Resilience and Self-Perceived Oral Health: A Hierarchical Approach

Aline Blaya Martins, DDS, MSc,† Camila Mello dos Santos, DDS, MSc,*† Juliana Balbinot Hilgert, DDS, PhD,*†‡ Renato José de Marchi, DDS, MSc,*† Fernando Neves Hugo, DDS, PhD,*†§ and Dalva Maria Pereira Padilha, DDS, PhD*†*

OBJECTIVES: To determine whether positive self-perceived oral health is associated with sociodemographic health variables, with an emphasis on resilience, in community-dwelling older adults in southern Brazil.

DESIGN: Cross-sectional study nested within a cohort study.

SETTING: Carlos Barbosa in southern Brazil.

PARTICIPANTS: Four hundred ninety-six community-dwelling adults aged 64 and older.

MEASUREMENTS: Sociodemographic information, a health history, and health perceptions were assessed using a structured questionnaire. Resilience was assessed using a resilience scale. For each participant, a brief oral examination was performed to assess number of teeth. Positive self-perceived oral health was the outcome of interest.

RESULTS: A final, fully adjusted Poisson regression model showed that high resilience potential (prevalence ratio (PR) = 1.18, 95% confidence interval (CI) = 1.06–1.32), income (PR = 1.18, 95% CI = 1.07–1.30), and no reported change in diet because of dental problems (PR = 1.34, 95% CI = 1.13–1.60) were associated with positive self-perceived oral health. Participants living in rural areas were less likely to report positive self-perceived oral health (PR = 0.83, 95% CI = 0.75–0.93).

CONCLUSION: Using a hierarchical approach, positive self-perceived oral health was found to be associated with several variables included in the conceptual framework of oral health outcomes, such as resilience. Resilience may act as a potentiating agent in the positive adaptation to tooth loss. **J Am Geriatr Soc 59:725–731, 2011.**

Key words: aged; self-perception; oral health; psychological resilience

Studies in the fields of geriatrics and gerontology tend to report disease-related outcomes more often than they report positive health and well-being outcomes, but an increasing number of studies are focusing on topics related to positive psychology, potentials and resources during aging.[1,2]

Resilience represents one of the positive individual traits that may ultimately contribute to active, healthy aging. The concept of resilience refers to a dynamic process involving social or personal psychic factors that are important for healthy development, even in the presence of adversity.[3,4] Resilience may represent an important individual trait that enables older adults to sustain or experience positive outcomes to a degree that is similar to, or even exceeds, that of periods when vulnerability events did not occur.[5]

Few studies in the literature have evaluated oral diseases as a cause of individual and community vulnerability in regard to physical and mental health, although a study published in 1981 suggested that those who become edentate may experience the onset of depression, anxiety symptoms, and diminished self-esteem.[6] Subsequent studies[7–9] showed that tooth loss may negatively affect oral function, including mastication, speech performance, and smiling. The number and position of missing teeth have also been shown to result in subjective feelings of shame, fear, loss, constraint, incompleteness, and resignation.[10,11]

In contrast, findings from studies evaluating self-perceived oral health, particularly those reporting a high prevalence of satisfaction with oral health by edentate older persons, encourage further studies addressing the significance of personal adaptive processes,[12–15] such as resilience. These studies suggest that older adults may convert losses into opportunities for forgiveness and growth, in part because of capacities related to resilience.[16] Resilient individuals

From the *Department of Preventive and Social Dentistry, Faculty of Dentistry, †Postgraduate Studies Program in Dentistry, ‡Postgraduate Studies Program in Epidemiology, §Center of Community Oral Health Research, Federal University of Rio Grande do Sul, Porto Alegre, Brazil.

