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Racial Differences in Oral Health-Related Quality of Life: A Multilevel Analysis in Brazilian Children

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This cross-sectional study aimed to assess the influence of race/ethnicity on Brazilian children' oral health-related quality of life (OHRQoL). A multistage random sampling selected a representative sample of 1,134 twelve-years-old children from public schools of Santa Maria, a city in Southern Brazil. Participants were examined by 4 calibrated clinicians (minimum Kappa-value for inter-examiner agreement of 0.8) and the Brazilian short version of the Child Perceptions Questionnaire (CPQ11-14) was administered. The children's parents or guardians answered questions regarding their demographics and socioeconomic status. Associations were analyzed using multilevel Poisson regression models. Children from racial/ethnic minority groups had poorer OHRQoL. The mean CPQ11-14 score was 1.08 times higher for non-white children than their white counterparts' score. "Social" and "Emotional well-being" were the most affected domains for non-white children, with significantly higher mean scores as compared to white children (RR 1.19, 95% CI, 1.07-1.33; and RR 1.14; 95% CI 1.04-1.24). This association remained significant even after adjusting for individual and contextual covariates. OHRQoL disparities are prevalent among children from racial/ethnic minority groups. Non-white children have lower OHRQoL compared to white children.

Key Words: adolescent, child, ethnicity, OHRQoL, race.

Introduction

Quality of life is recognized as a multidimensional concept, involving a subjective sense of well-being that is not restricted to the physical and psychological effects of therapies, but is primarily related to physiological, familial, and environmental issues (1). Oral health cannot be dissociated from overall health (1) and has been strongly linked to well-being, since poor oral health status may have a negative impact on children's routine (2). The use of patient-reported outcomes and self-reports of health-related quality of life has become increasingly popular (3). Such measures were considered as suitable, cost-effective and a non-invasive tool for gathering data regarding health outcomes (4).

Oral health-related quality of life (OHRQoL) has been a construct associated with the impact of oral health conditions on individuals' daily activities, quality of life and well-being (5). For children, it refers to their ability to play, attend school and relate to others, as well as the influence on growth, phonation and chewing (2).

The interaction between socioeconomic factors and social characteristics affects health differently across groups (6,7). The socioeconomic status (SES) is considered a powerful determinant of health because it can shape life experiences and control exposure to psychological and environment risk factors in one's lifetime (8).

Despite the strong influence of SES, ethnic/racial inequalities have also been recognized as important predictors for disparities in self-perceived oral health and quality of life (9). In this sense, race has been considered as a social aspect in which individuals share features of cultural aspects more than a biological characteristic (10). In Brazil probably due to the historic context and past heritage, the non-white people have both worse SES (11) and QoL (6). Furthermore, studies in different countries found that non-white ethnic groups with the same SES and educational level as their Caucasian counterparts had lower-level occupations and income, thus hindering access to services (12). Thus, racial/ethnic issues could also reflect differences in OHRQoL.

Theoretical explanations of the link between racial disparities and health outcomes focus on socioeconomic, psychosocial, and behavioral issues (13) and on cultural and biological (genotypic) differences that lead to discrimination (12). Racial/ethnic discrimination has been postulated as a multidimensional environmental and chronic psychosocial stressor at the community and individual levels, affecting health behaviors and choices, which in turn, may have detrimental effects on the individual's health (14).

Although some authors have reported racial/ethnic differences in clinical outcomes and the influence of clinical predictors on OHRQoL (9,15), studies evaluating racial/ethnic differences in OHRQoL among Brazilian

school-going children are scarce and to the best of our knowledge, no study assessed the link between race and OHRQoL using a multilevel approach. Better understanding of ethnic/racial differences in OHRQoL is of great importance to improve this population's OHRQoL and planing future health interventions. Thus, this study attempted to assess the influence of racial/ethnics on COHRQoL of Brazilian children. Our hypothesis is that non-white children present a worse COHRQoL compared to their white counterparts.

Material and Methods

Ethics

The Ethics in Research Committee of the Federal University of Santa Maria approved this study. All children provided their agreement to participate and written informed consent was obtained from their parents/legal guardians. Moreover, they were assured that their child could decline participation without detriment.

