conditions and the variation in the perception of impact, including on quality of life, and the possibility of the sociodemographic and socio-economic factors occurring in an independent manner [46]. The small number of individuals included in the study might be another explanation for the lack of significant association between contextual variables and OHIP.

It is appropriate to clarify that in models using a hybrid structure, including data aggregated in ecological designs, there is an obvious requirement for the maximum reduction of errors to compensate for design weaknesses, as well as the choice of an adequate model that enables sufficient variable capture in the ecological exposure of interest [47]. The key concern of these methods has to be the minimization of aggregation biases capable of producing so-called "ecological fallacies".

There are recommendations in the literature for care to be taken in inferring equally to all individuals' specific conditions found in particular sectors studied [48]. In this study this does not appear to be a problem, since the census tract data are very close to the overall data for the municipality of São Leopoldo, thus permitting the results to be inferred for the local population [23].

The multilevel analysis technique was adopted since, currently, in studies involving public health it has shown itself to be a powerful resource for helping to discern the influence of social determinants and individual variables on the health-illness process [49,50]. As such it is possible to find explanations for the impacts generated not only by individual characteristics but also by the conditions of the context in which individuals are located. This technique systematically reveals how the different levels are associated with the outcome of interest [49].

Conclusion

The results indicate that individual and contextual variables are associated with self-perceptions of oral health. This may be important to help the development and planning of oral health care services aimed at addressing population demands and to reduce oral health inequalities.

Resumen

El objetivo de este estudio fue evaluar la asociación entre los factores individuales y contextuales de la salud oral en la percepción subjetiva de los habitantes de Sao Leopoldo, Río Grande do Sul, Brasil. Este fue un estudio transversal con una muestra aleatoria de 1.100 adultos en 38 secciones censales. La autopercepción se evaluó utilizando el Oral Health Impact Profile *(OHIP-14). El análisis de datos utilizó la regresión logística multinivel. En el análisis multivariado, los sujetos femeninos con edad avanzada, con peores calificaciones de calidad de vida y el apoyo social, malos hábitos alimenticios, tabaquismo y pertenecientes a las secciones censales de bajos ingresos eran más propensos a informar un peor estado de salud bucal autopercibida (OHIP-1). El estudio identifica los factores asociados con la salud auto-evaluada a nivel individual y sus factores contextuales. Esto es esencial para la planificación de los servicios de salud que desean satisfacer las necesidades de información sobre salud de la población.*

Análisis Multinivel; Salud Bucal; Calidad de Vida

Contributors

M. C. L. Gabardo contributed towards the conception of the study design, interpretation of the results and writing. S. J. Moysés participated in the conception of the study design, interpretation of the results, writing and final approval of the article. S. T. Moysés contributed towards the critical review of the article. M. Olandoski and M. T. A. Olinto collaborated on the data analysis and interpretation of the results. M. P. Pattussi contributed to the critical review and final approval of the article.

References

1. Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. Community Dent Health 1994; 11:3-11.

2. Allen PF. Assessment of oral health related quality of life. Health Qual Life Outcomes 2003; 1:40.

3. Brennan DS, Spencer AJ. Dimensions of oral health related quality of life measured by EQ-5D+ and OHIP-14. Health Qual Life Outcomes 2004; 2:35.

4. Brennan DS, Singh KA, Spencer AJ, Roberts-Thomson KF. Positive and negative affect and oral health-related quality of life. Health Qual Life Outcomes 2006; 4:83.

5. Ximenes RAA, Martelli CM, Merchán-Hamann E, Montarroyos UR, Braga MC, de Lima ML, et al. Multilevel analysis of hepatitis A infection in children and adolescents: a household survey in the Northeast and Central-west regions of Brazil. Int J Epidemiol 2008, 37:852-61.

6. Cavalini LT, de Leon AC. Morbidity and mortality in Brazilian municipalities: a multilevel study of the association between socioeconomic and health-care indicators. Int J Epidemiol 2008, 37:775-83.

7. Zanini RR, Moraes AB, Giugliani ER, Riboldi J. Infant mortality trends in the State of Rio Grande do Sul, Brazil, 1994-2004: a multilevel analysis of individual and community risk factors. Cad Saúde Pública 2009; 25:1035-45.