Address correspondence to Fernando N. Hugo, Universidade Federal do Rio Grande do Sul, Faculdade de Odontologia, Centro de Pesquisas em Odontologia Social, Rua Ramiro Barcelos, 2492, Porto Alegre 90035-003, Brazil. E-mail: fnhugo@yahoo.com.br

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are described as possessing self-esteem, belief in their own self-efficacy, and satisfying interpersonal relationships.[17] Thus, it may be hypothesized that resilient older persons with poor oral status, as represented by extensive tooth loss and edentulism, are more likely to perceive their oral health as good than less-resilient older persons.

In addition, individual ability to adapt represents an important aspect related to the resilience process that should be taken into account. The hypothesis of the present study was that high resilience is associated with positive self-perception of oral health, even when other factors are taken into account. Thus, the objective was to evaluate the associations between positive self-perceived oral health and resilience and exogenous primary determinants, as well as health behavior and oral health variables, using a hierarchical approach in community-dwelling older persons living in Carlos Barbosa, Brazil.

METHODS

Population and Sample

This study was part of a larger cohort study of older persons in the city of Carlos Barbosa that took place from 2004 to 2008.[18,19] Carlos Barbosa is a city located in southern Brazil, 104 kilometers north of Porto Alegre, the capital of Rio Grande do Sul. The city had 20,519 inhabitants in 2000, of whom 2,167 were aged 60 and older.

People aged 60 and older who were living independently and were generally healthy were invited to take part in the study at baseline in 2004. Eight hundred seventy-two participants were selected for the baseline study using a simple random sampling method. The follow-up study was conducted during 2008 using a consecutive sample. Subjects who took part in the study at baseline were invited to participate in the 2008 study if they were still living in the community. The sociodemographic, resilience, and dental information used in the present study was collected during the 2008 follow-up study. This is a cross-sectional study nested within a cohort. The sample size was estimated from a pilot study of 50 subjects, in which 67% of the participants who reported good self-perceived oral health displayed low levels of resilience, and 75% of those who reported good self-perceived oral health displayed high levels of resilience. When using a 95% confidence interval, a β value of 20%, and 80% power, the necessary sample size was estimated to be 496 participants. The Committee of Ethics in Research of the Federal University of Rio Grande do Sul approved the study protocol. Before starting data collection, participants were informed about the study objectives and procedures and were asked to sign the informed consent form. All participants provided written informed consent. The study was performed according to the Brazilian resolution for standards of ethics in research involving human participants.[20]

Data Collection

Data collection consisted of interviews and oral examinations. Oral examinations were performed in dental operatories provided by the health department in Carlos Barbosa. The researchers conducted individual interviews in the participants' homes or in community clubhouses.

Oral Examinations

The number of teeth that people retain is indicative of their history of dental diseases and the treatment of these diseases by dental services throughout the life of their permanent teeth.[21] Two previously trained and calibrated dentists performed oral examinations that included an assessment of the number of natural teeth, following World Health Organization criteria,[22] as a measure of oral health status. The number of teeth was later categorized in accordance with the shortened dental arch criteria, which divides participants into zero, one to 19, or 20 or more natural teeth.[23]

Evaluation of Self-Reported Sociodemographic, Behavioral, and Health Information

A standard questionnaire was used to collect sociodemographic, behavioral, and health information on age, sex, geographic location of the participant's residence, marital status, education, monthly income, participation in groups of older people, frequency of tooth brushing, smoking status, diet changes due to oral or dental problems, and visits to the dentist.

All variables were categorized for analysis purposes. Age was categorized using the quartiles determined from the study sample's age distribution. Monthly income was categorized as minimum wage or less versus greater than minimum wage, using the Brazilian minimum wage during the data collection period (US$219.50) as the reference. Marital status was categorized as married, single or divorced, or widowed. Schooling was categorized as 3 or fewer versus more than 4 years of formal education. The frequency of tooth brushing was categorized as once a day or less, twice a day, or more than twice a day. For smoking status, each participant was categorized as a never or former smoker versus a current smoker. Visits to the dentist were categorized as "I never go to the dentist," "I go to the dentist only when I have a problem," or "I go to the dentist on a regular basis." The following question from the Oral Health Impact Profile questionnaire, with answers on a 5-point Likert scale ranging from never (1) to very often (5), was used as a proxy of perceived masticatory function: "Have you had to interrupt meals because of problems with your teeth, mouth, or dentures?"[24]