Sample

A survey was conducted on twelve-year-old children from public schools in Santa Maria, a middle-sized city in Southern Brazil. At the time of the study, the city had approximately 261,031 individuals and out of them 3,817 were twelve-year-old children. The sample size for assessing OHRQoL according to ethnic/racial groups was estimated considering the following parameters: a 5% standard error, 80% power, 95% confidence level, and a mean score of 13.0 (SD=8.7) in the exposed group (non-white children) and 11.3 (SD=8.2) in the unexposed group (white children) on the Brazilian short version of the Child Perceptions Questionnaire (CPQ11-14) (16). Correction factors of 1.2 for effect design and 10% for non-response were applied to increase accuracy. Thus, the minimum required sample size was 1,028 children.

For sample selection, we adopted a two-stage sampling procedure. All public schools in the municipality were considered in the first stage (n=39), from which 20 schools were selected (17). To ensure that all children had an equal likelihood of being selected, we used probabilities proportional to the size of schools by the number of students (18). The children enrolled in the school were considered as our second stage unit.

Data Collection

The data gathering included dental examination and structured interviews performed by four calibrated examiners. To assess clinical variables such gingival bleeding, dental plaque, calculus, dental caries, dental trauma and occlusal disorders, a 36-h training and calibration program that included theory-based activities with discussions on diagnostic criteria for all dental conditions and a trial examination of 20 children was conducted (18). The entire training procedure was conducted by a benchmark dental examiner.

Dental examinations were conducted in a classroom using a plain mouth mirror, gauze, and Community Periodontal Index (CPI) probe under natural light, according to the international criteria standardized by the World Health Organization for oral health surveys (18). Dental plaque (visible plaque index), calculus (CPI criteria), dental caries (decayed, missing and filled teeth index) and dental crowding (dental aesthetic index) were also assessed using standardized criteria (18).

SES and sociodemographic characteristics were obtained from a structured questionnaire applied to the children's parents/guardians. The same questionnaire was used in a previous study (19) and includes questions regarding gender, race, parents' educational level, household income, household overcrowding and parent's perception of their child's oral health. Based on the parents' responses, participants were dichotomized into "non-white" (children of African and mixed descent) and "white" (children of European descent) race groups, according previous criteria (20). Educational level was further divided categorized into two levels: high (those parents who completed eight years of formal instruction, which in Brazil corresponds to primary school) and low education level. Household income was measured based on the average monthly income of all individuals living in the child's house. It was further dichotomized according to the median value of the income distribution (720 USD per month). The feasibility of the socioeconomic questionnaire was previously assessed in a sample of 20 parents during the training process.

Oral Health-Related Quality of Life (OHRQoL)

The OHRQoL was measured by a face-to-face interview using the validated short version of the Brazilian CPQ11-14 (21). In order to avoid influencing responses, all interviews were performed before the dental examination. Besides, interview and dental examination were performed by different examiners. The Brazilian CPQ11-14 short version comprises 16 questions, addressing four domains, namely oral symptoms, functional limitations, emotional well-being and social well-being. Each question has five possible answers ranging from 0 to 4 in rank order. The total CPQ11-14 score was computed by summing all scores for each domain, with overall scores ranging 0-64. Higher overall scores indicate worse OHRQoL.

Contextual factors related to the adolescent's school (i.e. mean neighborhood household income per month)

were collected in order to assess the environment influence on OHRQoL. These data were obtained from a government database (20). Schools were classified according to the median value of the Brazilian Minimum Wage (BMW) of the neighborhood (540 USD).

Statistical Analysis

Data analysis was performed with the software STATA 12 (Stata Corporation; College Station, TX, USA). The demographic, clinical and socioeconomic characteristics were presented as descriptive data, considering the sample weights for complex data survey. A multi-level Poisson regression analysis was performed to assess the association between race/ethnics and the mean score of CPQ11-14 after adjusting for individual and contextual covariates. The rate ratio (RR; 95% confidence interval [CI]) was calculated based on the ratio of arithmetic CPQ mean scores between non-white and white children. In our data, the children (first level) were nested in schools (second level).

Results

Table 1 shows the sample's clinical, demographic and socioeconomic characteristics. Participants were 1,134 children (54.1% girls and 45.9% boys), with a response rate of 93%. The non-participation reason was primarily due to participants' absence on the examination day or failure to return the signed consent form.

