Toothbrushing and Access to Dental Services in Peruvian Children

**Natalie Hadad-Arrascue, DDS[1,2],
María Claudia Garcés-Elías, MBA[2]** iD **, and Jesús L. Chirinos, DrPH[1]**

Abstract

Objective. The aim was to determine the association between access to dental services and toothbrushing in Peruvian children under 12 years old. *Methods.* This was a cross-sectional study with a population of 2021 database of the Demographic and Family Health Survey. Records of children under 12 years old who provided answers about their toothbrushing were included. Variables were evaluated descriptively and followed by a bivariate analysis; multivariate tests were performed using Poisson regression with a multilevel regression analysis. *Results.* General toothbrushing was 96.32% (n = 34 198), and daily toothbrushing was 88.05% (n = 28 444). Access to dental services was associated with general toothbrushing (aPR: 1.18; 95% CI: 1.14-1.22; *P* < .001), daily toothbrushing (aPR: 1.08; 95% CI: 1.04-1.12; *P* < .001) and minimum toothbrushing 2 times a day (aPR: 1.12; 95% CI: 1.07-1.17; *P* < .001). *Conclusion.* Access to dental services was associated with general toothbrushing, daily toothbrushing and toothbrushing at least twice a day.

Keywords

toothbrushing, oral health, health services accessibility, oral hygiene, cross-sectional studies

Introduction

Access to health services refers to a process involving factors such as availability, efficacy, acceptability, and the presence of barriers and facilitators for its use, considering its main purpose to satisfy the population's needs.[1,2] From a dental perspective, access is limited and inequitable, resulting in a more significant disease burden, mainly affecting lower-income populations.[3] In Peru, it has been identified that extreme age groups such as children and older adults face limited access to dental services, with the area of residence, natural region, wealth quintiles, and sex being perceived as mediating factors.[4-6]

On the other hand, the high prevalence of oral pathologies such as dental caries is a problem for global public health, particularly in developing countries, highlighting the necessity to reinforce effective preventive habits against this disease.[7] Evidence suggests that diet control, access to information, use of fluorides, and toothbrushing are the main preventive habits.[8] Thus, access to dental care is essential in ensuring the provision of preventive tools for this condition.[9] Regarding toothbrushing, it is urged that this habit should begin before the first year of life to ensure consistency in its practice over time; it is also recommended to practice it at least twice daily, given its preventive purposes against dental caries. It is essential to emphasize that toothbrushing is a beneficial, affordable, widespread, and culturally accepted act; hence, it is an effective measure for public health.[10,11] At the national level, specific reports indicate a limited frequency of toothbrushing, mainly in younger individuals and members of families with limited economic resources.[12,13]

Promoting healthy practices, like toothbrushing,[14] within the context of the lowest dental care access is challenging, especially in vulnerable communities. Scientific evidence shows that the successful establishment of the toothbrushing habit is linked to receiving information on

[1]Facultad de Salud Pública y Administración, Universidad Peruana Cayetano Heredia, Lima, Perú
[2]Facultad de Estomatología, Universidad Peruana Cayetano Heredia, Lima, Perú

Corresponding Author:
María Claudia Garcés-Elías, Facultad de Estomatología, Universidad Peruana Cayetano Heredia, Av. Honorio Delgado 430, San Martín de Porres, Lima 15102, Perú.
Email: maria.garces@upch.pe

the prevention of oral cavity diseases, which in many countries is provided in the dental office.[15,16] On the other hand, it was observed that the poorest adults have the same or greater predisposition to follow preventive practices than others with a higher socioeconomic level; contradictorily, their use of dental services was the lowest.[17] In this regard, the Peruvian Dental Caries Clinical Practice Guideline suggests that before the first year of life, children should receive a dental evaluation, an opportunity to make parents aware of the initiation and frequency of brushing.[18] In this sense, evidence has yet to be identified on the association between these 2 factors, and it is necessary to consider that Peruvian children have an inadequate frequency of this good oral health practice. Therefore, the aim is to generate studies that address this problem, starting with this one that seeks to determine the association between access to dental services and toothbrushing in Peruvian children under 12 years old.