8. Backes V, Olinto MT, Henn RL, Pattussi MP. Associação entre aspectos psicossociais e excesso de peso referido em adultos de um município de médio porte do Sul do Brasil. Cad Saúde Pública 2011; 27:573-80.

9. Egan M, Tannahill C, Petticrew M, Thomas S. Psychosocial risk factors in home and community settings and their associations with population health and health inequalities: a systematic meta-review. BMC Public Health 2008; 8:239.

10. Braubach M, Faiurburn J. Social inequities in environmental risks associated with housing and residential location: a review of evidence. Eur J Public Health 2010; 20:36-42.

11. Aldabe B, Anderson R, Lyly-Yrjänäinen M, Parent-Thirion A, Vermeylen G, Kelleher CC, et al. Contribution of material, occupational, and psychosocial factors in the explanation of social inequalities in health in 28 countries in Europe. J Epidemiol Community Health 2011; 65:1123-31.

12. Richter M, Moor I, van Lenthe FJ. Explaining socioeconomic differences in adolescent self-rated health: the contribution of material, psychosocial and behavioural factors. J Epidemiol Community Health 2012; 66:691-7.

13. Pattussi MP, Marcenes W, Croucher R, Sheiham A. Social deprivation, income inequality, social cohesion and dental caries in Brazilian school children. Soc Sci Med 2001; 53:915-25.

14. Aida J, Ando Y, Oosaka M, Niimi K, Morita M. Contributions of social context to inequality in dental caries: a multilevel analysis of Japanese 3-year-old children. Community Dent Oral Epidemiol 2008; 36:149-56.

15. Antunes JLF, Peres MA, Frias AC, Crosato EM, Biazevic MGH. Saúde gengival de adolescentes e a utilização de serviços odontológicos, Estado de São Paulo. Rev Saúde Pública 2008; 42:191-9.

16. Antunes JL, Peres MA, Mello TRC, Waldman EA. Multilevel assessment of determinants of dental caries experience in Brazil. Community Dent Oral Epidemiol 2006; 34:146-52.

17. Cohen-Carneiro F, Souza-Santos R, Rebelo MA. Quality of life related to oral health: contribution from social factors. Ciênc Saúde Coletiva 2011; 16 Suppl 1:1007-15.

18. McGrath C, Broder H, Wilson-Genderson M. Assessing the impact of oral health on the life quality of children: implications for research and practice. Community Dent Oral Epidemiol 2004; 32:81-5.

19. Bastos JL, Boing AF, Peres KG, Antunes JLF, Peres MA. Periodontal outcomes and social, racial and gender inequalities in Brazil: a systematic review of the literature between 1999 and 2008. Cad Saúde Pública 2011; 27 Suppl 2:S141-53.

20. Lundegren N, Axtelius B, Håkansson J, Akerman S. Dental treatment need among 20 to 25-year-old Swedes: discrepancy between subjective and objective need. Acta Odontol Scand 2004; 62:91-6.

21. Locker D, Gibson B. Discrepancies between self-ratings of and satisfaction with oral health in two older adult populations. Community Dent Oral Epidemiol 2005; 33:280-8.

22. Locker D. Concepts of oral health, disease and the quality of life. In: Slade GD, editor. Measuring oral health and quality of life. Chapel Hill: University of North Carolina; 1997. p. 11-23.

23. Cremonese C, Backes V, Olinto MTA, Dias-da-Costa JS, Pattussi MP. Neighborhood sociodemographic and environmental contexts and self-rated health among Brazilian adults: a multilevel study. Cad Saúde Pública 2010; 26:2368-78.

24. Slade GD. Derivation and validation of a short-form oral health impact profile. Community Dent Oral Epidemiol 1997; 25:284-90.

25. Nuttall NM, Slade GD, Sanders AE, Steele JG, Allen PF, Lahti S. An empirically derived population-response modelo of the short form of the Oral Health Impact Profile. Community Dent Oral Epidemiol 2006; 34:18-24.

26. Tassinari WS, de León AP, Werneck GL, Faerstein E, Lopes CS, Chor D, et al. Contexto sócio-econômico e percepção da saúde bucal em uma população de adultos no Rio de Janeiro, Brasil: uma análise multinível. Cad Saúde Pública 2007; 23:127-36.

27. Locker D. Measuring oral health: a conceptual framework. Community Dent Health 1988; 5:5-13.

28. Slade GD, Spencer AJ, Locker D, Hunt RJ, Strauss RP, Beck JD. Variations in the social impact of oral conditions among older adults in South Australia, Ontario, and North Carolina. J Dent Res 1996; 75:1439-50.