The majority of participants were white; most parents of participants attained a high education level, and earned less than 720 USD. A high prevalence of dental caries and malocclusion were found (49.9% and 42.4%, respectively). Kappa values for intra- and inter-examiner agreement regarding the clinical variables ranged from 0.80 to 0.92. The overall mean score of the CPQ11-14 was 10.3 (standard error: 0.32), presenting a large variation (scores ranged from 0-43). No ceiling effect or large variations were observed in domain-specific scores. Average scores (S.E.) for oral symptoms, functional limitation, emotional well-being and social well-being domains were 3.48(0.09), 2.45(0.07), 2.68(0.15) and 1.62(0.08), respectively. Mean differences in CPQ11-14 total and domain scores according to racial/ethnic group are shown in Table 2. Non-white children presented lower total CPQ11-14 mean scores compared with white children. Additionally, lower mean scores for non-white children were observed in domain specific analysis for emotional well-being (RR 1.27, 95% CI, 1.17-1.38), functional limitation (RR 1.10; 95% CI, 1.00-1.20), and social well-being (RR 1.28, 95% CI, 1.15-1.42). The multilevel adjusted analysis of individual and contextual covariates for the mean CPQ11-14 scores is shown in Table 3. Racial inequality in OHRQoL remains significant for total CPQ11-14 scores and for emotional and social well-being domains. The mean CPQ11-14 scores were

Table 1. Clinical, demographic and socioeconomic characteristics of the study sample. Santa Maria, RS, Brazil

Variables	N	%
Covariates of the child level		
Sex		
Female	611	54.12
Male	523	45.88
Race/ethnics		
White	851	77.93
Non-white	254	22.07
Household income (per month)		
>720 USD	487	47.78
≤720 USD	549	52.22
Mother's schooling		
With primary education	702	65.55
Without primary education	382	34.45
Father's schooling		
With primary education	628	61.44
Without primary education	406	38.56
Gingival bleeding		
<15% sites	836	73.76
≥15% sites	298	26.24
Dental caries		
Yes	654	57.72
No	480	42.28
Dental trauma		
Yes	848	74.84
No	286	25.16
Malocclusion		
Yes	656	57.64
No	478	42.36
Covariate of the school level		
Neighborhood's mean income (per month)		
>540 USD	893	79.68
≤540 USD	241	20.32

Descriptive analysis was run considering the sample weight. Monthly income of the subjects and neighborhood were based on the median value of the income distribution. USD: United States dollar

1.08 times higher for non-white children than the white children's scores. Social and emotional well-being domains were most affected for non-white children, with significantly higher mean scores as compared to white children (RR 1.19, 95% CI, 1.07-1.33; and RR 1.14, 95% CI, 1.04-1.24).

Discussion

This population-based study assessed racial/ethnic differences in OHRQoL. Even accounting for clinical and demographic factors, OHRQoL was influenced by racial/ethnic status. The most important finding was that non-white children presented poorer OHRQoL compared with white children. Other studies have also found poor OHRQoL (6,9) among non-white populations and those from other racial/ethnic minority groups. However, none assessed the influence of race on OHRQoL of school-going children.

The difference on OHRQoL between non-white/white children remained significant even after adjusting for individuals and neighborhood covariates (Table 3). The exception was for oral symptoms and functional limitations. This may be due to the substantial influence of clinical conditions in these domains. The items refer to limitations on performing normal functions, such as chewing difficulty and dental pain. It is well known that dental conditions like caries and malocclusion affect the COHRQoL, resulting in disturbance of daily performance and affecting also dental appearance (15). However, differences in OHRQoL across racial groups were significant for emotional and social well-being domains, even after adjusting for possible confounders. This is consistent with a study that found that minority racial/ethnic groups had worse OHRQoL and fewer permanent teeth when compared to their counterparts. Minorities had the lowest means for all domains of the questionnaire used to evaluate OHRQoL (9). Further, similar results have been observed in another study where race affected almost all domains of children's quality of life, independent of socioeconomic status (6).

The influence of race on oral health perceptions is complex and is linked to biologic, socioeconomic, behavioral and psychosocial factors that vary across the racial/ethnic groups (22). Individuals with low SES may be exposed to several risk factors for their oral health and quality of life, which affect psychological and social aspects of their life (23). Moreover, historically, some groups have experienced greater social exclusion, due to racism and discrimination. This may explain their predisposition to present the worst health outcomes as compared to their peers (24).

It has been suggested that racial differences in health outcomes are not explained by genetic variation, following a biomedical model, since it is known that the genetic variability is higher within racial groups than between them (25); besides, skin color definition through self-reports does not capture genotype differences (26). Notwithstanding, the concept of race is related to social groups that share the same cultural characteristics (10), individual identity, access to resources and society appreciation (27). According to the "Critical Race Theory" (28), race is not just a personal characteristic, but a socially constructed concept. Furthermore, it has been described as feature for racism-related exposures like discrimination (28). Thus, the higher CPQ11-

Table 2. Mean scores of the CPQ 11-14 by race/ethnic groups.

