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RESEARCH

Total edentulism in older adults: aging or social inequality?

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Abstract

This study estimated the self-reported prevalence of total edentulism in older adults aged 60 years or older in a municipality of Minas Gerais, Brazil, enrolled in the Family Health Strategy and identified associated socioeconomic factors. Data collection took place in the participants' domiciles through a questionnaire including socio-demographic, economic, and general and oral health data. The statistical analysis used "total edentulism" as the dependent variable, with significance level of 5%. A total of 1,750 older adults participated, 63.4% of whom were female, 11.5% were illiterate and 27.8% had a family income below one minimum wage. Total edentulism was 46.4%, with a higher prevalence in women, in participants who were aged ≥80 years, single/widowed/divorced, illiterate and in those who did not seek dental service in the last six months (p<0.05). Family income was lower for the edentulous older adults (p=0.001), and a high prevalence was found for edentulism associated with socioeconomic factors, showing iniquity in oral health and, therefore, the need for State protection.
Keywords: Aged. Tooth loss. Socioeconomic factors. Health status disparities. Oral health. Primary health care.

Resumo

Edentulismo total em idosos: envelhecimento ou desigualdade social?

Este estudo estimou a prevalência autorreferida de edentulismo total em idosos de 60 anos ou mais em município de Minas Gerais cadastrados na Estratégia Saúde da Família, identificando fatores socioeconômicos associados. Os dados foram coletados no domicílio dos participantes, aplicando-se questionário que abarcava aspectos sociodemográficos, econômicos e de saúde geral e bucal. A estatística utilizou a variável dependente "edentulismo total", com nível de significância de 5%. Participaram 1.750 idosos – 63,4% mulheres, 11,5% analfabetos e 27,8% com renda familiar abaixo do salário mínimo. O edentulismo total foi de 46,4%, com maior prevalência em mulheres, entrevistados com idade ≥80 anos, solteiros/viúvos/divorciados, analfabetos e idosos que não procuraram serviço odontológico nos últimos seis meses (p<0,05). A renda familiar foi menor para os edêntulos (p=0,001), e constatou-se alta prevalência dessa condição associada a fatores socioeconômicos, demonstrando iniquidade em saúde bucal e necessidade de proteção do Estado.
Palavras-chave: Idoso. Perda de dente. Fatores socioeconômicos. Disparidades nos níveis de saúde. Saúde bucal. Atenção primária à saúde.

Resumen

Edentulismo total en ancianos: ¿envejecimiento o desigualdad social?

Este estudio estimó la prevalencia autorreferida de edentulismo total en ancianos de 60 años o más, registrados en la Estrategia de Salud Familiar, en el municipio de Minas Gerais, Brasil, e identificó factores socioeconómicos asociados. Los datos se recolectaron en el domicilio de los participantes, aplicándose un cuestionario que abarcaba aspectos sociodemográficos, económicos y de salud general y bucal. La estadística utilizó la variable dependiente "edentulismo total", con un nivel de significancia del 5%. Participaron 1.750 ancianos –el 63,4% mujeres, el 11,5% analfabetos y el 27,8% tenían renta familiar por debajo del salario mínimo. El edentulismo total fue del 46,4%, con mayor prevalencia en mujeres, encuestados con edad ≥80 años, solteros/viudos/divorciados, analfabetos y ancianos que no buscaron servicio odontológico en los últimos seis meses (p<0,05). La renta familiar fue más baja para los edéntulos (p=0,001), y se comprobó una alta prevalencia de esta condición asociada a factores socioeconómicos, demostrando la inequidad en la salud bucal y la necesidad de protección del Estado.
Palabras clave: Anciano. Pérdida de diente. Factores socioeconómicos. Disparidades en el estado de salud. Salud bucal. Atención primaria de salud.

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Edentulism, or tooth loss, is a very common oral health condition among older people [1], considered by the Institute for Health Metrics and Evaluation at the University of Washington [2] as the third oral condition with the highest global incidence in 2010. Tooth loss can be explained by the chronic and cumulative effect of dental caries and periodontal disease, the main oral diseases [3]. As a result, the prevalence of edentulism has become the most recommended index for assessing oral health conditions in the older adult population [4].

