

## Factors associated with self-rated health in older adults receiving oral prosthetic rehabilitation

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**Keywords**— *older adults, self-rated health, oral health, nutrition.*

**Abstract**— *Objectives: To assess factors associated with self-perception of health in older adults submitted to oral prosthetic rehabilitation in order to contribute to a more contextualized planning of public policies, actions and health services aimed at healthy aging. Design: Analytical cross-sectional study. Setting: Dental specialty centers. Participants: 244 people aged 60 years and older enrolled for oral prosthetic rehabilitation. Intervention: Interviews, oral examination and anthropometric measurements. Measurements: A questionnaire assessed demographic and economic data, general health and oral health and self-perception of oral health-related quality of life was measured by the Geriatric Oral Health Assessment Index (GOHAI). Performance in instrumental activities of daily living was assessed by the Lawton and Brody scale, mood was assessed by the Geriatric Depression Scale and nutritional status was assessed by the Mini Nutritional Assessment. Results: The multivariate analysis showed that factors such as hospitalization in the previous year, diabetes and risk of malnutrition determined the negative self-*

*perception of general health and current health status compared with 12 months ago. Needing assistance to perform AIDL significantly influenced self-perception of general health while income and vision problems interfered with older adults' perception of their current health status compared with 12 months ago. Conclusion: Older adults who needed oral prosthetic rehabilitation exhibited a predominantly negative self-perception of oral health.*

## I. INTRODUCTION

Population aging is a reality in Brazil, a country where older adults are people aged 60 years or older. This age group is prioritized in health services and there are even specific regulations that prioritize people aged over 80 years [1].

Healthy Aging is the process of development and maintenance of functional capacity that allows well-being at an advanced age [2]. According to the World Health Organization (WHO), health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity [3].

Self-perceived health consists of people's perception of their health status taking into consideration the socioeconomic, cultural and historical context and is used to assess older adults' functional capacity [4,5]. Research on older adults' self-perceived health has presented contradictory results. Positive self-rated health can mean older adults' difficulty in performing a critical analysis of their own health while negative self-rated health can also be influenced by older adults' functional disability and mental health.

Studies emphasize that most older adults report a self-perception of good health despite the presence of chronic diseases. This finding indicates that this population group relates health to autonomy and independence, thus showing that the absence of diseases does not necessarily influence their self-perception of health [5-7].

Oral health is an integrating part of general health. Therefore, maintaining good oral health in older adults is key to ensuring healthy aging, especially because older adults are commonly submitted to curative and mutilating dental procedures. In Brazil, for instance, the rate of use of and need for dental prosthesis in 2010 was 78.2% and 68.7%, respectively [8].

Given that, public health policies should take into consideration the clinical and subjective needs of older adults based on their self-perception of health and the influence of oral health on the quality of life [9].

In view of the considerations outlined above, we raised the hypothesis that negative self-perception of health is influenced by sociodemographic conditions, general

health, oral health, self-perception of oral health, functional capacity, mood, and nutritional status. Thus, the present study aimed to assess factors associated with self-perception of health in older adults submitted to oral prosthetic rehabilitation.

## II. METHODS

A cross-sectional study was carried out in two dental specialty centers (*Centros de Especialidades Odontológicas – CEOs*) located in the city of Fortaleza in Northeastern Brazil. The CEOs are reference secondary care centers for oral prosthetic rehabilitation of people served by Brazil's Unified Health System (*Sistema Único de Saúde – SUS*) [10].

The sample of 260 older adults was obtained using the formula for finite population considering a total of 257,715 older adults in the city of Fortaleza [11], an expected loss of 20%, an expected value of sample proportion of 83% of older adults who need dental prosthesis [8], a significance level of 5%, and a maximum permissible error of 5%.

Data were collected by previously trained researchers between December 2016 and April 2017. We collected sociodemographic information and general and oral health data through interviews held in private in the centers where the research took place after obtaining written informed consent from the participants.

Self-perception of general health was assessed by asking the following question: "How is your general health?". The dependent variable of the study was dichotomized into negative perception ("poor" category) and positive perception ("very good" and "fair" categories). Self-perception of current health status compared with 12 months ago was assessed by asking the following question: "How is your health now compared with 12 months ago?". The dependent variable was dichotomized into negative perception ("worse" category) and positive perception ("better" and "the same" categories) [12].