Self-Perceived Oral Health

Perception of one's health depends on individual judgment and values.[25] Although different approaches are available for evaluating self-perceived oral health, single-item indicators have frequently been used because they represent a valid and simple measure for evaluating oral health–related outcomes and summarizing oral health status.[26]

Positive self-perceived oral health was the outcome evaluated in the present study. Participants were asked, "Compared with others your age, how would you rate the health of your mouth overall?" Answers were initially selected from a 5-point Likert scale (excellent = 1, very good = 2, good = 3, fair = 4, and not good = 5).[27] The answers were later dichotomized for analysis purposes, with participants who rated their oral health as excellent, very good, or good categorized as good and those who rated their oral health as fair or not good categorized as not good.

Resilience Scale

The Resilience Scale (RS) was originally developed in 1993[28] and then validated in Brazilian Portuguese in 2005.[29] It is one of the few instruments used to assess positive psychosocial adaptation to stressful events. The scale comprises 25 items describing positive statements, with responses given on a 7-point Likert scale ranging from strongly disagree (1) to strongly agree (7). Total scores range from 25 to 175, with higher scores indicating greater resilience. The RS aims to evaluate individual resilience by accounting for positive personality characteristics that emphasize personal coping ability. It was developed based on the premise of evaluating individual ability and potential.[28]

Total RS scores were categorized according to tertiles of the sample distribution. Participants with RS scores in the first tertile were categorized as having low resilience, those in the second tertile as having moderate resilience, and those in the third tertile as having high resilience.

Conceptual Framework

Data analysis was performed using a hierarchical approach based on the conceptual framework, "Ethnicity, Aging and Oral Health Outcomes,"[25] originally proposed to explore the multitude of factors influencing oral health systematically. The model consists of variables distributed into four levels: exogenous variables, primary determinants of oral health, health behaviors, and oral health outcomes. In the original model, the fourth level (oral health outcomes) included evaluated and perceived health status. This conceptual framework was developed for the International Collaborative Study of Oral Health Outcomes and aims to explain the determinants of oral health based on a systems perspective.[25] The present study explored resilience as a factor influencing self-perceived oral health among other factors (Figure 1). Clinically evaluated health status, defined as the number of remaining natural teeth, was incorporated into the analysis as an independent variable. Because more than 50% of the study population had no natural teeth, it was not possible to consider the numbers of decayed or filled teeth as variables. The outcome was positive self-perceived oral health.

This expanded behavioral model conceptualized exogenous variables (age and sex) as distal variables included in the first level of analysis. The second level of analysis, primary determinants, included external environment (geographic location of each participant's residence) and personal characteristics (marital status, resilience, and available resources, which include education, income, and participation in older people's social groups). The third level of analysis, health behaviors, included personal practices variables (frequency of tooth brushing, difficulties eating, and smoking status) and visits to the dentist. The fourth and most proximal level of analysis included the number of remaining natural teeth as an indicator of oral health status.

This conceptual framework allowed self-perceived oral health to be modeled as the outcome of a complex process. The scheme presented focused on the systematic assessment of the importance of resilience as one of several factors that may influence self-perception of oral health.

Statistical Analysis

Chi-square tests were used to evaluate the distributions of the categorical independent variables in relation to the study outcome of positive self-perceived oral health. The inter- and intra-examiner reproducibilities of oral examination results before and during the study were calculated using the Cohen kappa coefficient. The internal consistency of the resilience scale was tested using the Cronbach alpha coefficient.