Methodology

A cross-sectional study was performed, where the population comprised the 2021 Demographic and Family Health Survey (ENDES) database, carried out by the National Institute of Statistics and Informatics of Peru (INEI). It is worth noting that a trained team executes the ENDES survey every year. This team conducts in-home interviews and administers questionnaires to the designated population.

It had a 2-stage, stratified, probabilistic, balanced, and independent sampling at the departmental level, both by urban and rural area. The sample size for the year 2021 amounted to 36760 dwellings, which meant 168145 children under 12 years old; only the data provided by survey respondents regarding their toothbrushing habits will be used for analysis, leading to a final sample size of 32023. As a criterion for managing the records, incomplete ones were eliminated (Figure 1). The ENDES survey comprises 3 questionnaires: health, household, and individual; it should be clarified that the person providing the information is the individual (over 15 years old) responsible for the children's health care.[19]

Regarding the variables established, general toothbrushing (Does [NAME] brush his/her teeth with a toothbrush?), daily toothbrushing (Does [NAME] brush his/her teeth every day?) and toothbrushing at least twice a day (How many times a day does [NAME] brush his/her teeth?) were considered dependent. In contrast, access to dental services, time since last dental care (measured in years) and place of dental care were determined as independent. According to the information given, the healthcare provider that carried out the service was classified as either the Ministry of Health of Peru (MINSA), Social Health Insurance of Peru (ESSALUD), Armed Forces (FF.AA) and Police (PNP), or the private sector. In addition, covariates were defined as the natural region, categorized into Metropolitan Lima, the rest of the coast, the highlands and the jungle. The area of residence was also evaluated, organized into urban and rural; place of residence divided into capital, city, town, and countryside; altitude measured at less than 2500 meters above mean sea level (MAMSL) or from 2500 MAMSL and more. Wealth index is a measure of a household's ability to access and enjoy goods and services; subsequently, a score was assigned to each household and its residents using a formula utilized by the United States Demographic and Health Surveys Program. It made it possible to classify each dwelling according to quintiles from the poorest to the richest.[20,21] It also included health insurance coverage, whether public or private; sex of the individual and age, divided into 2 groups: 0 to 5 and 6 to 11 years old.

Data Collection Procedures

The 2021 database was downloaded from the INEI's official web page (http://iinei.inei.gob.pe/microdatos/), obtaining the survey's modules and technical datasheet, and finally exported to STATA SE 17.0.