The need for oral prosthetic rehabilitation was assessed using a WHO instrument recommended by the 2010 SB-Brazil Survey [8,13]. Oral health-related quality of life was assessed by the Geriatric Oral Health

Assessment Index (GOHAI) [14]. Higher index values indicate better oral health and better self-perception of oral health-related quality of life. Values ranging 34-36 are considered high, values ranging 31-33 are considered moderate, and values below 30 are considered low [15].

Performance in Instrumental Activities of Daily Living (IADL) was assessed by the Lawton & Brody scale [16]. The scale assesses nine domains and the total score ranges 9-27 points. Individuals with scores of 19-27 points are classified as independent. Scores of 10-18 indicate assisted independence and scores of 1-9 points indicate dependence.

Nutritional status was assessed using the Mini Nutritional Assessment (MNA), which consists of 18 self-reported questions. Results are given based on the sum of the scores in each domain [17]. Scores of 24-30 points indicate normal nutritional status, scores of 17-23.5 points indicate risk of malnutrition, and scores below 17 points indicate malnutrition. Height (cm) and weight (kg) measurements were taken according to the World Health Organization protocol [18].

Mood was assessed using Geriatric Depression Scale (GDS). The short form of the GDS consists of 15 questions (GDS15) and its total score ranges 0-15. Scores of 0-5 are considered normal; 6-10 indicate mild depression; and 6-15 indicate severe depression [19].

This study was approved by a Research Ethics Committee (Approval No 1.699.965/2016). Data were presented using descriptive statistics and bivariate analyses were performed using either the Chi-squared test or Fisher's exact test. The strength of the associations was measured using prevalence ratios for independent variables with a significance level of 95%. Variables with a *p* value below 0.20 were analyzed using Poisson regression with robust error variance. The final model included the variables that presented significant associations at  $p < 0.05$ .

### III. RESULTS

Participants were 244 older adults, which means there was a loss of 6.2%, which was lower than expected. There was a predominance of women (74.2%) and participants aged 60-69 years (62.3%). Age ranged 60-91 years and the mean age was 68.9 years (SD: 7.1). There were higher rates of Mixed-race Brazilians (49.6%), married participants (56.9%), participants who lived with their spouse (36.9%) or children (30.7%), unemployed participants (75.4%), participants with an income of up to two minimum wages (72.9%), and participants with one to eight years of study (54.5%). The majority (89.3%) used medication and there was a mean of 3.6 (SD: 3.1)

medications per older adult. In addition, 112 (45.9%) participants were physically active, 30 (12.3%) were smokers and 40 (16.4%) were drinkers.

Systemic diseases were reported by 208 (85.2%) participants and the main diseases were hypertension (68%), diabetes (29.1%) and osteoporosis (21.7%). History of falls was reported by 145 (59.4%) participants and 200 (81.9%) reported vision problems, 82 (33.6%) reported hearing problems and 20 (8.2%) reported speech problems. In all, 51 (20.9%) participants reported having a health insurance and 207 (84.8%) had used health services in the last year, 180 (73.7%) of whom used public health services. In addition, 165 (67.6%) participants said they had their health problems solved.

Dry mouth was reported by 108 (44.2%) participants. Additionally, 107 (43.9%) participants had difficulty chewing and swallowing food, 51 (20.9%) had problems with the taste of food, 18 (7.4%) needed assistance to eat, 170 (69.7%) were already using some type of dental prosthesis and needed to replace it, and 74 (30.3%) had never used dental prostheses.

Older adults who needed oral prosthetic rehabilitation exhibited a predominantly (52.1%) negative self-perception of oral health. A total of 235 (96.3%) participants had a good index of independence in IADL, 179 (73.4%) presented normal nutritional status and 185 (75.8%) did not exhibit signs of depression. In addition, 56 (23%) older adults rated their general health as very good, 145 (59.4%) rated it as fair and 43 (17.6%) rated it as poor (CI: 13.1-23.0). As for self-perception of current health status compared with 12 months ago, 50 (20.5%) participants said their health was better, 141 (57.8%) said it was the same and 53 (21.7%) said it was worse (CI: 16.7-27.4).

Tables 1 to 3 present the bivariate analyses of the associations between the independent variables of the study and the results of older adults' self-perception of general health and current health status compared with 12 months ago.

