




# Frequency of toothbrushing in children under 12 years old in Peru, 2019-2021


## Frecuencia del cepillado dental en niños menores de 12 años de edad en Perú, 2019-2021


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### ABSTRACT

**Introduction:** having adequate hygiene could help prevent oral diseases such as dental caries. The objective of this study was to determine the practice of toothbrushing in Peruvian children under 12 years of age between 2019 and 2021. **Methods:** a cross-sectional, analytical, and retrospective analysis was done by using the data from the 2019, 2020 and 2021 Demographic and Family Health Survey databases. 38 203 records were obtained in 2019, 18 613 in 2020, and 35 759 in 2021. The variables were general, daily, and minimum two times a day toothbrushing, natural region, area and place of residence, altitude, wealth index, health insurance coverage, age, and sex. A descriptive, bivariate, and multivariate statistical evaluation was carried out. **Results:** general toothbrushing was 94.93% (n=83,032), daily toothbrushing was 86.32% (n=67,753), and at least twice a day was 82.93% (n=53,824). In the multivariate form, the year 2020 showed a negative association with daily toothbrushing (RPa: 0.97; 95% CI: 0.96-0.99; p<0.001) and at least twice a day (RPa: 0.96; 95% CI: 0.95-0.98; p<0.001). The year 2021 revealed a negative association with general toothbrushing (RPa:0.98; 95%CI: 0.97-0.98; p<0.001), daily (RPa:0.97; 95%CI: 0.95-0.98; p<0.001) and minimum twice a day (RPa: 0.94; 95%CI: 0.92-0.96; p<0.001), adjusted for the previously associated covariates. **Conclusion:** the studied years were negatively associated with general toothbrushing, daily toothbrushing, and toothbrushing minimum twice daily.

**Keywords:** toothbrushing, child health, oral hygiene.

### Resumen

**Introducción:** mantener una higiene adecuada podría ayudar a prevenir enfermedades bucales como las caries dentales. El objetivo del estudio fue determinar la práctica del cepillado dental en niños peruanos menores de 12 años entre 2019 y 2021. **Métodos:** se ejecutó un análisis transversal, analítico y retrospectivo junto con datos de la Encuesta Demográfica y de Salud Familiar 2019-2021. Se obtuvieron 38 203 registros en 2019, 18 613 en 2020 y 35 759 en 2021. Las variables fueron cepillado dental general, diario y mínimo 2 veces al día, región natural, área y lugar de residencia, altitud, índice de riqueza, cobertura de seguro de salud, edad y sexo. Se realizó una evaluación estadística descriptiva, bivalente y multivalente. **Resultados:** el cepillado dental general fue del 94,93% (n=83.032), el cepillado dental diario fue del 86,32% (n=67.753) y al menos dos veces al día fue del 82,93% (n=53.824). En forma multivariada, el año 2020 presentó una asociación negativa con el cepillado dental diario (RPa: 0,97; IC 95%: 0,96-0,99; p<0,001) y al menos dos veces al día (RPa: 0,96; IC 95%: 0,95-0,98; p<0,001). El año 2021 presentó asociación negativa con el cepillado dental general (RPa:0,98; IC 95%: 0,97-0,98; p<0,001), diario (RPa:0,97; IC 95%: 0,95-0,98; p<0,001) y mínimo dos veces al día (RPa: 0,94; IC 95%: 0,92-0,96; p<0,001), ajustado por las covariables previamente asociadas. **Conclusiones:** los años estudiados se asociaron negativamente con el cepillado dental general, cepillado dental diario y cepillado dental mínimo dos veces al día.

**Palabras clave:** cepillado dental, salud infantil, higiene bucal.

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## INTRODUCTION

Dental caries is a public health problem<sup>1</sup>, defined as a chronic prevalent condition by the World Health Organization. Peru studies, although not current, report dental caries in 60%-90% of school-age children. Other oral diseases can affect the living conditions and health of the population, especially in children<sup>2</sup>. Preventive measures for dental caries should be explained to parents, while health professionals should apply other measures. In this sense, while sugars and fermentable carbohydrate consumption should be avoided in the child's diet, toothbrushing and flossing, and 0.05% sodium fluoride rinses should be used in children over 6 years old with high caries risk<sup>3</sup>.