Statistical Analysis

For the statistical analysis, absolute and relative frequencies of the variables were obtained through a descriptive analysis, followed by a bivariate analysis using the Chi-square test to find associations between the variables under study. It is essential to clarify the use of the svy command, which allowed representative estimates to be established following the survey design, where the sampling patterns were distinguished according to stratum, primary sampling unit, and weights. Furthermore, Poisson logistic regression was utilized to conduct multivariate tests to determine the crude prevalence ratios (PR) and adjusted prevalence ratios (aPR) based on the previously demonstrated significance variables. The variables' association with toothbrushing was analyzed using multilevel regression; it should be noted that the 24 regions of Peru were established as the level of analysis. With this information, a variance component model was built (null model) using general toothbrushing, daily toothbrushing and toothbrushing at least twice a day as dependent variables, but without inserting explanatory variables; the null models estimated the general variability of the dependent variables and attributed it to the regions justifying proceeding with the analysis ($P < .001$). Subsequently, a series of explanatory variables
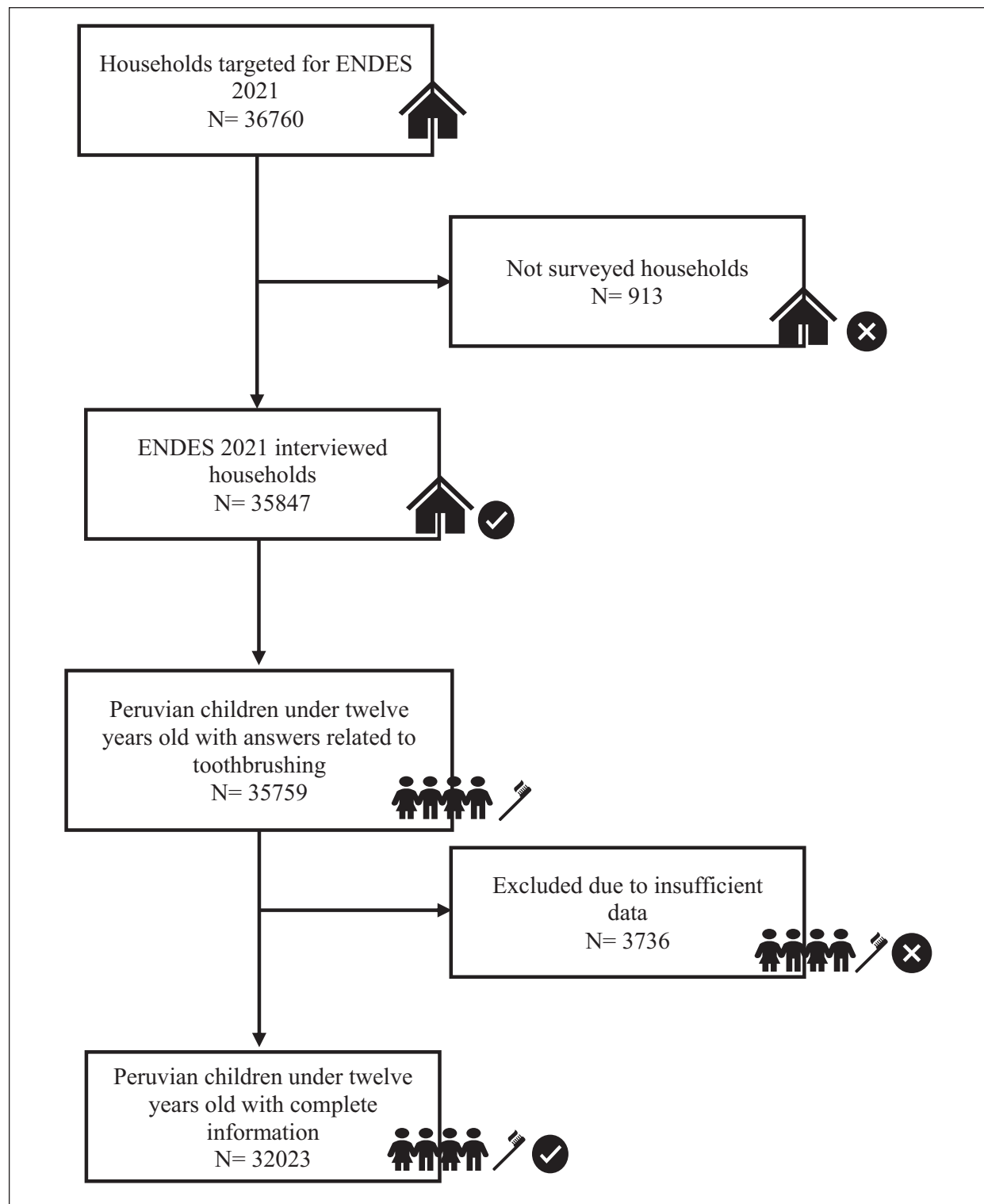
Figure 1. Flow chart of sample screening inclusion and exclusion.

were included to analyze the association with each independent variable and covariates. Four models were created: unadjusted model 1 of access to dental services, unadjusted model 2 of geographical characteristics, unadjusted model 3 of sociodemographic characteristics and adjusted model 4 of access to dental services by

covariates. This research used a confidence level of 95%, and as an indicator of statistical significance, a value of $P < .05$ was defined in all tests.

Ethical Approval and Informed Consent

The study was approved by the Institutional Ethics Committee of Universidad Peruana Cayetano Heredia (CIE-UPCH), with a SIDISI code of N° 206253. It should be noted that these databases are publicly accessible, and the records are coded to maintain the anonymity of the respondents. For this research, CIE-UPCH waived the requirement for informed consent due to the survey characteristics.

Results

General toothbrushing was 92.76% (n = 32 023), daily toothbrushing was 84.28% (n = 25 511), while minimum toothbrushing 2 times daily was 79.95% (n = 19 871). Access to dental care was 52.96% (n = 17 519), 12.72% (n = 2071) reported that their care was less than 2 years ago, and the main place of dental care was the Peruvian Ministry of Health with 46.37% (n = 10 306) (Table 1). In a bivariate manner, access to dental care, time since last dental care, and place of dental care presented an association with general toothbrushing ($P < .05$); concerning daily toothbrushing, it was associated with access and place of dental care ($P < .05$). While toothbrushing at least twice a day was associated with access to dental care and place of that care ($P < .05$). Similarly, the 3 variables of interest were associated with the natural region, area of residence, place of residence, altitude, wealth index, and age. On the other hand, sex was associated with general toothbrushing ($P < .05$) (Table 2).

