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Prevalence of Edentulism and Associated Factors in Older Adults: a Cross-Sectional Study

Prevalência de Edentulismo e Fatores Associados em Idosos: um Estudo Transversal

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Abstract

Studies assessing edentulism in a population-base sample are scarce. To evaluate the prevalence of edentulism and associated factors among older adults. A cross-sectional home-based observational study with a probabilistic sample per cluster was conducted with 282 older adults aged ≥60 years in the city of Veranópolis/Brazil. Clinical oral health examination and a structured questionnaire was administered. The main outcome was edentulism. Uni- and multivariate analyses were performed, using Poisson regression with robust variance. The prevalence of edentulism was 48.6% (n=137). In the final multivariate model, age, level of education and access to the dentist remained associated with edentulism. With each one-year increase in age, there is a 2.7% increase in the Prevalence Ratio (PR) of being edentulous (PR: 1.027; 95% confidence interval [95%CI]:1.015–1.039). Older adults with medium/high level of education had 39.4% lower PR of being edentulous (PR: 0.606; 95%CI:0.382–0.961). Older adults without access to the dentist had 78% (p<0.001) higher PR of being edentulous when compared to those that visited the dentist in the last 12 months. The prevalence of edentulism in the older adults was high and was associated with sociodemographic and access to oral care variables.

Keywords: Aged. Tooth Loss. Risk Factors. Epidemiology.

Resumo

Estudo que avaliem edentulismo em uma amostra de base populacional são escassos. Avaliar a prevalência de edentulismo e fatores associados em idosos. Um estudo transversal de base populacional com amostra probabilística per cluster foi conduzida com 282 idosos, com idade ≥60 anos, na cidade de Veranópolis/Brasil. Exames orais e questionário estruturados foram realizados. O principal desfecho foi edentulismo. Análise uni- e multivariada foram realizadas, utilizando regressão de Poisson com variância robusta. A prevalência de edentulismo foi 48,6% (n=137). No modelo multivariado final, idade, nível educacional e acesso ao dentista permaneceram associados com edentulismo. Para cada ano de aumento, há um aumento da razão de prevalência (RP) de 2,7% em ser edêntulos (RP: 1,027; intervalo de confiança de 95% [IC95%]: 1,015–1,039). Idosos com nível educacional médio/alto apresentaram 39,4% menor RP de ser edêntulos (RP: 0,606; IC95%: 0,382–0,961). Idosos sem acesso ao dentista presentaram 78% (p<0,001) maior RP de ser edêntulos quando comparado com aqueles que visitaram o dentista nos últimos 12 meses. A prevalência de edentulismo nos idosos foi alta e esteve associado com variáveis sociodemográficos e acesso ao dentista.

Palavras-chave*: Idoso. Perda de Dente. Fatores de Risco. Epidemiologia.*

1 Introduction

Edentulism is the result of the cumulative effect of the main oral diseases throughout life, and it is considered a poor oral health condition[1]. In fact, the total loss of teeth, in addition to the individual load and its consequences, may affect the overall health and the process of aging[2]. These issues are especially important in developing countries, which are also experiencing an accelerated aging process. This process represents a serious challenge to the public health system because it involves a great demand for resources including oral rehabilitation[3].

The reasons for the occurrence of edentulism include both the cumulative effect of oral diseases and its social aspects, which may interfere in the final decision to remove the last remaining teeth[4]. It should be noted that partial tooth loss or loss of all teeth constitute a picture of the poor oral health conditions observed in a population. The effects of edentulism are not simple and include functional, social and psychological consequences, with worsening quality of life and social isolation[5].

Some countries have experienced a reduction in the incidence of edentulism in recent years[6]. Conversely, cross-sectional studies in several countries report a prevalence of edentulism around 25%[7,8], or between 10 to 15%[6,9,10]. Unfortunately, data from the latest Brazilian national oral health survey show that the average tooth loss is still high, with more than 50% of the older adults being considered edentulous[11].

The literature also demonstrated that tooth loss is strongly associated with socioeconomic conditions[1]. Several studies, in

different countries, demonstrate the association of edentulism with low household income and/or low education level[12-14]. These issues tend to be more evident in developing countries that have lower level of education and income inequality. The present study aimed to assess the prevalence of edentulism and its associated factors among older adults.