29. Slade GD, Nuttall N, Sanders AE, Steele JG, Allen PF, Lahti S. Impacts of oral disorders in the United Kingdom and Australia. Br Dent J 2005; 198: 489-93.

30. Fleck MPA, Louzada S, Xavier M, Chachamovich E, Vieira G, Santos L, et al. Application of the Portuguese version of the abbreviated instrument of quality life WHOQOL-bref. Rev Saúde Pública 2000; 34:178-83.

31. Sherbourne CD, Stewart AL. The MOS social support survey. Soc Sci Med 1991; 32:705-14.

32. Department of Mental Health and Substance Dependence, Noncommunicable Diseases, and Mental Health Cluster, World Health Organization. International guide for monitoring alcohol consumption and related harm. Geneva: World Health Organization; 2000.

33. Ståhlnacke K, Söderfeldt B, Unell L, Halling A, Axtelius B. Perceived oral health: changes over 5 years in one Swedish age-cohort. Community Dent Oral Epidemiol 2003; 31:292-9.

34. Lahti S, Suominen-Taipale L, Hausen H. Oral health impacts among adults in Finland: competing effects of age, number of teeth, and removable dentures. Eur J Oral Sci 2008; 116:260-6.

35. Bandéca MC, Nadalin MR, Calixto LR, Saad JR, Silva SR. Correlation between oral health perception and clinical factors in a Brazilian community. Community Dent Health 2011; 28:64-8.

36. Locker D, Quiñonez C. To what extent do oral disorders compromise the quality of life? Community Dent Oral Epidemiol 2011; 39:3-11.

37. Sanders AE, Slade GD, John MT, Steele JG, Suominen-Taipale AL, Lahti S, et al. A cross-national comparison of income gradients in oral health quality of life in four welfare states: application of the Korpi and Palme typology. J Epidemiol Community Health 2009; 63:569-74.

38. Gift HC, Atchison KA. Oral health, health, and health-related quality of life. Med Care 1995; 33(11 Suppl):NS57-77.

39. Turrell G, Sanders AE, Slade GD, Spencer AJ, Marcenes W. The independent contribution of neighborhood disadvantage and individual-level socioeconomic position to self-reported oral health: a multilevel analysis. Community Dent Oral Epidemiol 2007; 35:195-206.

40. Berkman LF, Glass T, Brissette I, Seeman TE. From social integration to health: Durkheim in the new millennium. Soc Sci Med 2000; 51:843-57.

41. Mulligan R, Seirawan H, Alves ME, Navazesh M, Phelan JA, Greenspan D, et al. Oral health-related quality of life among HIV-infected and at-risk women. Community Dent Oral Epidemiol 2008; 36:549-57.

42. Poortinga W, Dunstan FD, Fone DL. Perceptions of the neighbourhood environment and self rated health: a multilevel analysis of the Caerphilly Health and Social Needs Study. BMC Public Health 2007; 7:285.

43. Franzini L. Self-rated health and trust in low-income Mexican-origin individuals in Texas. Soc Sci Med 2008; 67:1959-69.

44. Wong IO, Cowling BJ, Lo SV, Leung GM. A multilevel analysis of the effects of neighbourhood income inequality on individual self-rated health in Hong Kong. Soc Sci Med 2009; 68:124-32.

45. Lee CC, Chien SH, Hung SK, Yang WZ, Su YC. Effect of individual and neighborhood socioeconomic status on oral cancer survival. Oral Oncol 2012; 48:253-61.

46. Bernabé E, Marcenes W. Periodontal disease and quality of life in British adults. J Clin Periodontol 2010; 37:968-72.

47. Blakely TA, Woodward AJ. Ecological effects in multi-level studies. J Epidemiol Community Health 2000; 54:367-74.

48. Greenland S, Robins J. Accepting the limits of ecologic studies: Drs. Greenland and Robins reply to Drs. Piantadosi and Cohen. Am J Epidemiol 1994; 139:769-71.

49. Diez Roux AV. A glossary for multilevel analysis. J Epidemiol Community Health 2002; 56:588-94.

50. Bailis DS, Segall A, Chipperfield JG. Two views of self-rated general health status. Soc Sci Med 2003; 56:203-17.