In the multilevel regression analysis, access to dental care was associated with general toothbrushing (aPR: 1.18; 95% CI: 1.14-1.22; $P < .001$), daily toothbrushing (aPR: 1.08; 95% CI: 1.04-1.12; $P < .001$), toothbrushing at least twice a day (aPR: 1.12; 95% CI: 1.07-1.17; $P < .001$), adjusted for the variables in which an association was previously identified. However, this analysis was also developed for the time since last dental care, showing the absence of statistical significance in the results for general toothbrushing (aPR: 0.98; 95% CI: 0.92-1.05; $P = .598$), daily toothbrushing (aPR: 1.05; 95% CI: 0.98-1.13; $P = .171$), toothbrushing at least twice a day (aPR: 1.03; 95% CI: 0.95-1.11; $P = .501$). At the same time, none of the providers of the place of dental care, according to general toothbrushing, did present statistical significance: Social security (EsSalud) (aPR: 1.01; 95% CI: 0.93-1.10; $P = .797$),

Table 1. Toothbrushing, Access to Dental Services and Characteristics of Children Under de 12 Years Old in Peru, 2021.

Variables	n	%
General toothbrushing		
Yes	32 023	92.76
No	3735	7.24
Daily toothbrushing		
Yes	25 511	84.28
No	6501	15.72
Toothbrushing at least twice a day		
Yes	19 871	79.95
No	5640	20.05
Access to dental services		
Yes	17 519	52.96
No	18 239	47.04
Time since last dental care		
Less than 2 years	2071	12.72
From 2 to more years	15 355	87.28
Place of dental care		
Ministry of health	10 306	46.37
Social security (EsSalud)	1824	12.13
FF.AA./PNP	36	0.54
Private sector	5339	40.96
Natural region		
Metropolitan Lima	2206	29.06
Rest of coast	5643	28.23
Highlands	6473	26.35
Jungle	5073	16.36
Area of residence		
Urban	12 872	76.22
Rural	6523	23.78
Place of residence		
Capital	2206	29.06
City	5481	21.25
Town	5185	25.91
Countryside	6523	23.78
Altitude		
Less than 2500 MAMSL	13 970	78.24
From 2500 MAMSL and more	5425	21.76
Wealth index		
Very poor	5628	21.98
Poor	4872	23.24
Medium	3548	21.49
Rich	2655	18.43
Very rich	1831	14.86
Health insurance coverage		
With insurance	29 792	78.39
Without insurance	5966	21.61
Sex		
Boys	18 462	70.23
Girls	17 296	29.77
Age		
From 0 to 5 years old	20 214	53.57
From 6 to 11 years old	15 544	46.43

n: Absolute frequency; %: Relative frequency.

Table 2. Toothbrushing According to Access to Dental Services and Characteristics of Children Under 12 Years Old in Peru, 2021.