All statistical analyses were performed using SPSS 16.0 software (SPSS, Inc., Chicago, IL). Prevalence ratios were estimated using Poisson regression with a robust variance estimator. Initially, the hierarchical approach consisted of univariate Poisson regression models that were used to estimate the relationships between each variable studied and the outcome. Multivariate Poisson regression was then performed within each level. Variables were retained in the subsequent hierarchical levels if their $P < .10$ after adjusting for confounders within their own levels and hierarchically anterior variables that remained associated ($P < .10$) with the outcome within their own levels. Finally, only variables

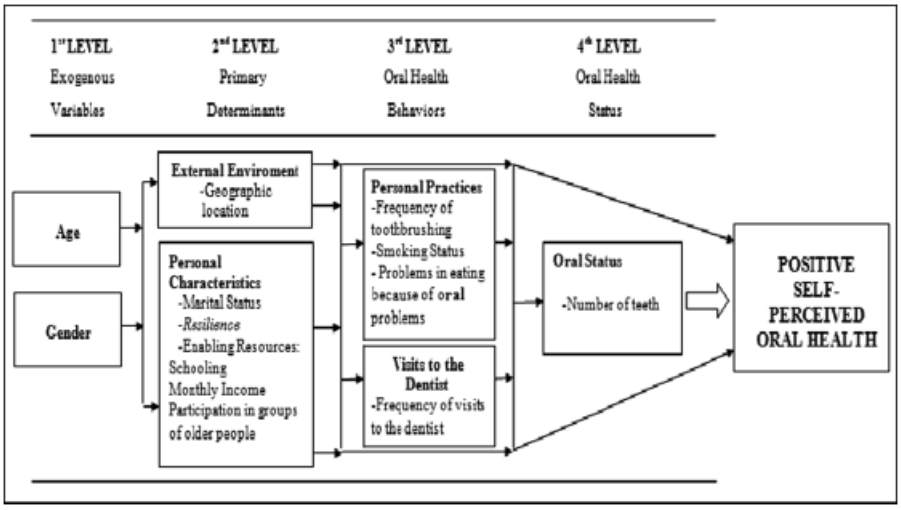

Figure 1. Conceptual framework.

that had $P < .10$ in the previous models were included in the final, fully adjusted model. In the fully adjusted model, the magnitudes of association between the independent variables and the studied outcome were estimated using prevalence ratios, considering $P < .05$ as significant, and 95% confidence intervals.

RESULTS

The mean age of the study participants was 70.6 ± 6.6. Three hundred thirty-two (66.7%) participants were female, and 225 (46%) had less than 4 years of formal education. More than half of the study sample was completely edentate (53.2%), 41% had one to 19 natural teeth, and only 5.8% had 20 or more natural teeth. The mean resilience score in the study sample was 141.1 ± 13.3.

The kappa coefficients for inter- and intra-examiner reproducibility before and during the study ranged from 0.97 to 0.98. The Cronbach alpha coefficient of the resilience score was 0.78.

The frequencies of the independent variables assessed in this study in relation to positive self-perceived oral health are shown in Table 1. The location of the participant's residence, resilience, income, and reported difficulties with eating were significantly associated ($P < .05$) with the outcome.

A hierarchical approach, with four levels, was used (Table 2).

First level—No significant associations were found between first-level variables and positive self-perceived oral health.

Second level—A negative and statistically significant association was found between positive self-perceived oral health and living in a rural area. Income was significantly associated with the outcome, even after adjusting for the other levels of the analysis. High resilience, defined as resilience scores in the third tertile of the sample's distribution, had a stronger association with the outcome after adjusting for variables within its own level and for variables in the hierarchically anterior levels. The three aforementioned variables were included in the final, fully adjusted model.