Toothbrushing is a fundamental self-care behavior for protecting oral health. It is considered a social norm that should be done at least twice a day<sup>4</sup>. In addition, there is strong evidence from systematic reviews that toothbrushing with fluoridated toothpaste is effective in decreasing the prevalence and intensity of caries<sup>5,6</sup>. Thus, toothpaste should contain more than 1000 parts per million (ppm) of fluoride and should be used in age-appropriate portions. However, a study indicates that some Peruvian children do not brush their teeth daily<sup>7</sup>. Preventive programs in oral health should promote healthy habits from an early age, considering that oral diseases in advanced stages are the fourth most costly health problem to treat<sup>8</sup>.

Peru and the entire world were affected throughout the pandemic caused by coronavirus 2019 (COVID-19) due to its high transmissibility.

As a result, governments adopted preventive measures such as distancing and mandatory social immobilization, which negatively impacted accessibility to health care, and dental care was also affected. As for dental care, it was recommended to delay or avoid visits and treat only emergency cases to prevent the possibility of cross-contagion by aerosols. Due to limited access, oral diseases increased in prevalence. Finally, it is essential to know that children did not brush their teeth permanently, given that the years compared in this study are included with the beginning and continuation of the pandemic.

Therefore, this research sought to determine the practice of toothbrushing in children under 12 years of age in Peru between 2019 and 2021.

## METHODS

A cross-sectional, analytical, and retrospective study was conducted using the Demographic and Family Health Survey (ENDES) database developed by the National Institute of Statistics and Informatics (INEI) of Peru during the years 2019, 2020, and 2021. The ENDES has a two-stage, probabilistic, balanced, stratified, and independent sample design classified into the rural and urban areas at the departmental level. The ENDES uses three questionnaires, but only the "Health Questionnaire" includes questions about general toothbrushing, daily toothbrushing, and toothbrushing at least twice a day for children aged 0 to 11 (Section 8). This section contains questions about the child's toothbrushing that can be answered by a person older than 15 years (parents or caregivers).

Only records taken from persons under 12 years old were considered, gathering a total of 167 750 records in 2019, 177 414 records in 2020, and 168 145 records in 2021. However, not all subjects were evaluated in the study variables. Therefore, the final sample size was 38 201 records in 2019, 18 611 records in 2020, and 35 758 records in 2021, including those who responded about toothbrushing<sup>9-11</sup>. As inclusion criteria, only the records of individuals under 12 years of age from the Peru Demographic and Family Health Survey of 2019, 2020, and 2021 referring to toothbrushing were incorporated.

This study established 2019, 2020, and 2021 as independent variables and general toothbrushing as the dependent variable, which refer to whether children perform this practice (QS809: (NAME) brush their teeth with a toothbrush?). Daily toothbrushing, defined as on whether they brush their teeth daily (QS810: (NAME) brush their teeth every day?) and minimum toothbrushing two times a day, referring to whether they brush their teeth between 2 or more times a day (QS811: (NAME) how many times a day do they brush their teeth?). Likewise, some covariables were presented as the natural region of residence, being classified in Metropolitan Lima, rest of the coast, highlands, and jungle; the area of residence was divided into rural and urban areas; the place of residence was classified into large city (capital), small city, town and countryside; altitude of residence was defined as less than 2500 meters above mean sea level (MAMSL) and from 2500 MAMSL and more; the wealth index was categorized from the 1st to the 5th quintile, referring to the people of a population distributed in 5 groups according to their economic level, from the poorest to the richest. The age was divided into two groups: 0 to 5 years and 6 to 11 years, and sex was divided into man and woman.

The first step for the research was to access the INEI website. To do so it was required to click on "database," follow by "microdata," and then to click on "survey query." In that window, we proceeded to type "Demographic and family health survey" in the search engine, and we chose 2019, 2020, and 2021 as the selected period. Once each database had been downloaded, they were merged using the STATA statistical software. Incomplete records were eliminated from the new database to perform the final data analysis.