From epidemiological surveys carried out in Brazil in 1986, 2003 and 2010, Cardoso and collaborators [5] estimated tooth loss rates in older adults for 2020, 2030 and 2040. Assuming that the problem follows a logistical function and verifying that the proportion of edentulous arches in older adults suffered a 0.76% variation per year between 1986 and 2010, it was estimated that, by 2040, 85.96% of this population will have edentulous arches, which is equivalent to 64 million individuals [5].

Edentulism affects the general health status of older adults and interferes with quality of life, since oral health is an important component of general well-being [6]. Tooth loss makes feeding difficult, decreases the functional capacity of phonation, causes nutritional, aesthetic and psychological losses, reduces self-esteem and impairs social integration [7-9]. Recent research has found that the absence of teeth exacerbates cognitive impairment, which worsens when the dental arch is not properly rehabilitated for more than 15 years [10], something common in socioeconomically disadvantaged population groups.

In this relationship between edentulism and social inequality, studies show that the population of lower socioeconomic level has more tooth loss as compared to the wealthier social classes [11,12]. A spatial analysis of edentulism among people aged 60 or over in Botucatu, São Paulo, Brazil, found a higher risk of incidence in the peripheral areas of the municipality [4], even though comprehensive healthcare is a constitutional right of all Brazilian citizens.

It should be noted that, corroborating constitutional law, the National Oral Health Policy (Política Nacional de Saúde Bucal – PNSB) [13] was instituted in the public sector in Brazil. By analyzing the PNSB from the perspective of protection bioethics, Costa and collaborators [14] reinforced the importance of including an oral health team in the Family Health Strategy (FHS) as part of the State's role in protecting Brazilian citizens. However, oral health care still lacks advances to guarantee the comprehensiveness of actions [14] aimed at the older adults, both preventing tooth loss and rehabilitating the edentulous people attended to within the scope of public health.

In this context, measuring edentulism in older adults can contribute to planning actions aimed at recovering their oral health. Assuming that people with lower income and education are more affected by total edentulism, the aim of this study was to estimate the self-reported prevalence of total edentulism in the older adults registered in the FHS and to identify associated socioeconomic factors.

Method

This study had a cross-sectional and analytical design, conducted with 1,750 older adults aged 60 or over served by the FHS in the urban region of Montes Claros, MG, Brazil, a medium-sized municipality in the north of Minas Gerais with around 400 thousand residents, more than 80 percent of whom are served by FHS teams. This work is part of a broader research on healthcare for older adults in primary care in that municipality, in which a pilot study was planned to adapt the method used.

Data were collected at the participants' homes in 2017 by trained researchers, using a questionnaire in the form of an interview. The study excluded older people who were unable to answer questions and who were not accompanied by caregivers/guardians at the time of data collection, as well as those who were not found at home after three visits and prior appointment.

Sociodemographic (gender, age, marital status, education), economic (monthly family income), and self-perceived general health data, as well as variables related to the oral health of older adults (having natural teeth, difficulties to swallow, seeking dental service in the last six months due to a mouth problem) were obtained. Age was categorized by age group at five-year intervals, and monthly family income per unit of minimum wage at the time (R$ 937.00).

The data were analyzed using descriptive and analytical statistics. The absolute and relative frequencies of the categorical variables and the minimum and maximum values, means, standard deviation and medians of age and family income were calculated. Pearson's chi-square test was used for bivariate analysis of total edentulism (absence of all natural teeth) and categorized schooling and monthly family income.

The medians of age and monthly family income were compared between the edentulous and non-edentulous groups using the Mann-Whitney U test,

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due to the lack of normality in the data (Kolmogorov-Smirnov test; $p<0.001$). Poisson regression with robust variance was performed to obtain the prevalence ratios (PR) adjusted by weighting[15] of sampling per cluster, in both bivariate and multivariate analysis. "Total edentulism" was established as the dependent variable, and the independent ones were related to socio-demographic, economic, general and oral health data, all dichotomized. The independent variables associated with the level of 20% ($p\leq0.20$) in the bivariate analysis were considered in the multivariate analysis, those with $p<0.05$ remaining in the final model. The statistics were calculated using the IBM SPSS software, version 22.0.