Table 4 shows the final model for the two outcome variables. The multivariate analysis showed that factors such as hospitalization in the previous year, diabetes and risk of malnutrition determined the negative self-perception of general health and current health status compared with 12 months ago. Needing assistance to perform AIDL significantly influenced self-perception of general health while income and vision problems interfered with older adults' perception of their current health status compared with 12 months ago.

#### IV. DISCUSSION

We certify that this work is novel and that its results can contribute to a better understanding of the factors that interfere with older adults' self-perception of health and the conditions perceived in a negative way, which may serve as an important strategy for developing public health policies, planning broader preventive actions and improving access to and quality of health services.

The present study stands out in the current scientific scenario as it was carried out with older adults in need of oral prosthetic rehabilitation treated in reference centers. Access to free oral health care may have contributed to older adults' positive self-perception of general health as poor access to health care services have been associated with older adults' negative self-perception of general health [20-22].

In fact, 82.4% of the older adults who needed oral prosthetic rehabilitation had a positive self-perception of general health. Moreover, 78.3% of the participants had a positive self-perception of current health status compared with 12 months ago. These rates are higher than those reported in the literature (41.9%-57.5%) [23-25]. However, some studies have reported rates ranging 65.0%-82.9% [5,12].

The rate of participants with a negative perception of general health (17.6%) and current health status compared with 12 months ago (21.7%) was lower than that reported (57.6%) by Medeiros et al. [20]. Studies have reported higher rates of negative perception of health among institutionalized older adults [12,26], old-old cohorts of older adults, individuals with functional decline and dependence, and individuals with history of hospitalizations and a higher burden of chronic diseases [12,27].

In the bivariate analysis, level of education, hospitalization, systemic diseases, diabetes, number of medications used, solution of health problems, nutritional risk and signs of depression were associated with negative self-perception of general health and current health status compared with 12 months ago, thus confirming the subjective and multidimensional aspects of the studied outcomes [25,27,28] as well as regional peculiarities and older adults' specific vulnerabilities [20].

The predominance of negative self-perception of oral health (52.1%) is probably associated with complete or partial edentulism. The prevalence rate of negative self-perception of general health was 89% higher among older adults with lower GOHAI scores. In the study by Zanesco et al [29], 19% of the older adults analyzed presented negative perceptions of oral health and were 1.92 times more likely to negatively perceive their general health.

In the final model, the variables that remained associated with negative self-perception of general health and current health status compared with 12 months ago were hospitalization in the previous year, diabetes and risk of malnutrition. Need for assistance to perform IADL influenced general health while income and vision problems had an impact on self-perception of current health status compared with 12 months ago.

A total of 30 (12.3%) older adults had been hospitalized in the previous twelve months. A higher rate was reported by Medeiros et al [20] and the 2013 National Health Survey [24] found that 90% of the interviewees had been hospitalized in the previous 12 months and that hospitalization was associated with older adults' increased likelihood of having a negative perception of health. In the present study, the prevalence of negative perception of general health was 95% higher among older adults who reported hospitalization. Moreover, hospitalization in the previous year increased by 2.1 times the prevalence of negative self-perception of current health status compared with 12 months ago.

Hospitalization can have a negative impact on the quality of physical and psychological aspects and may lead to a decrease in older adults' autonomy to perform daily activities. Hospitalization may have resulted from complications of chronic systemic diseases or from factors such as falls and malnutrition. Hospitalization is more prevalent and prolonged in older adults [30] and increases the incidence of malnutrition [31]. Researchers found that older patients who reported poor health had an increased risk of hospitalization, institutionalization and mortality when compared with those who reported very good health [32].

The fact that diabetic patients (29.1%) were more likely to have negative self-perceptions of general health (PR: 2.43) and current health status compared with 12 months ago (PR: 1.89) is corroborated by researchers who found a significant association between self-perceived health and diabetes [23] and other authors whose multivariate analysis revealed that having diabetes is associated with a negative perception of health [20].

Diabetes is one of the most prevalent diseases in older adults [33] and it may interfere with performance of daily activities due to the continuous use of medications and dietary restrictions, which seem to be more strongly associated with negative perception of health status than the disease itself [34]. Diabetes is also associated with functional disability, hypertension and higher rates of hospitalization and premature death in older adults [35]. It may be associated with xerostomia and oral infections such as periodontal disease [36] as chronic hyperglycemia



modifies vascular and cerebral metabolism [37]. Therefore, limitations and complications caused by diabetes may explain older adults' negative self-perception of health.