2 Material and Methods

2.1 Study design and location

The present cross-sectional observational study of community dwelling individuals interviewed and examined older adults aged ≥60 in both urban and rural areas of the city of Veranópolis. This city is located in the northeast of the state of Rio Grande do Sul, Brazil, about 160 km from the capital, Porto Alegre. The city of Veranópolis has a population of approximately 22,810 inhabitants[15]. Of these, 3,554 are in the age group of 60 years or over, with 42.91% being male and 57.09% female. A total of 87% of the population lives in the urban area, and the MHDI (Municipal Human Development Index) in 2010 was 0.75[16]. GNP per capita was R$ 41,184.25 (approximately US$ 9,385)[16] and the Gini Index in 2010 was 0.4836[17]. Life expectancy at birth was 75.24 years, and the illiteracy rate of people aged 15 or over was 2.82%[18]. The present study was reviewed and approved by the Institutional Review Board of the University of Passo Fundo under the protocol #2,990,088. All individuals read and signed the informed consent before participating in the study.

2.2 Sample size calculation and sampling strategy

The formula used to perform the sample calculation was: sample size = standardized variation^2 X outcome prevalence X (1 - outcome prevalence) / absolute error^2. The estimated sample was based on the prevalence of edentulism in older adults, of 25.3%, as reported in another study[7]. We assumed an error of 5% (standardized variation of 1.96) and an absolute error of 5%, resulting in a total number of 269 older adults people needed for the development of the study. An attrition rate of 5% was added.

A probabilistic sample by conglomerate was conducted to interview and examine 282 older adults, respecting the proportionality between the urban and rural areas of the municipality. Based on the map of the urban area of the city, all blocks were numbered. A total of 82 blocks (20% of the total blocks) in the urban area were randomly selected to participate in the study, using the website www.random.org. Additionally, the corners of the blocks were numbered from one to four, and a new draw was conducted to determine the starting point of the first interview. In each block, three households were visited with at least one older adult. After the first interview, the visits continued in a clockwise direction until the completion of the planned work. New blocks were selected in order to include the number of households required. A total of three rural communities were part of the study, randomly selected among all the rural communities of the city. Within each community, 12 households were visited with at least one older adult. Households in the rural area involved households in the central core of the community and households located along vicinal roads of access to the community.

2.3 Inclusion and exclusion criteria

The criteria adopted for inclusion in this study were individuals aged 60 years or older, living in the selected areas. The present study included healthy individuals, defined as individuals whose physical, medical and mental condition made it possible to carry out the study, as well as understanding the examinations and interviews that were conducted. If, during the initial contact, the researcher observes that older adults were unable to take part in the study, or if the person responsible for the older adult informed that he/she was not able to participate, the individual was excluded. If more than one resident fulfilled the eligibility criteria at home, they took part of the study. Residential buildings included only one apartment in the study. In the case of absence on the day of data collection, a new moment was chosen for data collection. After that, if a new absence was detected, the household was excluded. Visitors at home, homes for the aged, commercial and uninhabited homes were excluded from the study.

2.4 Clinical examination and interview

A structured questionnaire was applied that included: sociodemographic, behavioral, medical and dental history data, obtained through the question blocks from the validated version of the PCATool-Brasil instrument[19]. The clinical examination of counting teeth was performed with the aid of a wooden spatula, without the use of artificial lighting or mouth mirrors. Teeth counting was performed in all teeth, except third molars. Teeth that could somehow be rehabilitated were considered present in the count. Teeth or roots indicated for extraction were considered absent.

The individuals were examined and interviewed between December 2018 and January 2019, by two teams composed of an interviewer and an oral health examiner, which were previously trained and calibrated by the study coordinator in order to ensure uniformity of the data. The training consisted of theoretical classes on the subject, discussion of all questions in the questionnaire, as well as explanations about oral health examinations. Prior to the study, a training was conducted with the application of the questionnaire and with the oral health examination in older adults patients undergoing treatment in the clinics of the Faculty of Dentistry of the University of Passo Fundo. The intra-examiner and inter-examiner reproducibility of the clinical oral health examination was verified in 5% of those examined, 14 days after the initial examination, chosen by random drawing. The minimum kappa coefficients for both intra-examiner and inter-examiner tooth loss were 0.89.