| | General toothbrushing | | | | | Daily toothbrushing | | | | | Toothbrushing at least twice a day | | | | |
| | Yes | | No | | | Yes | | No | | | Yes | | No | | |
Variables	n	%	n	%	P*	n	%	n	%	P*	n	%	n	%	P*
Access to dental services															
Yes	17063	98.48	456	1.52	<.001	14091	87.49	2967	12.51	<.001	11561	83.54	2530	16.46	<.001
No	14960	86.32	3279	13.68		11420	80.15	3534	19.85		8310	74.93	3110	25.07	
Time since last dental care															
Less than 2 years	1327	97.79	58	2.21	.036	1114	88.22	213	11.78	.624	916	85.15	198	14.85	.383
From 2 to more years	14987	98.57	368	1.43		12337	87.34	2646	12.66		10100	83.21	2237	16.79	
Place of dental care															
Ministry of health	9914	97.64	392	2.36	.003	7757	84.11	2154	15.89	<.001	6239	80.80	1518	19.20	.028
Social security (EsSalud)	1790	98.00	34	2.00		1570	87.56	220	12.44		1322	84.26	248	15.74	
FF.AA./PNP	36	100.00	0	0.00		34	99.22	2	0.78		30	92.99	4	7.01	
Private sector	5309	99.55	30	0.45		4722	91.05	585	8.95		3963	85.96	759	14.04	
Natural region															
Metropolitan Lima	2002	95.85	204	4.15	<.001	1711	88.07	290	11.93	<.001	1363	82.39	348	17.61	<.001
Rest of coast	4931	93.04	712	6.96		4137	88.59	792	11.41		3225	83.18	912	16.82	
Highlands	5397	89.63	1076	10.37		3550	73.95	1845	26.05		2575	75.21	975	24.79	
Jungle	4367	91.83	706	8.17		3518	85.93	848	14.07		2533	75.92	985	24.08	
Area of residence															
Urban	11370	94.23	1502	5.77	<.001	9211	86.49	2155	13.51	<.001	6983	80.94	2228	19.06	<.001
Rural	5327	88.06	1196	11.94		3705	76.68	1620	23.32		2713	76.12	992	23.88	
Place of residence															
Capital	2002	95.85	204	4.15	<.001	1711	88.07	290	11.93	<.001	1363	82.39	348	17.61	.007
City	4846	93.68	635	6.32		3948	87.33	897	12.67		2931	79.51	1017	20.49	
Town	4522	92.85	663	7.15		3552	83.98	968	16.02		2689	80.42	863	19.58	
Countryside	5327	88.06	1196	11.94		3705	76.68	1620	23.32		2713	76.12	992	23.88	
Altitude															
Less than 2500 MAMSL	12183	93.61	1787	6.39	<.001	10035	87.31	2144	12.69	<.001	7632	81.22	2403	18.78	<.001
From 2500 MAMSL and more	4514	89.72	911	10.28		2881	72.92	1631	27.08		2064	74.25	817	25.75	
Wealth index															
Very poor	4457	86.07	1171	13.93	<.001	3034	76.09	1421	23.91	<.001	2220	77.09	814	22.91	.008
Poor	4209	92.23	663	7.77		3216	83.80	992	16.20		2367	79.45	849	20.55	
Medium	3153	94.26	395	5.74		2523	85.38	628	14.62		1863	79.88	660	20.12	
Rich	2390	95.21	265	4.79		1993	86.49	396	13.51		1555	78.73	438	21.27	
Very rich	1687	96.10	144	3.90		1500	91.72	187	8.28		1198	85.04	302	14.96	
Health insurance coverage															
With insurance	26719	92.66	3073	7.34	.322	21255	84.17	5453	15.83	.671	16663	80.08	4592	19.92	.690
Without insurance	5304	93.15	662	6.85		4256	84.68	1048	15.32		3208	79.49	1048	20.51	
Sex															
Boys	16217	92.46	2245	7.54	.025	12738	84.68	3472	15.32	.217	9774	80.76	2964	19.24	.056
Girls	15806	93.47	1490	6.53		12773	83.34	3029	16.66		10097	78.05	2676	21.95	
Age															
From 0 to 5 years old	16832	87.30	3382	12.70	<.001	12779	80.45	4050	19.55	<.001	9467	77.15	3312	22.85	<.001
From 6 to 11 years old	15191	99.06	353	0.94		12732	88.18	2451	11.82		10404	82.55	2328	17.45	

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

Armed Forces/PNP (aPR: 1.03; 95% CI: 0.63-1.68; $P=.904$) and the private sector (aPR: 1.03; 95% CI: 0.97-1.10; $P=.285$); for daily toothbrushing, Social security (EsSalud) (aPR: 1.04; 95% CI: 0.95-1.14; $P=.347$), Armed Forces/PNP (aPR: 1.04; 95% CI: 0.63-1.171; $P=.890$) and private sector (aPR: 1.07; 95% CI: 1.00-1.14; $P=.051$) were not statistically significant. Finally, toothbrushing at least twice a day indicated that Social Security (EsSalud) (aPR: 1.03; 95% CI: 0.94-1.14; $P=.525$) and the Armed Forces/PNP (aPR: 1.14; 95% CI: 0.68-1.92; $P=.614$) and private

sector (aPR: 1.06; 95% CI: 0.99-1.14; $P=.110$) were not statistically significant (Table 3).