Third level—The *P*-values for the frequency of tooth brushing fluctuated after adjustment, such that $P = .10$ in the univariate analysis, $P = .07$ after adjusting for variables within the same level, and $P = .11$ after adjusting for variables in the hierarchically anterior levels. Thus, the frequency of tooth brushing was excluded from the final, fully adjusted model. The variable "problems eating because of oral or dental problems" was significantly associated with positive self-perceived oral health after adjustment and was retained in the final, fully adjusted model. The variable "visits to the dentist" changed its significance after adjustment, but it was included in the final model because of its marginal *P*-value ($P = .08$).

Fourth level—In the univariate analysis, having 20 or more natural teeth was statistically significant ($P = .08$) but lost its significance after adjustment for hierarchically anterior variables.

In the final fully adjusted model (Table 3), there was a negative and significant association between living in a rural area and good self-perceived oral health. Participants

Table 1. Characteristics of the Studied Sample According to Self-Perceived Oral Health

Characteristic	n (%) Poor Self-Perceived Oral Health	n (%) Good Self-Perceived Oral Health	*P*-Value
Age			
64–66	39 (33.6)	98 (25.8)	
67–70	24 (20.7)	96 (25.8)	
71–75	21 (18.1)	82 (21.6)	
≥76	32 (27.6)	104 (27.4)	.35
Geographic location			
Urban	47 (40.5)	218 (57.4)	
Rural	69 (59.5)	162 (42.6)	.001
Sex			
Male	34 (29.3)	130 (34.2)	
Female	82 (70.7)	250 (65.8)	.33
Marital status			
Married	77 (67.0)	242 (64.0)	
Single or divorced	7 (6.1)	31 (8.2)	
Widowed	31 (27.0)	105 (27.8)	.72
Resilience tertile			
First	43 (37.1)	123 (32.4)	
Second	48 (41.4)	113 (29.7)	
Third	25 (21.6)	144 (37.9)	.004
Schooling, years			
≤3	57 (50.9)	168 (44.6)	
>4	55 (49.1)	209 (55.4)	.24
Monthly income, $*			
≤219.50	78 (67.2)	177 (46.8)	
>219.50	38 (32.8)	201 (53.2)	<.001
Frequency of toothbrushing, per day			
≤1	70.37 (7.07)	71.13 (6.44)	
2	28 (24.1)	68 (18.0)	
>2	47 (40.5)	146 (38.6)	.20
Smoking status			
Current smoker	5 (4.3)	22 (5.8)	
Never or former smoker	111 (95.7)	356 (94.2)	.53
Problems in eating because of oral or dental problems			
Occasionally, fairly often, or very often	32 (27.6)	49 (13.0)	
Never or hardly ever	84 (72.4)	329 (87.0)	<.001
Visits to the dentist			
Never	43 (37,1)	100 (26.7)	
Problem oriented	59 (50,9)	232 (61.9)	
Regularly	14 (12,1)	43 (11.5)	.08
Number of teeth			
0	67 (57.8)	197 (51.8)	
1–19	45 (38.8)	158 (41.6)	
≥20	4 (3.4)	25 (6.6)	.33
Participation in groups of older people			
Yes	77 (66.4)	221 (58.6)	
No	39 (33.6)	156 (41.4)	.13

Chi-square tests were used to evaluate the distribution of the variables in relation to the outcome positive self-perceived oral health.

* $219.50 was equivalent to the U.S. minimum wage during data collection.

Table 2. Association Between Variables and Positive Self-Perceived Oral Health Outcome in Independent-Living Older Persons from Carlos Barbosa, South Brazil