2.5 Statistical analysis

The dependent variable of the present study was the prevalence of edentulism (loss of 28 teeth). Exploratory variables included socioeconomic conditions, general and oral health conditions, general and oral health behavior.

Ethnicity/skin color was categorized as white or non-white. The non-white group included the older adults who referred themselves as black, yellow, brown or indigenous. The level of education was categorized as low, which includes older adults with up to complete elementary education, including illiterates; and medium/high level of education, for those with at least incomplete high school education. Household monthly income was defined by the average household income in Brazilian Reais. The living area (urban or rural areas) was determined by the data and maps provided by the city hall of Veranópolis. Retirement was categorized into three groups: non-retired, retired that do not work and retired that reported some work activity. Marital status was categorized into two groups: married and unmarried. The unmarried group included: widowed, single or divorced.

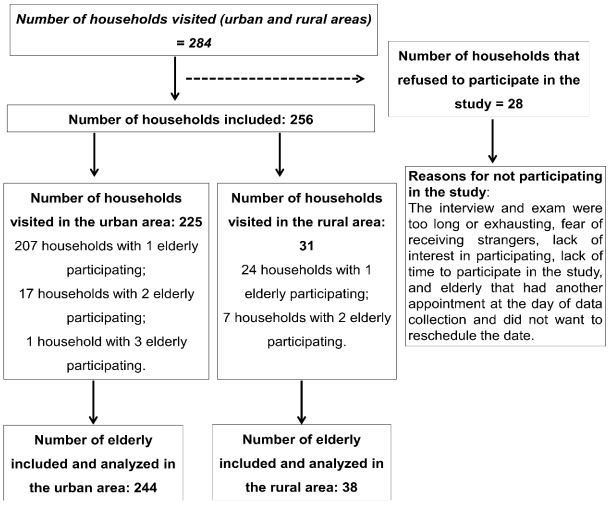
Health problem was categorized into two groups, one with older adults who reported not having or not knowing that they have a health problem, and another group with older adults who reported having at least one health problem. Smoking exposure was divided into current smokers, former smokers and never smokers. Use of medication was categorized into two groups, one with older adults who reported using one or more medicines, and another who reported not using it. The brushing frequency was categorized as <2 times per day and ≥2 times per day. The access to oral care in the last 12-months was dichotomized into yes and no.

Data analysis was performed using the SPSS (version 21.0) statistical package (SPSSInc., Chicago, United States). Associations between the dependent and independent variables were assessed using the chi-square or Mann-Whitney tests, presented through the distribution of frequencies. The level of significance was 5%. Uni- and multivariate analyses were performed, using Poisson regression with a robust variance, in order to verify the association between the dependent variable and the independent variables. Only those variables that presented p <0.20 in the univariate analysis were included in the multivariate model. Multicollinearity analysis was performed, but none was observed.

3 Results and Discussion

A total of 282 older adults were interviewed and examined, 244 (86.5%) in the urban area and 38 (13.5%) in the rural area, as described in the flowchart (Figure 1). No missing data was detected for any variable, and all the 282 individuals were included in the analyses. The mean age was 71.42 years (SD ± 7.89), of which 81 (28.7%) were male and 201 (71.3%) females. As for ethnicity/skin color, 252 (89.4%) reported being white and 30 (10.6%) were non-white. Regarding the level of education, 208 (79.8%) had low education, of which 17 (6%) declared to be illiterate. Approximately 53% of older adults were married, while 47% were between single, divorced or widowed. At least one health problem was observed in 248 older adults (87.9%).

Figure 1 - Flowchart of the participants in the study



Source: Resource data.

The prevalence of edentulism (loss of all natural teeth) was 48.6% (n=137), and the average tooth loss was 20.72±9.12. A statistically significant association was observed between edentulism and the following variables: gender (p=0.014), age (p<0.001), level of education (p<0.001), household monthly income (p=0.034), retirement (p<0.001), marital status (p=0.005), access to the dentist in the last 12 months (p<0.001) (Table 1).