Results

Most of the 1,750 study participants were female (63.3%), over 65 (76.4%), married (53.9%), with at least one year of schooling (88.3%) and monthly family income above the minimum wage at the time (72.1%). The participants showed good/excellent (70.8 %) self-perception of their general health. Total edentulism was reported by almost half of the older adults (46.3%). Most respondents reported not having difficulty swallowing food (90%), and 85.3% had not sought dental care in the past six months due to mouth problems (Tables 1 and 2).

The percentage of older adults with total tooth loss tended to increase linearly with advancing age, with 28.8% of the participants between 60 and 64 years old and 71.4% of those between 90 and 94 years old being totally edentulous ($p<0.001$). Individuals with five or more years of schooling had a lower percentage of total edentulism (26.8%) as compared to those with no education (66.5%) or those who had one to four years of schooling (53.4%) ($p<0.001$). Older people with a monthly family income equivalent to more than five minimum wages showed a lower percentage (31.9%) of total tooth loss as compared to those with lower income (Table 1).

In the totally edentulous individuals, the median age was 73 years, and in the non-edentulous 68 years ($p<0.001$). Totally edentulous individuals had lower income (on average almost R$ 400.00 less than those without total edentulism), with a significant difference (Table 3).

Table 1. Total edentulism in older adults according to age, years of schooling and monthly family income by minimum wage (Montes Claros, Minas Gerais, Brazil, 2017)

Variables	Total edentulism		Pearson's chi-square
	Yes n (%)	No n (%)	*p*
Age range*			
60 to 64 years	118 (28.8)	292 (71.2)	<0.001
65 to 69 years	177 (40.1)	264 (59.9)	
70 to 74 years	165 (50.0)	165 (50.0)	
75 to 79 years	132 (55.7)	105 (44.3)	
80 to 84 years	102 (64.6)	56 (35.4)	
85 to 89 years	74 (67.3)	36 (32.7)	
90 to 94 years	30 (71.4)	12 (28.6)	
95 to 99 years	11 (68.8)	5 (31.3)	
100 years or more	2 (66.7)	1 (33.3)	
Years of schooling*			
No schooling	133 (66.5)	67 (33.5)	<0.001
1 to 4 years	530 (53.4)	463 (46.6)	
5 years or more	148 (26.8)	405 (73.2)	
Family income (minimum wage=R$ 937.00)*			
Up to 1 minimum wage	229 (47.2)	256 (52.8)	<0.005
>1 and ≤2 minimum wages	327 (49.2)	337 (50.8)	
>2 and ≤3 minimum wages	123 (45.9)	145 (54.1)	
>3 and ≤4 minimum wages	62 (50.4)	61 (49.6)	
>4 and ≤5 minimum wages	33 (36.3)	58 (63.7)	
>5 minimum wages	37 (31.9)	79 (68.1)	

**There was a loss of respondents due to lack of record in the questionnaire. The percentage values were adjusted.*

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Table 2. Prevalence ratio of total edentulism in older adults according to sociodemographic, economic, general and oral health profile (Montes Claros, Minas Gerais, Brazil, 2017)