	White mean (SE)	Non-white mean (SE)	RR* (95%CI)	p value
CPQ (overall scale)	9.92 (0.34)	11.46 (0.49)	1.14 (1.10-1.20)	0.00
Domains				
Oral symptoms	3.47 (0.09)	3.53 (0.18)	1.04 (0.97-1.12)	0.28
Functional limitation	2.40 (0,07)	2.66 (0.14)	1.10 (1.00-1.20)	0.03
Emotional well-being	2.51 (0.17)	3.31(0.19)	1.27 (1.17-1.38)	0.00
Social well-being	1.53 (0.09)	1.94 (1.16)	1.28 (1.15-1.42)	0.00

*Rate ratio (arithmetic score mean ratio). Unadjusted Multilevel Poisson regression.

Table 3. Association of CPQ11-14 scores with race/ethnic groups assessed by multilevel adjusted Poisson models

	White	Non-white RR (95% CI)*	p value
CPQ (overall scale)	1	1.08 (1.04-1.13)	0.00
Domains			
Oral symptoms	1	1.02 (0.94-1.11)	0.50
Functional limitation	1	1.03 (0.94-1.13)	0.41
Emotional well-being	1	1.14 (1.04-1.24)	0.00
Social well-being	1	1.19 (1.07-1.33)	0.00

*Multilevel Poisson Regression Model adjusted by individual level variables: malocclusion, dental caries, household income, gender, dental trauma, bleeding severity and contextual level variable: mean income of the neighborhood.

14 scores among non-white participants suggest that the most important race-related factor influencing OHRQoL may be psychosocial features — e.g. discrimination— rather than oral or functional problems.

Some theories (12,14,27) explain the link between health outcomes and race; the most important focus being on health determinants that recognize the influence of race on individuals' health behavior, access to economic resources and psychosocial support (13). In this sense, race may have an influence on self-perceived oral health through social class discrimination and exposure to a low SES (12).

This study has some limitations. Data were obtained from public schools, not considering private schools. However, it can not be considered a great bias since approximately 85% of the children in the city studied in public schools. In addition, our sample comprises individuals from different socioeconomic levels and educational backgrounds; so, including private schools heterogeneity would increase since there are fewer non-white children in private schools.

In our study, caregivers were a proxy for the skin color report. Although some researchers have assessed race using self-reports or interviewers' assessments of skin color (11), other national-level study has used caregivers as respondents (20). Despite these limitations, the current study has a significant contribution to the understanding of racial inequalities in OHRQoL. Racial/ethnic disparities in clinical outcomes in health and oral health have been reported; nevertheless, few authors have demonstrated racial/ethnic disparity on OHRQoL (9). Recognizing racial inequalities in OHRQoL may help tailor public health policies and create supportive and inclusive environments, thus reducing inequality faced by racial/ethnic minorities.

Resumo

Este estudo transversal avaliou a influência da raça/etnia na qualidade de vida relacionada à saúde bucal (QVRSB) de crianças brasileiras. O processo de amostragem aleatório selecionou uma amostra representativa de 1.134 crianças de 12 anos de idade de escolas públicas de Santa Maria, uma cidade do sul do Brasil. Os participantes foram examinados por 4 clínicos calibrados (valor mínimo de Kappa para concordância inter-examinador de 0,8) e a versão brasileira reduzida do questionário *Child Perception Questionnaire* (CPQ 11-14) foi aplicada a cada um. Os pais ou responsáveis pelos crianças responderam a questões relacionadas à suas características demográficas e socioeconômicas. As associações foram analisadas utilizando modelos multiníveis com regressão de Poisson. Crianças de grupos étnico/raciais minoritários tiveram pior QVRSB. O escore médio do CPQ 11-14 foi 1,08 maior para crianças não-brancos do que o escore dos seus pares. Os domínios "Bem-Estar Social" e "Bem-Estar Emocional" foram os mais afetados para crianças não-brancos, com escores médios significativamente maiores quando comparados aos crianças brancos (RR 1,19, 95% IC, 1,07-1,33; e RR 1,14; 95% IC 1,04-1,24). Essa associação permaneceu significante mesmo após ajustes por covariáveis individuais e contextuais. Disparidades na QVRSB são prevalentes entre crianças de grupos étnico/raciais minoritários. Crianças não-brancas tiveram pior QVRSB comparados aos crianças brancos.

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