## STATISTICS

The statistical program used was STATA SE/15.1, with a confidence level of 95% and a  $p < 0.05$ . We began with a descriptive study for each variable to obtain the absolute and relative frequencies. Then, we proceeded with the bivariate study using the chi-square test to measure the association of the studied variables. Finally, Poisson regression was used for the multivariate study to find crude prevalence ratios (PR) and adjusted prevalence ratios (aPR). Two models were generated: one crude and the other adjusted, in which the years 2019, 2020, and 2021 were considered as independent variables. The dependent variables were general toothbrushing, daily toothbrushing, and toothbrushing at least twice daily. For the adjusted models, the covariates were those previously reported that have achieved bivariate association: natural region of residence, area of residence, place of residence, altitude of residence, wealth index, health insurance coverage, age, and sex. The `svy` command was used to have representative estimates because the survey design where sampling patterns are specified in the stratum, primary sampling unit, and weights was incorporated into this data study.

## ETHICS

To begin the administrative processes, consent was requested from the Integrated Unit of Research, Science and Technology Management of the Faculties of Medicine, Stomatology and Nursing, obtaining its approval on July 21, 2022, with the code SIDISI No. 209189. Subsequently, the consent of the Institutional Ethics Committee of the Universidad Peruana Cayetano Heredia (CIE-UPCH) was requested and approved on August 8, 2022. It is essential to mention that the databases used publicly accessible on the official INEI website, where all records are coded, maintaining the anonymity of the respondents.

## RESULTS

General toothbrushing was performed in 94.93% (n=83 032) of the children, daily toothbrushing in 86.32% (n=67 753) and minimum toothbrushing twice a day in 82.93% (n=53 824). 31.42% (n=6 281) of the sample came from Metropolitan Lima, 76.50% (n=35 630) from the urban area, 31.42% (n=6 281) from the capital, and 78.25% (n=37 704) live at less than 2 500 MASML. 22.85% (n=13 198) were poor, 76.61% (n=75 291) had health insurance, 72.85% (n=49 455) were male, and 58.33% (n=40 735) were aged 6 to 11 years. In a bivariate manner, general toothbrushing and daily toothbrushing were associated with year, natural region, area of residence, place of residence, altitude, wealth index and age; minimum toothbrushing twice a day was associated with year, natural region, area of residence, place of residence, altitude, wealth index, health insurance holding, sex, and age (Table 1).

**Table 1.** Toothbrushing according to the sociodemographic characteristics of Peruvian children under 12 years old

Variables	n	%	General toothbrushing					Daily toothbrushing					Toothbrushing at least twice a day				
			Yes		No		p*	Yes		No		p*	Yes		No		p*
			n	%	n	%		n	%	n	%		n	%	n	%	
Total	92570	100.00	83032	94.93	9538	5.07		67753	86.32	15239	13.68		53824	82.93	13929	17.07	
<b>Year</b>																	
2019	38201	42.28	34196	96.32	4005	3.68	<0.001	28442	88.05	5735	11.95	<0.001	23058	85.43	5384	14.57	<0.001
2020	18611	21.05	16813	95.94	1798	4.06		13800	86.29	3003	13.71		10895	82.66	2905	17.34	
2021	35758	36.66	32023	92.76	3735	7.24		25511	84.28	6501	15.72		19871	79.95	5640	20.05	
<b>Geographical landscape</b>																	
Metropolitan Lima	6281	31.42	5905	96.89	376	3.11	<0.001	5199	89.88	702	10.12	<0.001	4335	85.2	864	14.8	<0.001
Rest of coast	15327	26.29	14083	94.90	1244	5.10		12217	89.65	1857	10.35		10008	85.06	2209	14.94	
Highlands	17528	26.31	15716	93.28	1812	6.72		11269	77.32	4438	22.68		8696	78.86	2573	21.14	
Jungle	13365	15.98	12157	93.86	1208	6.14		10394	88.31	1758	11.69		8096	80.46	2298	19.54	
<b>Area of residence</b>																	
Urban	35630	76.50	33037	96.03	2593	3.97	<0.001	28080	88.40	4935	11.60	<0.001	22560	83.8	5520	16.2	<0.001
Rural	16871	23.50	14824	91.38	2047	8.62		10999	79.23	3820	20.77		8575	79.59	2424	20.41	