Table 1 - Association between edentulism and demographic, socioeconomic, behavioral, medical and oral history among the elderly, Veranópolis

Variables		Non-edentulous N = 145 (51.4%)	Edentulous N = 137 (48.6%)	p-value
Tooth loss	Mean ± SD	13.83±8.2	28.0±0.0	-
Gender	Male - n (%) Female - n (%)	51 (35.2) 94 (64.8)	30 (21.9) 107 (78.1)	0.014*
Age	Mean±SD	69.04±6.24	73.93±8.53	<0.001#
Ethnicity/skin color	White - n (%) Non-white - n (%)	129 (89.0) 16 (11.0)	123 (89.8) 14 (10.2)	0.824*

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Variables		Non-edentulous N = 145 (51.4%)	Edentulous N = 137 (48.6%)	p-value
Level of education	Low - n (%) Medium/high - n (%)	102 (70.3) 43 (29.7)	123 (89.9) 14 (10.2)	<0.001*
Household monthly income	Mean±SD (in thousands of Brazilian reais)	3.90±2.78	3.14±1.76	0.034#
Living area	Urban - n (%) Rural - n (%)	120 (82.8) 25 (17.2)	124 (90.5) 13 (9.5)	0.057*
Retirement	Not retired - n (%) Retired - n (%) Retired and working - n (%)	14 (9.7) 83 (57.2) 48 (33.1)	19 (13.9) 100 (73.0) 18 (13.1)	<0.001*
Marital status	Married - n (%) Not married - n (%)	89 (61.4) 56 (38.6)	61 (44.5) 76 (55.5)	0.005*
Health problem	Yes - n (%) No - n (%)	127 (87.6) 18 (12.4)	121 (88.3) 16 (11.7)	0.850*
Use of medication	Yes - n (%) No - n (%)	123 (84.8) 22 (15.2)	122 (89.1) 15 (10.9)	0.294*
Exposure to smoke	Smokers - n (%) Former smokers - n (%) Never smokers - n (%)	11 (7.6) 36 (24.8) 98 (67.6)	9 (6.6) 32 (23.4) 96 (70.1)	0.892*
Access to the dentist	Yes - n (%) No - n (%)	92 (63.4) 53 (36.6)	39 (28.5) 98 (71.5)	<0.001*
Brushing frequency	<2 times / day - n (%) ≥2 times / day - n (%)	17 (11.7) 128 (88.3)	17 (12.4) 120 (87.6)	0.860*

Legend: * Chi-square; # Mann-Whitney.
Source: Resource data.

Table 2 shows the univariate analysis of the association between edentulism and exploratory variables. Older adults females had a 43.7% higher Prevalence Ratio (PR) to be edentulous (PR: 1.437; 95% confidence interval [95%CI]: 1,052-1,964), when compared to male individuals. Moreover, age was associated with edentulism. For each one-year increase in age, there is a 3.8% increase in the PR of older adults being edentulous (PR: 1.038; 95%CI: 1.026-1.050). The medium/high level of education level was associated with lower edentulism when compared to low level of education. Older adults with medium/high education had a 55.1% lower PR to be edentulous (PR: 0.449; 95%CI: 0.281-0719). Household income was associated with edentulism. For each R$ 1,000.00 increase in household income, there is an 8.4% lower PR for older adults to be edentulous (PR: 0.916; 95%CI: 0.858-0978). Retired older adults maintaining some type of work had a 52.6% lower PR to be edentulous when compared to non-retired older adults people (RP: 0.474; 95%CI: 0.290-0.774). Unmarried older adults people had a 41.6% higher PR to be edentulous when compared to married older adults people (p = 0.005). Older adults without access to the dentist in the last 12 months had a 218% (p <0.001) higher PR to be edentulous when compared to older adults with access to the dentist.