Discussion

From the dental perspective, low access to dental care is one of the leading public health problems. This situation prevents the optimal extension of hygienic habits to the population, such as toothbrushing,[14] and there are limitations to its application in vulnerable communities, especially in those individuals in the extreme stages of

Table 3. Association Between Toothbrushing and Access to Dental Services in Children Under 12 Years Old in Peru, 2021.

Variables	General toothbrushing									Daily toothbrushing									Toothbrushing at least twice a day								
	Null model	Unadjusted model				Adjusted model 4				Null model	Unadjusted model				Adjusted model 4				Null model	Unadjusted model				Adjusted model 4			
	Coefficient	Coefficient	PR	95% CI	P	Coefficient	aPRa	95% CI	P	Coefficient	Coefficient	PR	95% CI	P	Coefficient	aPRb	95% CI	P	Coefficient	Coefficient	PR	95% CI	P	Coefficient	aPRb	95% CI	P
Model 1: Access to dental services																											
Access to dental services																											
No		Ref.				Ref.					Ref.				Ref.					Ref.				Ref.			
Yes		0.19	1.21	1.18-1.25	<.001	0.17	1.18	1.14-1.22	<.001		0.11	1.12	1.08-1.16	<.001	0.07	1.08	1.04-1.12	<.001		0.13	1.14	1.09-1.19	<0.001	0.11	1.12	1.07-1.17	<0.001
Time since last dental care																											
Less than 2years		Ref.				Ref.					Ref.				Ref.					Ref.				Ref.			
From 2 to more years		−0.02	0.98	0.92-1.04	.484	−0.02	0.98	0.92-1.05	.598		0.03	1.03	0.96-1.11	.359	0.05	1.05	0.98-1.13	.171		0.01	1.01	0.94-1.10	.722	0.03	1.03	0.95-1.11	.501
Place of dental care																											
Ministry of health		Ref.				Ref.					Ref.				Ref.					Ref.				Ref.			
Social security (EsSalud)		0.03	1.03	0.95-1.01	.509	0.01	1.01	0.93-1.10	.797		0.08	1.09	0.99-1.18	.054	0.04	1.04	0.95-1.14	.347		0.05	1.05	0.96-1.15	.247	0.03	1.03	0.94-1.14	.525
FF.AA./PNP		0.06	1.06	0.67-1.66	.809	0.03	1.03	0.63-1.68	.904		0.15	1.16	0.73-1.84	.535	0.04	1.04	0.63-1.71	.89		0.2	1.22	0.76-1.96	.416	0.13	1.14	0.68-1.92	.614
Private sector		0.05	1.05	0.99-1.10	.069	0.03	1.03	0.97-1.10	.285		0.13	1.14	1.08-1.21	<.001	0.07	1.07	1.00-1.14	.051		0.08	1.08	1.01-1.15	.015	0.06	1.06	0.99-1.14	.11
Variance	0.22					0.2				0.23					0.22				0.23					0.22			
Intra-class correlation (ICC %)	.14					0.12				.07					.07				.07					.07			
P	<.001					<.001				<.001					<0.001				<.001					<.001			
Model 2: Geographic characteristics																											
Natural region																											
Metropolitan Lima		Ref.									Ref.									Ref.							
Rest of coast		−0.04	0.96	0.91-1.01	.153						−0.03	0.97	0.89-1.05	.401						−0.02	0.98	0.92-1.04	.503				
Highlands		−0.09	0.92	0.86-0.97	.006						−0.22	0.8	0.69-0.93	.004						−0.09	0.91	0.85-0.97	.005				
Jungle		−0.08	0.92	0.86-0.98	.006						−0.08	0.92	0.82-1.03	.166						−0.11	0.89	0.78-1.03	.122				
Area of residence																											
Urban		Ref.									Ref.									Ref.							
Rural		−0.08	0.93	0.90-0.96	<.001						−0.09	0.91	0.87-0.95	<.001						−0.03	0.97	0.93-1.02	.263				
Place of residence																											
Capital		Ref.									Ref.									Ref.							
City		−0.03	0.97	0.92-1.03	.326						−0.05	0.95	0.89-1.02	.15						−0.07	0.93	0.84-1.04	.226				
Town		−0.04	0.96	0.91-1.01	.138						−0.06	0.95	0.85-1.04	.249						−0.05	0.95	0.89-1.01	.125				
Countryside		−0.1	0.9	0.84-0.96	.001						−0.17	0.85	0.72-0.99	.032						−0.08	0.92	0.86-0.98	.011				