Variables	Total edentulism		Prevalence ratio (95% CI) *p**	
	Yes n (%)	No n (%)	Bivariate analysis *p*	Multivariate analysis *p*
Sex*				
Male	262 (40.9)	378 (59.1)	1	1
Female	549 (49.6)	558 (50.4)	1.060 (1.027-1.093) *p*<0.001	1.045 (1.012-1.079) *p*=0.007
Age in years*				
60 to 79	591 (41.7)	826 (58.3)	1	1
80 to 107	220 (66.7)	110 (33.3)	1.192 (1.143-1.242) *p*<0.001	1.155 (1.106-1.203) *p*<0.001
Marital status*				
Married/common-law marriage	385 (40.8)	559 (59.2)	1	1
Single/widowed/divorced	426 (53.1)	376 (46.9)	1.087 (1.054-1.121) *p*<0.001	1.036 (1.002-1.071) *p*=0.037
Illiterate*				
No	678 (43.9)	868 (56.1)	1	1
Yes	133 (66.5)	67 (33.5)	1.174 (1.115-1.236) *p*<0.001	1.107 (1.050-1.168) *p*<0.001
Family income – cut by median*				
>R$ 1,875	255 (42.6)	343 (57.4)	1	–
≤R$ 1,874	556 (48.4)	593 (51.6)	1.042 (0.989-1.085) *p*=0.131	–
Self-perception of general health*				
Excellent/good	541 (43.8)	695 (56.2)	1	–
Poor/very poor	270 (52.8)	241 (47.2)	1.062 (1.026-1.099) *p*=0.001	–
Difficulty swallowing*				
Never	715 (45.4)	860 (54.6)	1	–
Rarely/very often/always	95 (56.5)	73 (43.5)	1.070 (1.013-1.131) *p*=0.015	–
Sought dental service in the last six months for mouth problems*				
Yes	64 (25.2)	190 (74.8)	1	1
No	746 (50.0)	746 (50.0)	1.164 (1.124-1.206) *p*<0.001	1.141 (1.102-1.182) *p*<0.001

CI: confidence interval; p: value p *in Poisson regression. Note: values adjusted for the design effect. *There was a loss of respondents due to lack of record in the questionnaire. The percentage values were adjusted.*

Table 3. Age and monthly family income of older adults with or without total teeth loss and comparison of medians (Montes Claros, Minas Gerais, Brazil, 2017)

Variables	Total edentulism						*p**
	Yes			No			
Demographic and economic profile	Minimum-maximum	Mean (standard deviation)	Median	Minimum-maximum	Mean (standard deviation)	Median	
Age	60-107	74.0 (8,922)	73	60-104	69.5 (7,801)	68	<0.001
Family income in *reais* (R$)	400.00-10,000.00	2,038.00 (1,381.32)	1,800.00	300.00-25,000.00	2,436.24 (2,137.49)	1,874.00	0.001

**p: referring to the comparison of medians by the Mann-Whitney U test*

Total edentulism was more prevalent among female participants (PR=1.060), aged 80 years or more (PR=1.192), single/widowed/divorced (PR=1.087), illiterate (PR=1.174), with self-perceived poor/very poor general health (PR=1.062), with difficulty in swallowing food (PR=1.070) and who did not seek dental services for mouth problems in the six months preceding the survey (PR=1.164), with a level of statistical significance of $p<0.05$ in the bivariate analysis. In multivariate analysis the higher prevalence of total tooth loss remained associated with female respondents (PR=1.045), those who were aged 80 years or more (OR=1.155), single/widowed/divorced (PR=1.036), illiterate (PR=1,107) and who did not seek dental care for mouth problems in the six months prior to the survey (PR=1,164), as shown in Table 2.

Discussion

This study estimated the self-reported prevalence of total tooth loss in 1,750 older people registered in the FHS in a medium-sized Brazilian city, located in northern Minas Gerais. The methodological design allowed to know the oral health profile of older adults receiving primary health care by estimating the prevalence of total edentulism and associated factors. Population-based studies contribute to understanding the relationship between total tooth loss and social inequality by confirming a statistically significant association with socioeconomic indicators.

One of these studies estimated the self-reported prevalence of edentulism in 1,451 people aged 60 years or over in Pelotas (RS), finding its incidence in 39.3% of those surveyed [16]. A higher value was found in a study that evaluated 372 older adults in Botucatu, São Paulo, Brazil, through clinical dental examination (63.17%) [4]. In the epidemiological survey of oral health conducted in 2010 in Brazil, it was found that 53.7% of older adults in the five Brazilian macro-regions, aged between 65 and 74, were completely edentulous [17]. It is estimated that this problem will grow until 2040, despite the reduction in tooth loss observed and expected among young people and adults [5]. International studies have observed a varying prevalence of edentulism in different countries: 4.4% in southern China [18], 15% in India [19] and 26% in the United States [20]. In European countries, there was a variation of 15% to 78% [20].