Table 2 - Univariate analysis of the association between edentulism and independent variables

Variables		Prevalence ratio (95% CI)	P value
Gender	Male Female	Ref. 1.437 (1.052 – 1.964)	0.023
Age		1.038 (1.026 – 1.050)	<0.001
Ethnicity/skin color	White Not white	Ref. 0.956 (0.639 – 1.430)	0.827
Level of Education	Low Medium / high	Ref. 0.449 (0.281 – 0.719)	0.001
Household monthly income		0.916 (0.858 – 0.978)	0.009
Living area	Urban Rural	Ref. 0.673 (0.426 – 1.064)	0.090
Retirement	Not retired Retired Retired and working	Ref. 0.949 (0.688 – 1.309) 0.474 (0.290 – 0.774)	0.750 0.003
Marital status	Married Not married	Ref. 1.416 (1.111 – 1.804)	0.005
Health problem	Yes No	Ref. 0.965 (0.660 – 1.408)	0.852
Use of medication	Yes No	Ref. 0.814 (0.540 – 1.227)	0.326

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Variables		Prevalence ratio (95% CI)	P value
Exposure to smoke	Smokers Former smokers Never smokers	Ref. 1.046 (0.606 – 1.806) 1.100 (0.664 – 1.822)	 0.872 0.712
Access to the dentist	Yes No	Ref. 2.180 (1.635 – 2.908)	<0.001
Brushing frequency	<2 times / day ≥2 times / day	Ref. 0.968 (0.675 – 1.387)	0.858

Source: Resource data.

In the final multivariate model, age, level of education and access to the dentist in the last 12 months remained associated with edentulism (Table 3). For each one-year increase in age, there is a 2.7% increase in the PR in being edentulous (RP: 1.027; 95%CI: 1.015-1.039). Older adults with medium/high level of education had a 39.4% lower PR to be edentulous (PR: 0.606; 95%CI: 0.382-0.961) when compared with older adults with low education. Older adults without access to the dentist in the last 12 months had a 78% (p <0.001) higher PR to be edentulous when compared to older adults with access to the dentist.

Table 3 - Multivariate analysis of the association between edentulism and independent variables

Variables		Prevalence Ratio (95% CI)	P-value
Living area	Urban Rural	Ref. 0.714 (0.473 – 1.076)	0.108
Gender	Male Female	Ref. 1.238 (0.935 – 1.638)	0.136
Age		1.027 (1.015 – 1.039)	<0.001
Level of education	Low Medium / high	Ref. 0.606 (0.382 – 0.961)	0.033
Retirement	Not retired Retired Retired and working	Ref. 1.052 (0.790 – 1.202) 0.750 (0.468 – 1.202)	 0.727 0.232
Access to the dentist	Yes No	Ref. 1.780 (1.346 – 2.353)	<0.001

Source: Resource data.

The present study aimed to evaluate the prevalence edentulism and associated factors among older adults in a city in south Brazil. Age, level of education and access to the dentist were associated with edentulism in the final multivariate model. The cumulative effects of most chronic oral diseases, including caries and periodontal disease, lead to tooth extraction. Frequently, this is the main treatment option, especially for the population with lower socioeconomic conditions[20]. In the history of oral care, this was a culturally acceptable option, but his assumption has changed overtime[20]. It is important to highlight that statistical analysis of tooth loss is important to estimate the effectiveness of oral health care in a population[21]. Therefore, these results can give support for public policy planning, for example, in the provision of financial resources for the prosthetic rehabilitation of a population. The city of Veranópolis was chosen because it is one of the pioneering municipalities in addressing issues related to the human aging process in Brazil[22]. Moreover, the World Health Organization granted the city with a title of "Age-friendly city".

In this study, the prevalence of edentulism was 48.6%. This high prevalence of edentulism was similar to some studies conducted in Brazil. In fact, according to data from the last National Oral Health Survey in 2010, approximately 50% of older adults were considered edentulous[11]. When compared with older adults from other countries, the data in the present study confirm the poor oral health conditions of the older adults from Brazil. The prevalence of edentulism in developed countries, such as Sweden and USA, was 20.6%[7] and 11%[6], respectively. In developing countries, a prevalence of edentulism of 28.2% was observed in Uruguay[13] and 25.5% in Mexico[8]. It is possible to observe that, in countries with socioeconomic conditions similar to Brazil, a better oral health condition for their older adults population was demonstrated. This is probably due to several situations including the time that a public health policy takes to be effective and, also, the size of the country. New trends are expected in the country, however there is a lost generation here represented by older adults.

