

# Association between access to oral hygiene information and toothbrushing among children in Peru<sup>1</sup>

## Asociación entre el acceso a la información sobre higiene oral y el cepillado dental en niños en el Perú<sup>1</sup>

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### Abstract

**Introduction:** the aim of this study was to determine the association between access to oral hygiene information and toothbrushing in children under 12 years in Peru in 2017. **Methods:** cross-sectional study of secondary data using the database of the 2017 Demographic and Family Health Survey (Encuesta Demográfica y de Salud Familiar, ENDES). The association between access to oral hygiene information and toothbrushing was estimated using multivariate regression analysis. The sample consisted of 24,076 records of children. The dependent variable was information about toothbrushing practices (daily toothbrushing, toothbrushing frequency and toothpaste use) and the independent variable was access to oral hygiene information. Covariables included sex, age, area of residence, and natural region. **Results:** the prevalence of access to oral hygiene information was 62.39%. A significant association was found between 2 of the 3 reported toothbrushing practices and access to oral hygiene information, with children under 12 years being more likely to brush teeth daily (PR = 1.03; 95% CI 1.02-1.05) and with a toothbrushing frequency 2 or more times a day (PR = 1.06; 95% CI 1.04 - 1.08) compared to children who did not receive hygiene and oral care information. The use of toothpaste was not associated with access to oral hygiene information. **Conclusion:** there was an association between daily toothbrushing, toothbrushing frequency and access to oral hygiene information in children in Peru in 2017.

**Keywords:** access to information, oral hygiene, toothbrushing, child

### Resumen

**Introducción:** el objetivo del presente estudio consistió en determinar la asociación entre el acceso a la información sobre higiene oral y el cepillado dental en niños menores de 12 años en el Perú, en el año 2017. **Métodos:** estudio transversal de datos secundarios utilizando la base de datos de la Encuesta Demográfica y de Salud Familiar (ENDES) del año 2017. Se estimó la asociación entre el acceso a la información de higiene oral y el cepillado mediante un análisis multivariado de regresión. La muestra fue conformada por 24.076 registros de niños. La variable dependiente fue la información acerca de las prácticas de cepillado dental (cepillado diario, frecuencia del cepillado y uso de la pasta dental) y la variable independiente fue el acceso a la información de higiene oral. Las covariables incluyeron sexo, edad, área de residencia y región natural. **Resultados:** la prevalencia del acceso a la información de higiene oral fue 62.39%. Se encontró asociación significativa entre 2 de las 3 prácticas de cepillado reportadas y el acceso a la información de higiene oral; los niños menores de 12 años tuvieron más probabilidades de cepillarse diariamente (PR=1.03; 95% IC 1.02-1.05), con una frecuencia de cepillado de 2 o más veces al día (PR = 1.06; 95% IC 1.04-1.08), en comparación con niños que no recibieron información de higiene y cuidado oral. El uso de pasta dental no estuvo asociado al acceso a la información de higiene oral. **Conclusión:** existe asociación entre el cepillado diario, la frecuencia del cepillado y el acceso a la información sobre higiene oral en niños del Perú en 2017.

**Palabras clave:** acceso a la información, higiene bucal, cepillado dental, niño

Submitted: April 2/2020 - Accepted: April 27/2020



**How to quote this article:** Avalos-Baltodano K, Tomairo-Agapito J, Villar-Zapata JC, León-Manco RA, Carbajal-Rodríguez G. Association between access to oral hygiene information and toothbrushing among children in Peru. Rev Fac Odontol Univ Antioq. 2020; 32(1): 57-66. <http://dx.doi.org/10.17533/udea.rfo.v32n1a6>

## INTRODUCTION

Caries is a multifactorial disease considered as a public health problem due to its high prevalence. In permanent teeth, untreated caries is the most prevalent condition worldwide, while it ranks tenth in deciduous teeth.<sup>1</sup> In Peru, the prevalence of dental caries in children under 11 years of age is 85% and in children aged 3 to 5 years it is 76%, according to studies conducted by Peru's Ministry of Health.<sup>2</sup> This condition may affect the quality of life of individuals, representing an extra expense for families and health systems.<sup>3,4,5</sup> There are preventive measures for the onset of dental caries, with fluoride being frequently used due to its high effectiveness. Fluoride is most commonly present in toothpastes.<sup>2,3,5,6</sup> Decreasing the prevalence of cavities also requires changes among the population, with good habits and behaviors, which should be developed throughout life.<sup>2,7</sup>