In this study, almost half of the older adults reported not having any natural teeth. In addition to advancing age, sociodemographic and economic factors, as well as marital status and not seeking dental services for mouth problems in the last six months, were associated with total edentulism. There was a greater participation of women, which can be partly explained by the age group of the participants, since life expectancy at birth in Brazil is higher for women [21]. In this study, the prevalence of total edentulism was 4.5% higher in women than in men, corroborating other Brazilian population-based studies [16,17].

The participation of 90-year-olds or older (3.5%) shows greater longevity than expected by life expectancy at birth among Brazilians, which in 2015 was 71.9 years for men and 79.1 years for women [22]. Totally edentulous older adults averaged 74 years of age, almost five years older than the average for non-edentulous ones (Table 3).

Eighty-year-olds or older showed a 15 percent higher prevalence for total edentulism as compared to those aged between 60 and 79 years (Table 2). This may be related to the fact that, according to the literature, tooth loss is considered a natural consequence of life and advancing age, which can influence inappropriate behaviors related to the prevention of oral diseases [16].

The increase in tooth loss with age is a universal trend, motivating in society the notion of toothless older adults as a natural reflection of human dentition. However, edentulism in older groups is an expression of the cumulative effect of oral disease over the years, with caries and periodontal disease being dependent on factors other than biological ones [4]. Therefore, edentulism in old age is not just a consequence of the aging process.

In this study, there were older people who were not fully edentulous in all age groups, despite the linear trend in the percentage of tooth loss with advancing age. The control or prevention of oral diseases such as caries throughout life enables the maintenance of dental elements among elders, that is, it allows aging with toothed arches.

A study that analyzed the problem of dental caries, based on Brazilian epidemiological surveys and analytical support in protection bioethics, pointed out differences in oral health across different population groups with different family incomes [23]. The combination of epidemiological

data and bioethical reflection is a way to protect individuals with more oral health needs and who live in a situation of social vulnerability [23], whatever stage of life they are in.

In the assessment of marital status, the highest prevalence of total edentulism in this study was associated with single, widowed and divorced older people, occurring 3.6% more than in married older adults or those in a stable relationship. This finding suggests that people who live with a partner took better care of their teeth, possibly due to the importance of oral health in interpersonal relationships, such as marital relationships.

The absence or low level of education of the majority of the studied group (68.2%) can be partly justified by the limited access to school at the time of their childhood or adolescence. A higher prevalence of edentulism was found in illiterate older adults than in those with at least one year of schooling (p<0.001), and other studies reported similar results [4,16,17]. In Brazil, dental losses reflect social and regional inequalities, which indicates the need to offer priority care to the most vulnerable subjects [24], from the perspective of protection bioethics [25].

The low level of education and illiteracy of most of the participants in this study may also be linked to low family income – of up to two minimum wages monthly for 65.7% of them. The highest monthly family income (of five minimum wages or more) was associated with the lowest percentage of totally edentulous individuals. When categorized by the median of all older adult participants (R$ 1,874.00), income was not associated with total edentulism in the multivariate analysis. However, the mean and median monthly family income were lower for the totally edentulous older adults, with a significant difference in the comparison of medians.

This result corroborates previous studies, in which low family income was associated with tooth loss among the older adults [16,17]. In this study, the indicators "monthly family income" and "schooling" were related to a higher percentage of totally edentulous older adults. The indicators of inequality in oral health reveal, above all, inequity in health, which requires qualified care actions to preserve the principle of equity according to the vulnerability of certain population groups [14].

Not seeking dental services in the six months prior to data collection due to mouth problems was associated with a higher prevalence of total edentulism in older adults. In this regard, it is worth discussing the perception of the need to seek these services among edentulous older people. Another Brazilian study with older people found that the prevalence of edentulism in participants who considered it unnecessary to seek dental treatment was 1.27 times higher than in the others [4].