Variable	Prevalence Ratio (95% Confidence Interval)		
	Crude	Adjusted*	Adjusted†
First level (exogenous variables)			
Age (reference 63–66)			
67–70	1.12 (0.97–1.28)	1.11 (0.97–1.28)	
71–75	1.11 (0.96–1.28)	1.11 (0.96–1.28)	
≥76	1.07 (0.93–1.23)	1.06 (0.92–1.22)	
Female (reference male)	0.95 (0.86–1.05)	0.95 (0.86–1.05)	
Second level (primary determinants)			
Rural (reference urban)	0.85 (0.77–0.94)	0.83 (0.75–0.93)	0.83 (0.75–0.93)‡
Marital status (reference married)			
Single or divorced	1.07 (0.91–1.27)	1.09 (0.93–1.27)	1.09 (0.93–1.28)
Widowed	1.02 (0.91–1.74)	1.01 (0.91–1.12)	0.99 (0.88–1.11)
Resilience tertile (reference first)			
Second	0.95 (0.83–1.08)	0.96 (0.84–1.10)	0.97 (0.85–1.10)
Third	1.15 (1.03–1.28)	1.18 (1.06–1.32)	1.20 (1.07–1.34)‡
Schooling >4 years (reference ≤3years)	1.06 (0.96–1.17)	1.04 (0.94–1.14)	1.05 (0.96–1.16)
Monthly income >1 minimum wage (reference ≤1 minimum wage)	1.21 (1.1–1.34)	1.17 (1.06–1.29)	1.18 (1.07–1.31)‡
No participation in groups of older people (reference yes)	1.08 (0.98–1.19)	1.01 (0.92–1.12)	1.0 (0.91–1.11)
Third level (oral health behaviors)			
Frequency of toothbrushing, per day (reference ≤1)			
2	1.13 (0.98–1.31)	1.15 (0.99–1.34)	1.14 (0.97–1.33)
>2	1.07 (0.92–1.24)	1.08 (0.92–1.26)	1.02 (0.87–1.19)
Smoking status yes (reference no)	0.94 (0.78–1.13)	0.96 (0.79–1.16)	0.95 (0.78–1.15)
No problems in eating because of oral or dental problems (reference yes)	1.32 (1.1–1.58)	1.35 (1.12–1.62)	1.34 (1.12–1.59)‡
Visits to the dentist (reference never)			
When I have problem	1.14 (1.1–1.29)	1.17 (1.04–1.32)	1.12 (0.99–1.27)‡
Regularly	1.08 (0.9–1.29)	1.1 (0.92–1.33)	1.01 (0.84–1.21)
Fourth level (oral status)			
Number of teeth (reference 0)			
1–19	1.04 (0.94–1.15)		0.99 (0.81–1.22)
≥20	1.15 (0.98–1.36)		(0.79–1.23)

* Adjusted for variables in the level.
† Adjusted for precedent levels.
‡ $P < .10$.

Table 3. Final Fully Adjusted Model

Variable	Adjusted Prevalence Ratio (95% Confidence Interval)	*P*-Value
Geographic location rural (reference urban)	0.83 (0.75–0.93)	.001
Resilience tertile (reference first)		
Second	0.96 (0.84–1.09)	.53
Third	1.18 (1.06–1.32)	.004
Monthly income >1 minimum wage reference ≤1 minimum wage)	1.18 (1.07–1.3)	.001
Problems in eating because of oral or dental problems never or hardly ever (reference occasionally, fairly often, or very often)	1.34 (1.13–1.6)	.001
Visits to the dentist (reference never)		
When I have problem	1.11 (0.98–1.26)	.10
Regularly	1.03 (0.86–1.23)	.74

who scored in the highest tertile of the resilience score distribution had a higher income and did not report problems with eating because of dental problems. These participants were also significantly more likely to perceive their oral health as good. The variable "visits to the dentist" was no longer significant after adjustment.

The prevalence ratio for high resilience, defined as a score in the third tertile of the resilience score distribution, and positive self-perceived oral health was 1.18 (95% confidence interval = 1.06–1.32). Thus, participants with high resilience were 18% more likely to rate their oral health as good, independent of the other variables included in the hierarchical approach.

DISCUSSION

The results of this study suggest that positive self-perceived oral health was associated with many variables included in the conceptual framework of oral health outcomes when

they were tested in the hierarchical approach. The hypothesis that high resilience is associated with greater prevalence of positive self-perceived oral health, even when other variables were taken into account, was confirmed. Resilience may play a role as a potentiating agent in the positive adaptation to tooth loss.