In our study, self-perception of health was also influenced by risk of malnutrition. In all, 60% the older adults who were at risk of malnutrition had a negative self-perception of current health status compared with 12 months ago and were 2.42 times more likely to have a negative perception of general health. The 26.6% rate of malnourished older adults found in our study is in accordance with the rates reported in the literature, with values ranging 15%-54.1% [38-41]. In contrast, the lowest rates of risk of malnutrition have been found among non-institutionalized older adults with positive perception of health [40]. The interviewees were people who would receive prostheses, therefore, the lack of these can influence their nutrition.

Malnutrition is more prevalent among hospitalized (31.2%-40%) and institutionalized (39.6%-60%) older adults [38-42]. Like Brazil, other countries have also exhibited similar rates, such as Indonesia (57%) [43] and India (52.5%) [44].

Changes in dietary intake and changes in nutrient absorption may lead to the risk of malnutrition, which is associated with older adults' frailty, which is included in a broad concept of functional impairment [40]. Functional capacity, on the other hand, includes older adults' potential to choose and perform daily life tasks independently. Functional capacity decreases with age and may be intensified by systemic diseases and other factors [45].

Need for assistance to perform IADL was presented by 3.7% of the participants. Changes in the ability to perform daily activities may be associated with malnutrition, cardiovascular diseases, cognitive impairment, and decreased muscle strength and physical performance [46].

Functional limitation is associated with older adults' increased chances of having a negative perception of health. Older adults without functional limitations were 7.76 times more likely to rate their health positively [23]. In our study, older adults who needed assistance to perform IADL were 2.23 times more likely to rate their general health in a negative way, which agrees with the findings reported by Zanesco et al [29].

Ability to perform daily activities strongly determines the health of older adults and has been little studied as an exposure variable. In addition, negative perception of health can worsen functional decline and increase dependence, hospitalization and mortality in older adults [12].

Low levels of income interfere negatively with healthy behavior, home environment and access to health services. People with low levels of income tend to seek health services less often and have poor access to medications. Therefore, they tend to have a poor adherence to treatment of systemic diseases [47].

Low levels of household income were associated with negative self-perception of health in 54.5% of the studies in a review [48]. In the present study, 73% of the older adults reported earning up to two minimum wages, a fact that was associated with a 5.06-fold increase in the chances of having a negative self-perception of current health status compared with 12 months ago in relation to those who reported an income of more than two minimum wages.

Vision problems were reported by 82% of the older adults in our study and were associated with a 3.03-fold increase in the chances of having negative self-perception of current health status compared with 12 months ago. Visual impairment may be a consequence of older adults' less favorable health and socioeconomic conditions [49]. In addition, they have been reported as major complaints related to the health status of this population group [6] and have been associated with a negative self-perception of health [25,49]. However, it should be noted that it is not the vision problem itself that leads older adults to negatively rate their health, but the social and psychological consequences of such problem.

The present study has some limitations. First, its cross-sectional design, and as so it does not allow to establish proof of a causal relationship in the associations found, thus limiting the interpretation of the results. Second, the information collected through interviews may have been distorted due to memory issues that were not controlled in our study. Finally, self-perception of health is a subjective process that changes according to older adults' context of life and physical and emotional health. However, despite the limitations outlined, our study remains relevant as it aimed to study a growing population whose peculiarities need different planning and reorientation of public health policies.

## V. CONCLUSION

Older adults who needed oral prosthetic rehabilitation exhibited a predominantly negative self-perception of oral health.

Hospitalization in the previous year, diabetes, risk of malnutrition, need for assistance to perform IADL, income and vision problems were associated with older adults' negative self-perception of health. Knowing the

factors that interfere with older adults' self-perception of health and the conditions perceived in a negative way are an important strategy for developing public health policies, planning broader preventive actions and improving access to and quality of health services.

### SPONSOR'S ROLE

Sponsors had no role in the design, methods, subject recruitment, data collections, analysis and preparation of paper.