Table 3. (continued)

	General toothbrushing									Daily toothbrushing									Toothbrushing at least twice a day								
Variables	Null model	Unadjusted model				Adjusted model 4				Null model	Unadjusted model				Adjusted model 4				Null model	Unadjusted model				Adjusted model 4			
	Coefficient	Coefficient	PR	95% CI	P	Coefficient	aPRa	95% CI	P	Coefficient	Coefficient	PR	95% CI	P	Coefficient	aPRb	95% CI	P	Coefficient	Coefficient	PR	95% CI	P	Coefficient	aPRb	95% CI	P
Altitude																											
Less than 2500 MAMSL	Ref.		Ref.							Ref.		Ref.							Ref.		Ref.						
From 2500 MAMSL and more	-0.05		0.96	0.92-0.99	.016					-0.14		0.86	0.81-0.92	<.001					-0.04		0.96	0.91-1.02	.229				
Variance	0.1									0.1									0.1								
Intra-class correlation (ICC %)	.85									.85									.86								
P	<.001									<.001									<.001								
Model 3: Sociodemographic characteristics																											
Wealth index																											
Very poor	Ref.		Ref.							Ref.		Ref.							Ref.		Ref.						
Poor	0.09		1.09	1.05-1.14	<.001					0.08		1.08	1.02-1.14	.005					0.01		1.01	0.95-1.07	.743				
Medium	0.12		1.13	1.07-1.18	<.001					0.12		1.13	1.07-1.20	<.001					0.01		1.01	0.94-1.07	.857				
Rich	0.13		1.14	1.08-1.20	<.001					0.17		1.19	1.11-1.27	<.001					0.07		1.07	0.99-1.15	.068				
Very rich	0.15		1.17	1.10-1.24	<.001					0.23		1.26	1.16-1.37	<.001					0.09		1.09	1.02-1.17	.017				
Health insurance coverage																											
With insurance	Ref.		Ref.							Ref.		Ref.							Ref.		Ref.						
Without insurance	0.01		1.01	0.97-1.05	.686					-0.01		0.99	0.95-1.03	.652					-0.03		0.98	0.93-1.03	.327				
Sex																											
Boys	Ref.		Ref.							Ref.		Ref.							Ref.		Ref.						
Girls	0.01		1.01	0.97-1.04	.731					-0.01		0.99	0.96-1.04	.945					-0.01		0.99	0.95-1.04	.877				
Age																											
From 0 to 5years old	Ref.		Ref.							Ref.		Ref.							Ref.		Ref.						
From 6 to 11years old	0.17		1.18	1.14-1.23	<.001					0.14		1.15	1.10-1.20	<.001					0.11		1.11	1.06-1.17	<.001				
Variance	0.19	1.26								1.16	1.27								0.18	1.32							
Intra-class correlation (ICC %)	.01	.25								.07	.23								.02	.23							
P	<.001	<.001								<.001	<.001								<.001	<.001							

Abbreviations: PR, prevalence ratio; aPR, adjusted prevalence ratio; 95% CI, 95% confidence interval; P: statistical significance.
a: Adjusted by natural region, area of residence, place of residence, altitude, wealth index, sex and age. b: Adjusted by natural region, area of residence, place of residence, altitude, wealth index and age.

life. Among the findings of this research, there is evidence of the association between access to dental care and general toothbrushing, daily and at least twice daily, as well as the place of dental care with general toothbrushing, daily and at least twice daily. Research conducted by Hernández-Vásquez and Azañedo suggests that children who have not had a dental visit in the last 6 months may tend to lower levels of brushing compared to those who have had a recent dental visit. Likewise, the study in Mexican children by Vallejos-Sánchez et al mentions that those who had dental care 1 year before the study had a higher probability of frequent brushing.[12,22] These suggest that regular contact with the oral health professional reinforces healthy preventive practices such as tooth brushing.