Place of residence																	
Capital	6281	31.42	5905	96.89	376	3.11	<0.001	5199	89.88	702	10.12	<0.001	4335	85.2	864	14.8	<0.001
City	15119	20.90	14038	95.76	1081	4.24		11977	88.44	2052	11.56		9471	82.79	2506	17.21	
Town	14230	24.17	13094	95.13	1136	4.87		10904	86.39	2181	13.61		8754	82.78	2150	17.22	
Countryside	16871	23.50	14824	91.38	2047	8.62		10999	79.23	3820	20.77		8575	79.59	2424	20.41	
Altitude																	
Less than 2500 MAMSL	37704	78.25	34614	95.39	3090	4.61	<0.001	29797	89.12	4798	10.88	<0.001	24056	84.09	5741	15.91	<0.001
From 2500 MAMSL and more	14797	21.75	13247	93.29	1550	6.71		9282	76.04	3957	23.96		7079	77.9	2203	22.1	
Wealth index																	
Very poor	14353	21.29	12422	90.50	1931	9.50	<0.001	9138	78.99	3282	21.01	<0.001	7119	80.4	2019	19.6	<0.001
Poor	13198	22.85	12060	94.56	1138	5.44		9761	84.38	2295	15.62		7665	81.74	2096	18.26	
Medium	9837	21.45	9135	95.91	702	4.09		7705	87.61	1420	12.39		6129	83.06	1576	16.94	
Rich	7305	18.69	6858	96.62	447	3.38		5945	89.13	910	10.87		4833	82.75	1112	17.25	
Very rich	5191	15.72	4926	97.25	265	2.75		4480	93.29	443	6.71		3793	88.13	687	11.87	
Health insurance																	
Yes	75291	76.61	67508	94.95	7783	5.05	0.858	54931	86.34	12544	13.66	0.916	43922	83.45	11009	16.55	0.004
No	17279	23.39	15524	94.9	1755	5.10		12822	86.27	2695	13.73		9902	81.2	2920	18.8	
Sex																	
Man	49455	72.85	44589	94.82	4866	5.18	0.098	36422	86.50	8145	13.50	0.267	29095	83.64	7327	16.36	0.001
Woman	43115	27.15	38443	95.23	4672	4.77		31331	85.84	7094	14.16		24729	80.99	6602	19.01	
Age																	
From 0 to 5 years old	51835	41.67	43114	89.22	8721	10.78	<0.001	33542	81.82	9552	18.18	<0.001	25429	79.26	8113	20.74	<0.001
From 6 to 11 years old	40735	58.33	39918	99.02	817	0.98		34211	89.22	5687	10.78		28395	85.09	5816	14.91	

n: Absolute frequency. %: Relative frequency. p: Statistical significance. \*Chi-square test

Source: by the authors

According to the multivariate analysis, the year 2020 presented a negative association only with daily toothbrushing (aPR: 0.97; 95%CI: 0.96-0.99; p<0.001) and toothbrushing minimum twice a day (aPR: 0.96; 95%CI: 0.95-0.98; p<0.001). The year 2021 presented negative association with general toothbrushing (aPR: 0.98; 95%CI: 0.97-0.98; p<0.001), daily toothbrushing (aPR: 0.97; 95%CI: 0.95-0.98; p<0.001) and toothbrushing minimum twice a day (aPR: 0.94; 95%CI: 0.92- 0.96; p<0.001), adjusted for the previously associated covariates (Table 2). These results show that 2021 boasted a lower probability of toothbrushing frequency compared to 2019, considering the three variables used to measure toothbrushing. The same occurred in 2020, except for general toothbrushing, compared to the same reference year.