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Supplementary table S1. Bivariate analysis of the associations of general health and current health status compared with 12 months ago with demographic and socioeconomic factors. Fortaleza, Ceará, Brazil, 2017.

Variables	General Health		PR (95%CI)	p value	Current Health Status Compared with 12 months ago		PR (95%CI)	p value
	Poor	Verygood / fair			Worse	Better / The same		
	n (%)	n (%)			n (%)	n (%)		
<b>Age</b>				0.647 <sup>2</sup>				0.950 <sup>1</sup>
60-69 years	26 (17.1)	126 (82.9)	1.43 (0.47 - 4.36)		33 (21.7)	119 (78.3)	0.9 (0.42 - 1.93)	
70-79 years	14 (20.9)	53 (79.1)	1.74 (0.55 - 5.55)		14 (20.9)	53 (79.1)	0.87 (0.38 - 2.01)	
80 years and older	3 (12)	22 (88)	1		6 (24)	19 (76)	1	
<b>Gender</b>				0.115 <sup>1</sup>				<b>0.044<sup>1</sup></b>
Men	7 (11.1)	56 (88.9)	1		8 (12.7)	55 (87.3)	1	
Women	36 (19.9)	145 (80.1)	1.79 (0.84 - 3.82)		45 (24.9)	136 (75.1)	1.96 (0.98 - 3.92)	
<b>Race</b>				0.194 <sup>1</sup>				0.150 <sup>1</sup>
White	19 (21.3)	70 (78.7)	1.61 (0.88 - 2.96)		21 (23.6)	68 (76.4)	1.36 (0.79 - 2.33)	
Black	8 (23.5)	26 (76.5)	1.78 (0.83 - 3.80)		11 (32.4)	23 (67.6)	1.86 (1 - 3.47)	
Mixed race	16 (13.2)	105 (86.8)	1		21 (17.4)	100 (82.6)	1	
<b>Marital status</b>				0.506 <sup>2</sup>				0.625 <sup>2</sup>
Single	6 (14)	37 (86)	0.81 (0.35 - 1.85)		9 (20.9)	34 (79.1)	0.97 (0.5 - 1.88)	
Married	24 (17.3)	115 (82.7)	1		30 (21.6)	109 (78.4)	1	
Divorced	11 (25)	33 (75)	1.45 (0.77 - 2.71)		8 (18.2)	36 (81.8)	0.84 (0.42 - 1.7)	
Widowed	2 (11.1)	16 (88.9)	0.64 (0.17 - 2.5)		6 (33.3)	12 (66.7)	1.54 (0.75 - 3.19)	
<b>Living alone</b>				0.790 <sup>1</sup>				0.383 <sup>1</sup>
Yes	8 (19.0)	34 (81.0)	1.01 (0.55 - 2.20)		7 (16.7)	35 (83.3)	0.73 (0.36 - 1.51)	
No	35 (17.3)	167 (82.7)	1		46 (22.8)	156 (77.2)		
<b>Working</b>				<b>0.026<sup>1</sup></b>				0.071 <sup>1</sup>
Yes	5 (8.3)	55 (91.7)	1		8 (13.3)	52 (86.7)	1	
No	37 (21)	139 (79)	2.52 (1.04 - 6.12)		43 (24.4)	133 (75.6)	1.83 (0.91 - 3.67)	



<b>Income</b>				0.189 <sup>1</sup>			<0.001 <sup>1</sup>
Upto 2 wages	35 (19.7)	143 (80.3)	1.63 (0.77 - 3.47)		48 (27.0)	130 (73.0)	5.21 (1.69 - 16.11)
> 2 wages	7 (12.1)	51 (87.9)	1		3 (5.2)	55 (94.8)	
<b>Education</b>				<b>0.040<sup>2</sup></b>			<b>0.049<sup>2</sup></b>
0	3 (21.4)	11 (78.6)	2.12 (0.65 - 6.89)		4 (28.6)	10 (71.4)	2.12 (0.79 - 5.65)
1-8 years	30 (22.6)	103 (77.4)	2.23 (1.11 - 4.47)		35 (26.3)	98 (73.7)	1.95 (1.07 - 3.55)
> 8 years	9 (10.1)	80 (89.9)	1		12 (13.5)	77 (86.5)	1