Tooth loss requires constant care to assess the need for prostheses – including repairs, maintenance and assessment of soft tissues to prevent diseases such as candidiasis or even pre-malignant or cancerous lesions. In this sense, care for oral health does not depend on the presence or absence of natural teeth.

The older adult's self-perception of their general health as poor or very poor and the difficulty in swallowing food were associated with total edentulism in the bivariate analysis (p<0.05) but not in the multivariate analysis (p>0.05), suggesting that these are confounding variables. Regarding the relationship between global health and edentulism, a study with 5,235 older adult Ecuadorians aged 60 years or older reported that 77.13% of the participants rated their general health as fair/poor, associating this variable with greater tooth losses [6].

Another qualitative investigation, whose aim was to identify the ideational representations of 14 older people about edentulism, demonstrated the importance of dental elements for good global health and for the social interactions of the participants [26]. In this case, tooth loss was understood to result from a dental care model that does not value disease prevention [26].

Reorientation of the care model requires state protection policies in the different spheres of governance, from the municipal to the international one. In this sense, Martínez and Albuquerque [27] analyzed the *Liverpool Declaration*, an international document that points out the need for States to strengthen oral health actions by 2020 and indicated the lack of an integral approach for older adults, with preventive, curative and rehabilitative actions.

In Brazil, despite the PNSB [13] standardizing integral care for older people, edentulism is estimated to increase by 2040 [5]. Therefore, it is necessary to improve the effectiveness of state actions so that there is less tooth loss in this group. PNSB [13] ensures comprehensive oral health care

for all citizens, both individually and collectively, regardless of age. To this end, it proposes to reorient the work process towards joint multiprofessional actions that encompass the entire health-disease process, from health promotion to rehabilitation.

It also provides for expanding access to oral health services for older adults as an important factor in maintaining quality of life. PNSB recommends dental professionals to carry out educational and disease prevention activities and to schedule individualized clinical appointments with older adults, without queues or bureaucracies. It also proposes to expand and qualify oral health care within the scope of the FHS, with home visits to the bedridden or people with impaired mobility, in order to identify risks and meet individual needs [13].

This study is limited by the self-reference of total edentulism. Although self-assessment proved to be a good index of general health status [26], it is known that clinical examination would be ideal to confirm self-reported edentulism. However, information biases are considered unlikely, since total edentulism is a condition that is easily perceived and seen on a daily basis by constant contact with the oral cavity, whether due to the need for food, speech or oral hygiene.

The inherent limitation of considering only total edentulism, rather than the absence of most teeth, as a cutoff point for categorizing older adults as edentulous should also be noted. A previous study with this same cutoff point [4] recognized that many of the elders placed in the category of partial edentulism may suffer from problems similar to those affected by total edentulism.

Final considerations

This study found a high prevalence of self-reported total edentulism associated with socioeconomic factors, which proves inequality in oral health among older adults. The high percentage of totally edentulous patients shows the magnitude of the problem of tooth loss, which should be considered a public health issue as it affects almost half of the individuals surveyed.

Total edentulism was shown to be a frequent condition among older adults, but it was not common to all individuals. Therefore, the loss of all teeth cannot be naturalized just as a result of chronological age and biological aging, even if it is associated with older age. Lower monthly family income and low education were also factors related to the higher prevalence of total edentulism in older people.

Inequalities in oral health could be minimized with better allocation of resources and organization of dental services to promote health and address unmet demands on the need for prosthetic rehabilitation of totally edentulous people. In this sense, this study contributes information to better understand edentulism in older adults, and its results can help the planning of state actions in the context of public oral health.

The data demonstrate that it is necessary for the State to support national policies and measures already implemented in the oral health sector and also to emphasize preventive measures to avoid total edentulism in older adults, in addition to planning the prosthetic rehabilitation of tooth loss as a way to protect people in situation of social vulnerability.

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Participation of the authors
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