**Table 2.** Association between toothbrushing and years 2019-2021 in Peruvian children under 12 years old

Variables	General toothbrushing						Daily toothbrushing						Toothbrushing at least twice a day						
	PR	95%CI	p	aaP R	95%CI	p	PR	95%CI	p	aaP R	95%CI	p	PR	95%CI	p	abP R	95%CI	p	
<b>Year</b>																			
2019	Ref.				Ref.				Ref.				Ref.				Ref.		
2020	0.99	0.99-1.00	0.212	0.99	0.99-1.00	0.327	0.98	0.97-0.99	0.010	0.97	0.96-0.99	<0.001	0.97	0.95-0.99	<0.001	0.96	0.95-0.98	<0.001	
2021	0.96	0.96-0.97	<0.001	0.98	0.97-0.98	<0.001	0.96	0.94-0.97	<0.001	0.97	0.95-0.98	<0.001	0.94	0.92-0.95	<0.001	0.94	0.92-0.96	<0.001	
<b>Geographical landscape</b>																			
Metropolitan Lima	Ref.				Ref.				Ref.				Ref.				Ref.		
Rest of coast	0.98	0.97-0.99	<0.001	-	-	-	0.99	0.98-1.01	0.749	-	-	-	0.99	0.98-1.02	0.878	-	-	-	
Highlands	0.96	0.96-0.97	<0.001	-	-	-	0.86	0.84-0.88	<0.001	-	-	-	0.93	0.90-0.95	<0.001	-	-	-	
Jungle	0.97	0.96-0.98	<0.001	-	-	-	0.98	0.96-1.00	0.062	-	-	-	0.94	0.92-0.97	<0.001	-	-	-	
<b>Area of residence</b>																			
Urban	Ref.				Ref.				Ref.				Ref.				Ref.		
Rural	0.95	0.94-0.96	<0.001	-	-	-	0.89	0.88-0.91	<0.001	-	-	-	0.95	0.93-0.97	<0.001	-	-	-	
<b>Place of residence</b>																			
Capital	Ref.				Ref.				Ref.				Ref.				Ref.		
City	0.99	0.98-0.99	<0.001	-	-	-	0.98	0.97-1.00	0.060	-	-	-	0.97	0.95-0.99	0.009	-	-	-	
Town	0.98	0.97-0.99	<0.001	-	-	-	0.96	0.94-0.98	<0.001	-	-	-	0.97	0.95-0.99	0.010	-	-	-	
Countryside	0.94	0.94-0.95	<0.001	-	-	-	0.88	0.86-0.90	<0.001	-	-	-	0.93	0.91-0.96	<0.001	-	-	-	

Altitude																	
Less than 2500 MAMSL		Ref.						Ref.						Ref.			
From 2500 MAMSL and more		0.98	0.97-0.98	<0.001				0.85	0.94-0.87	<0.001				0.93	0.91-0.94	<0.001	
Wealth index																	
Very poor		Ref.						Ref.						Ref.			
Poor		1.04	1.04-1.05	<0.001	-	-	-	1.07	1.05-1.09	<0.001	-	-	-	1.02	0.99-1.04	0.143	-
Medium		1.06	1.05-1.07	<0.001	-	-	-	1.11	1.09-1.13	<0.001	-	-	-	1.03	1.01-1.06	<0.001	-
Rich		1.07	1.06-1.08	<0.001	-	-	-	1.13	1.10-1.15	<0.001	-	-	-	1.03	1.01-1.06	0.037	-
Very rich		1.08	1.07-1.08	<0.001	-	-	-	1.18	1.16-1.20	<0.001	-	-	-	1.10	1.07-1.12	<0.001	-
Health insurance																	
Yes		Ref.						Ref.						Ref.			
No		0.99	0.99-1.00	0.859	-	-	-	0.99	0.99-1.01	0.916	-	-	-	0.97	0.95-0.99	0.006	-
Sex																	
Man		Ref.						Ref.						Ref.			
Woman		1.00	0.99-1.01	0.092	-	-	-	0.99	0.98-1.01	0.272	-	-	-	0.97	0.95-0.99	<0.001	-
Age																	
From 0 to 5 years old		Ref.						Ref.						Ref.			
From 6 to 11 years old		1.11	1.10-1.12	<0.001	-	-	-	1.09	1.08-1.10	<0.001	-	-	-	1.08	1.06-1.09	<0.001	-

PR: Prevalence ratio; aPR: Adjusted prevalence ratio; 95%CI: 95% confidence intervals; p: Statistical significance  
a: Adjusted for Geographical landscape, Area of residence, Place of residence, Altitude, Wealth Index and Age  
b: Adjusted for Geographical landscape, Area of residence, Place of residence, Altitude, Wealth Index, Health insurance, Sex and Age  
Source: by the authors

## DISCUSSION

Inadequate oral hygiene that does not include fluoridated toothpaste will result in a high caries risk and gingivitis. Consequently, there is broad consensus that oral hygiene behavior is essential for everyone and should begin with the eruption of a child's first tooth<sup>12</sup>. Correct practice will help keep the oral cavity clean and healthy to prevent disease. Worldwide, more than 530 million children suffer from primary tooth decay, and research on risk factors associated with poor oral health indicates that preventive measures are the key to good hygiene, with toothbrushing being the most common and effective means<sup>13</sup>.