<sup>1</sup> Chi-squared test; <sup>2</sup> Fisher’s Exact test

Supplementary table S2. Bivariate analysis of the associations of general health and current health status compared with 12 months ago with systemic health and lifestyle variables. Fortaleza, Ceará, Brazil, 2017

Variables	General Health		PR (95%CI)	p value	Current Health Status Compared with 12 Months Ago		PR (95%CI)	p value
	Poor	VeryGood / Fair			Worse	The Same / Better		
	n (%)	n (%)			n (%)	n (%)		
<b>Hospitalization in the previous year</b>				<b>0.003<sup>1</sup></b>				<b>0.010<sup>1</sup></b>
Yes	11 (36.7)	19 (63.3)	2.45 (1.39 - 4.33)		12 (40)	18 (60)	2.09 (1.24 - 3.5)	
No	32 (15)	182 (85)	1		41 (19.2)	173 (80.8)	1	
<b>Systemicdiseases</b>				<b>0.003<sup>1</sup></b>				<b>0.011<sup>1</sup></b>
Yes	43 (20.7)	165 (79.3)	-		51 (24.5)	157 (75.5)	4.41 (1.12 - 17.33)	
No	0 (0)	36 (100)	-		2 (5.6)	34 (94.4)	1	
<b>Diabetes mellitus</b>				<b>&lt;0.001<sup>1</sup></b>				<b>0.003<sup>1</sup></b>
Yes	23 (32.4)	48 (67.6)	2.8 (1.65 - 4.77)		24 (33.8)	47 (66.2)	2.02 (1.27 - 3.21)	
No	20 (11.6)	153 (88.4)	1		29 (16.8)	144 (83.2)	1	
<b>Cardiovascular disorders</b>				0.087 <sup>1</sup>				<b>0.048<sup>1</sup></b>
Yes	34 (20.5)	132 (79.5)	1		42 (25.3)	124 (74.7)	1.79 (0.98 - 3.29)	

No	9 (11.5)	69 (88.5)	0.56 (0.28 - 1.12)	11 (14.1)	67 (85.9)	1
<b>Osteoporosis</b>						<b>0.015<sup>1</sup></b>
Yes	13 (24.5)	40 (75.5)	1.56 (0.88 - 2.78)	18 (34)	35 (66)	1.85 (1.15 - 3)
No	30 (15.7)	161 (84.3)	1	35 (18.3)	156 (81.7)	1
<b>Nutritional deficiency</b>						<b>0.522<sup>2</sup></b>
Yes	0 (0)	3 (100)	-	1 (33.3)	2 (66.7)	1.55 (0.31 - 7.79)
No	43 (17.8)	198 (82.2)	-	52 (21.6)	189 (78.4)	1
<b>Use of medications</b>						<b>0.019<sup>1</sup></b>
Yes	42 (19.3)	176 (80.7)	5.01 (0.72 - 34.89)	52 (23.9)	166 (76.1)	6.2 (0.89 - 43.01)
No	1 (3.8)	25 (96.2)	1	1 (3.8)	25 (96.2)	1
<b>Number of medications used</b>						<b>&lt;0.001<sup>1</sup></b>
Upto 3	15 (11.1)	120 (88.9)	1	21 (15.6)	114 (84.4)	1
More than 3	27 (32.5)	56 (67.5)	2.93 (1.66 - 5.17)	31 (37.3)	52 (62.7)	2.4 (1.48 - 3.89)
<b>History of falls</b>						<b>0.154<sup>1</sup></b>
Yes	32 (22.1)	113 (77.9)	1.99 (1.05 - 3.75)	36 (24.8)	109 (75.2)	1.45 (0.86 - 2.42)
No	11 (11.1)	88 (88.9)	1	17 (17.2)	82 (82.8)	1
<b>Vision problems</b>						<b>0.066<sup>1</sup></b>
Yes	38 (19)	162 (81)	1.67 (0.7 - 4)	48 (24)	152 (76)	2.11 (0.89 - 5)
No	5 (11.4)	39 (88.6)	1	5 (11.4)	39 (88.6)	1
<b>Hearing problems</b>						<b>0.176<sup>1</sup></b>
Yes	16 (19.5)	66 (80.5)	1.16 (0.67 - 2.03)	22 (26.8)	60 (73.2)	1.39 (0.86 - 2.25)
No	27 (16.8)	134 (83.2)	1	31 (19.3)	130 (80.7)	1
<b>Speech problems</b>						<b>1.000<sup>2</sup></b>
Yes	7 (35)	13 (65)	2.18 (1.12 - 4.25)	4 (20)	16 (80)	0.91 (0.37 - 2.27)
No	36 (16.1)	188 (83.9)	1	49 (21.9)	175 (78.1)	1
<b>Smoking</b>						<b>0.100<sup>1</sup></b>
Yes	7 (23.3)	23 (76.7)	1.39 (0.68 - 2.83)	10 (33.3)	20 (66.7)	1.66 (0.94 - 2.94)