In the present study, age was associated with edentulism. In fact, age can be considered a risk factor for tooth loss and edentulism. This can be confirmed by several studies that associate increasing age with a greater number of missing teeth[12, 14]. A cross-sectional population-based study conducted in the city of Pelotas/RS showed that older adults aged between 60 and 69 years old had a prevalence of edentulism of 24.2%, which increased to 64.6% in older adults aged over 80 years[12]. A study conducted in the USA showed that older adults aged ≥65 were more likely to be edentulous compared to individuals between 50 and 64 years[14].

The data from the present study showed that older adults with higher level of education presented a lower PR of

being edentulous when compared to older adults with lower education. A better level of education is related to better general health conditions and greater longevity[23], which also includes better oral health conditions. An analysis of the data from the last National Survey on oral health showed that about 60% of the older adults with lower education were considered edentulous[11]. Another regional study showed that low level of education was associated with edentulism[12]. It can be noted the low educational level of older adults of Veranópolis follows the trend of the Brazilian older adults, as observed in the last National Census[15]. Socioeconomic issues, including income and education, tend to influence the choice of treatment type[13]. It may be hypothesized that a better educational level is associated with better oral health behavior, leading to a better understanding of the importance of maintaining the natural teeth.

It should be highlighted that skin color/ethnicity was not associated with edentulism in this population. This is an interesting result, since an important number of studies use skin color as a proxy of socioeconomic/educational situation, which seems not to be the case in this population. It should be also taken into consideration that the area under study has a majority of white individuals and this is a representative study.

Additionally, in the present study, older adults without access to the dentist in the last 12 months were associated with higher PR of edentulism. These results are in line with studies that demonstrate that individuals without access to oral care had a higher prevalence of edentulism[12]. In fact, it is to be expected that individuals without teeth, seek dental services less, even when there is still a need for oral rehabilitation. This can be observed by the high prevalence of older adults people in need of prosthetic rehabilitation in Brazil[24]. At the same time that older adults can have access to the dentist, the values of dental treatments are often high, making it difficult to choose more sophisticated and specialized treatments, which makes it harder to maintain your teeth, even for those who have access to services dental care. On the other hand, it should be emphasized that, in the univariate analysis, females presented higher degrees of edentulism. Even though this did not remain significant in the final model, it is known that females seek dental care more often than males and this might reflect in edentulism[25], especially because in the present study tooth loss has not been evaluated as a continuous variable.

This study is representative of the socioeconomic strata in the city of Veranópolis, RS, Brazil. For this reason, a study with a probabilistic sample per cluster was performed. Concerning this, there was proportionality between urban and rural areas. Additionally, the level of education in older adults included was similar to that observed in the last national census for this city[15]. Moreover, the examiners were trained and calibrated to collect the data, which increases the internal validity. The used questionnaire has been validated and therefore there is more certainty about the quality of the obtained information. On the other hand, this study has some limitations. The cross-sectional design, which did not allow assessing the temporality of the associations between edentulism and exploratory variables. Additionally, no question was asked about the reasons for tooth loss. No clinical examination for the diagnosis of caries and periodontal disease in older adults was performed, which may be another limitation. Despite these limitations, the study design allows generalization of data for comparisons with other home-based studies with a representative sample.

The study and statistical analysis of edentulism make it possible to diagnose the oral health conditions of a population, potentially contributing to governmental public health actions. Unfortunately, the epidemiological data available demonstrate that being older adults in Brazil is associated with severe tooth loss and edentulism, as well as the lack of prosthetic rehabilitation for most of this population. The assessment of this condition is important as the literature demonstrates that good oral health is generally associated with a better quality of life[8]. The results of the present study justify the permanent need for epidemiological studies on the oral health conditions of older adults Brazilians, in the hope that the new generation of older adults does not demonstrate the same conditions observed in current and previous generations.

4 Conclusion

It was concluded that the prevalence of edentulism was high and associated with sociodemographic and access to oral care variables.

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