Although the concept of positive perception of oral health is not new,[30] to the knowledge of the authors, this study is one of the first to address the relationship between adaptive processes (resilience) following adverse events (high prevalence of extensive tooth loss and edentulism) and positive self-perceived oral health. A possible explanation is that a person with high resilience can cope with stressors in a positive manner instead of avoiding them.[31] Resilience may have acted as a protective mechanism against the deleterious effects of tooth loss in the study sample. Although elderly people may experience shame or embarrassment related to oral problems, these findings are consistent with previous studies that show good perceived oral health in similar populations, despite small complaints.[15] Evidence suggests that protective mechanisms reduce the effects of risks due to changes in the significance of danger or changes in the exposure to or involvement with risks. Protective mechanisms may also reduce the effects of risks by reducing the negative reactions due to risk exposure, maintaining self-esteem and self-efficacy, and creating opportunities to reverse the effects of stress.[17]

Positive self-perception regarding oral health in older adults is a complex process that demands resilience and determination.[32] Resilient behavior is associated with better adaptive abilities when facing adversities and incorporates interactions between diverse factors.[33] The fully adjusted model in the current study reveals the dynamic nature of resilience once increasing resilience is shown after adjusting for variables in the hierarchical precedence levels of the conceptual framework. Thus, the findings of the present study support those of a recent literature review that suggest that resilience plays a fundamental role in the maintenance of quality of life.[34] That study provides evidence that resilience may be helpful in explaining the paradox of aging, or in other words, why many older people who experience limitations related to the aging process also report good levels of well-being.

The hierarchical approach revealed two other factors associated with positive self-perceived oral health independent of the important exogenous variables: age and sex. The geographical location of the participant's residence had an independent effect on the study outcome. Persons living in rural areas were less likely to perceive their oral health as good. In contrast, higher income resulted in a greater prevalence of positive self-perceived oral health. Older persons who did not report problems related to masticatory function due to oral problems (those who did not interrupt meals because of oral problems) were also more likely to report positive self-perceived oral health, independent of other factors.

The significance of the social context in the perception of oral health in older Brazilians may explain the negative association between living in a rural area and positive self-perceived oral health.[35] According to the Program of Oral Health in the Rural Area of the State of Rio Grande do Sul,[36] populations living in rural areas have historically been denied access to dental services and fluoridated water. Negative self-perceived oral health may, therefore, be a result of governmental abandonment and political neglect. Because of the accumulation of adversities related to oral health disadvantages during their lifetime, older persons living in a rural area might be less likely to have an optimistic view of their oral health. Living in a rural area and becoming older may make it more difficult to access dental care, such as oral rehabilitation for tooth loss and inadequate management of oral or dental pain. Previous studies also indicate that a positive perception of tooth loss is related to pain relief resulting from tooth extraction due to dental problems.[12,13]

The hierarchical approach enabled whether the associations between risk factors and the outcome are direct or whether they are mediated by other variables to be evaluated.[37] Intermediate-level variables associated with positive self-perceived oral health were identified. In other words, primary determinants of oral health and oral health behaviors were significantly associated with the outcome of self-perceived oral health. These results suggest that these factors are more relevant to determining self-perception of oral health than oral health status is, at least in older Brazilians.

Limitations of the present study include the limited generalizability of the results because of the homogenous characteristics of the study sample, which consisted mainly of Caucasian subjects. The transience of two variables studied may be another limitation. Self-perceived oral health and resilience are subjective indicators developed as part of dynamic processes. The resilience scale also has limitations, mainly because it does not include "low resilience" items or negatively worded items.[28,29] The cross-sectional and innovative design of this study encourages further research in this area, which would allow for generalization of the findings obtained from similar research. Replicating this type of research as a prospective study might be helpful to evaluate changes over time.

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