No	36 (16.8)	178 (83.2)	1	43 (20.1)	171 (79.9)	1
<b>Drinking</b>						0.066 <sup>1</sup>
Yes	3 (7.5)	37 (92.5)	1	6 (15)	34 (85)	1
No	40 (19.6)	164 (80.4)	2.61 (0.85 - 8.04)	47 (23)	157 (77)	1.54 (0.7 - 3.35)
<b>Physicalactivity</b>						0.208 <sup>1</sup>
Yes	16 (14.3)	96 (85.7)	1	24 (21.4)	88 (78.6)	1
No	27 (20.5)	105 (79.5)	1.43 (0.81 - 2.52)	29 (22)	103 (78)	1.03 (0.64 - 1.65)
<b>Healthinsurance</b>						0.411 <sup>1</sup>
Yes	7 (13.7)	44 (86.3)	1	8 (15.7)	43 (84.3)	1
No	36 (18.7)	157 (81.3)	1.36 (0.64 - 2.87)	45 (23.3)	148 (76.7)	1.49 (0.75 - 2.95)
<b>Used health services in the previous year</b>						0.034 <sup>1</sup>
Yes	41 (19.8)	166 (80.2)	3.66 (0.93 - 14.5)	48 (23.2)	159 (76.8)	1.72 (0.73 - 4.02)
No	2 (5.4)	35 (94.6)	1	5 (13.5)	32 (86.5)	1
<b>Service used</b>						0.166 <sup>1</sup>
Public	38 (21.1)	142 (78.9)	1.9 (0.72 - 4.99)	47 (26.1)	133 (73.9)	3.13 (1.03 - 9.52)
Private/healthinsurance	4 (11.1)	32 (88.9)	1	3 (8.3)	33 (91.7)	1
<b>Health problemwassolved</b>						<0.001 <sup>1</sup>
Yes	22 (13.3)	143 (86.7)	1	32 (19.4)	133 (80.6)	1
No	20 (40)	30 (60)	3 (1.79 - 5.03)	18 (36)	32 (64)	1.86 (1.15 - 3.01)

<sup>1</sup> Chi-squared test; <sup>2</sup> Fisher's Exact test

Supplementary table S4. Multivariate analysis of the associations of general health and current health status compared with 12 months ago with variables included in the model. Fortaleza, Ceará, Brazil, 2017.

Variables in the model	General Health		Current Health Status Compared with 12 Months Ago	
	Adjusted PR	p value	Adjusted PR	p value
<b>Income</b>				

Upto 2 wages	-	-	5.06 (1.67 - 15.34)	<b>0.004</b>
> 2 wages	-	-	1	
<b>Hospitalization in the previous year</b>				
Yes	2.1 (1.27 - 3.49)	<b>0.004</b>	1.95 (1.21 - 3.14)	<b>0.006</b>
No	1		1	
<b>Diabetes mellitus</b>				
Yes	2.43 (1.44 - 4.1)	<b>0.001</b>	1.89 (1.2 - 2.98)	<b>0.006</b>
No	1			
<b>Vision problems</b>				
Yes	-	-	3.03 (1.09 - 8.41)	<b>0.034</b>
No	-	-	1	
<b>MNA</b>				
Risk ofmalnutrition	2.42 (1.44 - 4.06)	<b>0.001</b>	1.6 (1 - 2.55)	<b>0.048</b>
Normal	1		1	
<b>IADL</b>				
Needingassistance	2.23 (1.16 - 4.27)	<b>0.016</b>	-	-
Independent	1		-	-

Supplementary table S3. Bivariate analysis of general health and current health status compared with 12 months ago with oral health variables, GOHAI, IADL, MNA and GDS. Fortaleza, Ceará, Brazil, 2017.