Regarding toothbrushing, this study found that approximately 90% of the sample reported that they typically brushed their teeth; in addition, comparable results were achieved with daily practice, but the effectiveness decreased when it was considered that the activity should be performed at least twice daily. On this matter, the Peruvian Ministry of Health, through its Clinical Practice Guideline for preventing, diagnosing, and treating dental caries in children, recommends that this preventive habit be performed at least twice daily, starting from the first tooth's eruption, approximately after 6 months of age.[18] On the other hand, a national database study carried out in Iran states that the frequency of children who brush their teeth twice daily is 4 times less than those who do it once; it has also been suggested that this occurrence may be related to socio-economic and demographic factors, as well as the healthcare system that the child and their family are associated affiliated.[23] Studies conducted on the Peruvian population confirm that the frequency of toothbrushing increases with age, and this practice is widely adopted and established,[12,13] aligning with the findings of this study.

It is essential to consider that the information produced by this research covered only the year 2021, within a national context perceived as a "new social coexistence" due to the COVID-19 pandemic.[24] However, the situation experienced in the country in 2020 would have impacted different sectors of Peruvian society, including oral health. The scientific evidence developed from health emergency reports that the time since the last dental care in Peruvian children would have increased by 1.39 years, indicating that this dilation in the search for timely care would be associated with the year of the pandemic, noting that in previous years, variables such as place of dental care, natural region of residence and age already showed significant differences, but the year itself denotes greater relevance.[25] Regarding toothbrushing, it was observed that the pandemic harmed its daily practice at least twice daily, which could be explained by the complex context faced by the country due to multiple measures to contain contagions that impacted the economy and social habits of Peruvian households, so that more pressing aspects may have been prioritized, rather than a preventive habit; similarly, it was found that factors such as geographic region, area and place of residence, altitude, health insurance coverage, economic level, age, and sex were associated with brushing.[26]

Among the limitations of this research is the use of secondary information sources such as the ENDES survey, where the information collected could present inaccuracies due to self-reporting. Regarding the study design, the cross-sectional type cannot infer causality from the associations or results found. Additionally, given the nature of the survey, it is not feasible to classify individuals by months of age, only by years completed. Therefore, it was decided to include those from 0 years of age, even though they did not yet have teeth. The Peruvian Clinical Practice Guidelines on dental caries recommends starting toothbrushing at 6 months of age,[18] so it can be expected that minors do not brush their teeth. Finally, it was observed that the survey lacks sufficient variables to assess the need for access to dental care, which would allow suggesting future modifications for future versions.

Despite the abovementioned limitations, the present study provides a first understanding of the link between access to dental health services and establishing preventive habits in Peruvian children, such as tooth brushing. It is essential to recognize that access to dental care in territories with emerging economies is still fragile and scarce, even though the country has been developing strategies such as Universal Health Insurance, intending to narrow the gap between people who do not have insurance and those who for financial reasons have not been able to obtain the necessary care. The multilevel regression analysis allowed us to understand the relevance of geographical characteristics variables; although these influence toothbrushing, access to dental services is still associated. Finally, policymakers at the national level should evaluate the importance and success of the application of these hygiene habits in oral health, not limiting it to coverage indicators, which, according to the study, access to a dental health service does not provide a guarantee that individuals in vulnerable situations, such as children under 12 years old, can enjoy optimal oral health and quality care.

Conclusion

Access to dental services was positive associated with general toothbrushing, daily toothbrushing, and

toothbrushing at least twice a day. Likewise, specific covariates such as natural region, place of residence, wealth index, and age showed association with the three variables of interest; additionally, area of residence and altitude were.

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Author Contributions

All the authors were involved in study conception, data collection, data acquisition and analysis, data interpretation, manuscript writing, review and editing. All the authors read and approved the final version of the manuscript for publication.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical Policy and Institutional Review Board Statement

The study received approval of the Institutional Ethics Committee of Universidad Peruana Cayetano Heredia (CIE-UPCH) SIDISI code N° 206253.

Patient Declaration of Consent

Not applicable.

ORCID iD

María Claudia Garcés-Elías https://orcid.org/0000-0003-4873-7661

Data Availability Statement

The dataset supporting the conclusions of this article is available in the National Institute of Statistics and Informatics of Perú repository (https://proyectos.inei.gob.pe/microdatos/).

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