A study published in 2019 indicates that less than a tenth of Peruvian children do not brush their teeth; the majority are between 1 and 5 years old. This could be attributed to the fact that at this age, they require help to brush<sup>7</sup>. Garcés-Elías et al. observed that the year of the outbreak of the COVID-19 pandemic negatively impacted daily toothbrushing and its frequency of at least twice a day. They also evaluated whether the changes caused by the COVID-19 pandemic would have affected the oral health of people, finding a reduction in the frequency of toothbrushing<sup>14</sup>. Gotler et al. reported an increase in the diagnosis of carious lesions in children who visited the dentist after the confinement period, compared to previous years<sup>15</sup>. The present study obtained similar results, showing an association between the COVID-19 pandemic and toothbrushing frequency. The years examined coincide with the pandemic period, revealing a negative association between this event and the maintenance of a daily toothbrushing routine, whether general or at least twice a day. These findings significantly highlight how a health emergency can notably impact oral health care.

Regarding toothbrushing at least twice a day, the current research associated this practice with the following geographic characteristics: natural region, area of residence, place of residence, and altitude. Martin et al. studied households of children under three years of age with low economic income and lived in urban areas; about half of the parents reported brushing their children's teeth twice a day<sup>16</sup>. In addition, an analysis conducted in Peru revealed that access to health services in rural areas is significantly lower compared to urban areas, reflecting a decrease in adequate toothbrushing frequency<sup>8</sup>. Similarly, regarding daily tooth brushing, an investigation found that the percentage of children who did not brush their teeth were under the care of guardians with a low level of education, which is characteristic of rural areas of Peru<sup>7</sup>. Concerning the above, this research worked with children under 12 years of age, showing that toothbrushing frequency was lower in rural and remote areas.

Sociodemographic characteristics, such as wealth index, age, sex, and possession of health insurance, were also associated with this analysis. It was found that people with low economic income were less likely to brush regularly, especially among children aged 0 to 5 years, who proved to be more diligent in this hygiene practice. Regarding sex and availability of health insurance, no significant effect on brushing frequency was observed. In addition, another study highlighted the adverse impact of economic factors on the oral health of students<sup>17</sup>. Casanova-Rosado et al. studied the frequency of tooth brushing in Mexican schoolchildren, finding that girls brushed their teeth



more than boys and that children who had visited the dentist in the last year before the analysis were more constant in this practice<sup>18</sup>, different from the results obtained in this investigation, where boys were the ones who brushed more than girls. Finally, a study in Australia on the influence of high socioeconomic level on tooth brushing shows that two-thirds of Australian children brush their teeth two or more times a day and that the mean age of initiation of tooth brushing with fluoridated toothpaste was 24 months. This may be influenced by parental education level and income above US\$76 159, with this value being the equivalent in Australian dollars approximately<sup>19</sup>. On the other hand, the development of this research may have had limitations due to its cross-sectional design, preventing the establishment of causal relationships with the events studied. In addition, by using a secondary data source, there is a high possibility of presenting memory and information biases due to the answers provided by the participants, who may not remember the events accurately.

Finally, parents more concerned about their children's dental hygiene had a higher economic level. There are still less than a tenth of children who do not brush their teeth, most of them under six years of age, which could be explained by the low wealth index of the families or by the lack of parental support in exercising healthy practices such as tooth brushing. It should also be considered that the remoteness of some health centers in rural areas has a strong influence on these healthy practices, such as having health insurance. It is crucial to remember that good oral health will help to have healthy teeth and gums; tooth brushing is a fundamental habit that should be instilled in children from an early age. Poor oral hygiene and little education on the subject are still a concern. Therefore, laws, health promotion, and disease prevention should be reinforced. This helps raise awareness among the population. Moreover, brushing teeth with toothpaste containing at least 1000 ppm is recommended.

## CONCLUSION

This study concludes that the frequency of toothbrushing decreased in Peruvian children under 12 years of age according to the Demographic and Family Health Survey during the years 2019 to 2021, whose associated factors were natural region, area of residence, place of residence, altitude, wealth index, health insurance tenure, sex, and age. Lastly, the studied years were negatively associated with general, daily, and minimum twice daily toothbrushing.

## CONFLICTS OF INTEREST

The authors state that they have no conflict of interest.

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