Variable	General Health		PR (95%CI)	p value	Current Health Status Compared with 12 Months Ago		PR (95%CI)	p value
	Poor	VeryGood / Fair			Poor	The Same / Better		
	n (%)	n (%)			n (%)	n (%)		
<b>Drymouth</b>				0.316 <sup>1</sup>				<b>0.041<sup>1</sup></b>
Yes	22 (20.4)	86 (79.6)	1.32 (0.77 - 2.27)		30 (27.8)	78 (72.2)	1.64 (1.02 - 2.66)	
No	21 (15.4)	115 (84.6)	1		23 (16.9)	113 (83.1)	1	



<b>Difficulty chewing and swallowing food</b>				<b>0.038<sup>1</sup></b>			0.072 <sup>1</sup>
Yes	25 (23.4)	82 (76.6)	1.78 (1.03 - 3.08)		29 (27.1)	78 (72.9)	1.55 (0.96 - 2.5)
No	18 (13.1)	119 (86.9)	1		24 (17.5)	113 (82.5)	1
<b>Problems with the taste of food</b>				0.097 <sup>1</sup>			<b>0.008<sup>1</sup></b>
Yes	13 (25.5)	38 (74.5)	1.64 (0.92 - 2.91)		18 (35.3)	33 (64.7)	1.95 (1.21 - 3.14)
No	30 (15.5)	163 (84.5)	1		35 (18.1)	158 (81.9)	1
<b>Pain with no apparent reason</b>				1.000 <sup>2</sup>			0.574 <sup>1</sup>
Yes	5 (18.5)	22 (81.5)	1.06 (0.46 - 2.46)		7 (25.9)	20 (74.1)	1.22 (0.62 - 2.43)
No	38 (17.5)	179 (82.5)	1		46 (21.2)	171 (78.8)	1
<b>Assistanceto eat</b>				0.532 <sup>2</sup>			0.554 <sup>2</sup>
Yes	4 (22.2)	14 (77.8)	1.29 (0.52 - 3.2)		5 (27.8)	13 (72.2)	1.31 (0.6 - 2.87)
No	39 (17.3)	187 (82.7)	1		48 (21.2)	178 (78.8)	1
<b>Use of prosthesis</b>				0.140 <sup>1</sup>			0.717 <sup>1</sup>
Yes	34 (20.0)	136 (80.0)	1.64 (0.83 - 3.25)		38 (22.4)	132 (77.6)	1.10 (0.65 - 1.88)
No	9 (12.2)	65 (87.8)	1		15 (20.3)	59 (79.7)	1
<b>GOHAI</b>				<b>0.028<sup>1</sup></b>			0.131 <sup>1</sup>
Low	29 (22.8)	98 (77.2)	1.89 (1.05 - 3.40)		32 (25.2)	95 (74.8)	1.46 (0.89 - 2.41)
Moderate/High	14 (12.1)	102 (87.9)	1		20 (17.2)	96 (82.8)	1
<b>IADL</b>				0.054 <sup>2</sup>			0.412 <sup>2</sup>
Needing assistance	4 (44.4)	5 (55.6)	2.68 (1.22 - 5.87)		3 (33.3)	6 (66.7)	1.57 (0.60 - 4.08)
Independent	39 (16.6)	196 (83.4)	1		50 (21.3)	185 (78.7)	1
<b>MNA</b>				<b>&lt;0.001<sup>1</sup></b>			<b>0.002<sup>1</sup></b>
Risk of malnutrition	22 (33.8)	43 (66.2)	2.88 (1.70 - 4.88)		23 (35.4)	42 (64.6)	2.11 (1.33 - 3.36)
Normal	21 (11.7)	158 (88.3)	1		30 (16.8)	149 (83.2)	1
<b>GDS</b>				<b>&lt;0.001<sup>1</sup></b>			<b>&lt;0.001<sup>1</sup></b>
Suspected depression	26 (44.1)	33 (55.9)	4.80 (2.80 - 8.20)		28 (47.5)	31 (52.5)	3.51 (2.23 - 5.52)
No suspected depression	17 (9.2)	168 (90.8)	1		25 (13.5)	160 (86.5)	1

<sup>1</sup> Chi-squared test; <sup>2</sup> Fisher's Exact test