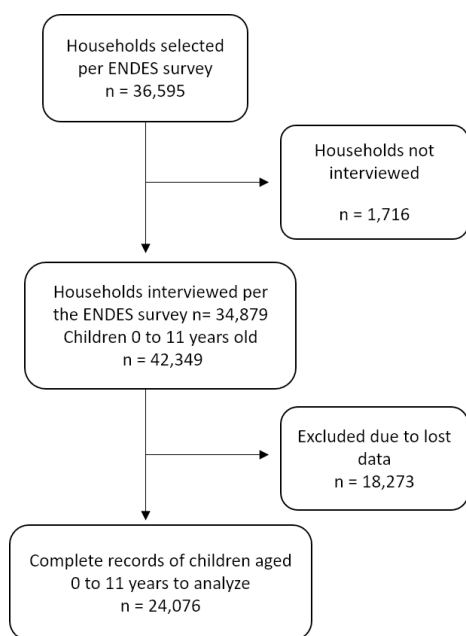
It is important for health promotion policies to implement strategies to promote oral hygiene habits both individually and collectively.<sup>5</sup> To this end, public and private institutions should provide information in an appropriate and easily accessible manner.<sup>8,9</sup> One of the most important habits is toothbrushing, which main objective is to eliminate and prevent the development of bacterial plaque in dental areas. It should be done daily and at least twice a day, with a toothpaste of  $\geq 1000$  ppm of fluoride.<sup>2,6</sup> It is recommended to start tooth brushing by the age of 6 months, with the eruption of the first tooth.<sup>6</sup> Research has found that

toothbrushing frequency is related to factors such as age and socioeconomic position.<sup>10,11</sup>

Due to the importance of toothbrushing for good oral health and the acquisition of knowledge for an adequate oral hygiene practice, the objective of this study was to determine the impact of access to oral care and hygiene information on toothbrushing practices in children under 12 years of age in Peru in 2017. The results will support decision-making for new strategies for the promotion and prevention of oral health.

## METHODS

This cross-sectional study used data from the 2017 National Survey on Demographics and Family Health (Encuesta Nacional en Demografía y Salud Familiar, ENDES). ENDES collects data through household interviews about socioeconomic and demographic characteristics, health status, risk factors, and access to health services. Originally, 36,595 households were selected, with a non-response rate of 2.2% and 34,879 households interviewed. For the study population, the database was analyzed, showing 42,349 records of children aged 0 to 11 years, including dental care data and oral hygiene information.<sup>12</sup> Records with complete data were included, removing those that did not have all the information related to the study's variables. 18,273 records were excluded (16,103 cases in the independent variable and 2,170 in all other variables) for a final sample of 24,076 children (Figure 1).



**Figure 1.** Flowchart defining the study sample

Source: by the authors

The database on the National Institute for Statistics and Informatics' (Instituto Nacional de Estadística e Informática, INEI) website was accessed. The information was available in modules, and those that showed the variables of interest were accessed and merged into a single database. Three dependent variables comprising the reported toothbrushing practices were considered: daily toothbrushing (yes/no), frequency of toothbrushing (1 time a day/2 or more times a day) and use of toothpaste (yes/no). The independent variable was access to information on oral care and hygiene of teeth, tongue, and mouth (yes/no). The covariables included: provider of information on oral care and hygiene, which was recategorized into 7 categories: MINSA (Peru's Ministry of Health or *Ministerio de Salud*), EsSalud (Peru's Social Security agency), Armed Forces and Police Forces (known in Peru as FF. AA. and FF. PP.), Private sector, Mass Media, Educational Institutions and No Information. Other covariables

included as possible confounding factors were sex (male/female); age presented as quantitative variable, which was grouped and presented as a dichotomous variable: 0 to 5 years and 6 to 11 years, taking into account an approximate age of dental replacement, i.e. deciduous dentition and mixed teething; natural region (Lima Metropolitan Area, Coast, Highlands, and Jungle), and area of residence (urban and rural).

The descriptive analysis was run by obtaining absolute and relative frequencies, followed by an analysis using the Chi-square and Chi-square linear trend test with 95% CI to observe the associations of brushing practices with other variables. The association between brushing practices and access to oral care and hygiene information was measured with generalized models (Poisson), using one crude and one adjusted model for all covariables. Since the practice of toothbrushing is a prevalent condition, prevalence ratio (PR) was reported as an association measure. The study had a 95% confidence interval and a  $p < 0.05$ . The statistical program STATA SE/15.1 was used. Data analysis incorporated the survey design. Sampling patterns were specified as stratification, primary sampling unit and weights, to obtain representative estimates.

The study was approved by the Institutional Ethics Committee of the Universidad Peruana Cayetano Heredia on March 6, 2019. ENDES has a publicly accessible database and the identification of participants is encrypted to ensure confidentiality.

## RESULTS

The results obtained in surveys about toothbrushing practices show that 86.8% of children and/or their parents reported

they brush their teeth daily. Regarding daily toothbrushing frequency, 42.5% reported they brush their teeth 2 times a day, a similar percentage (42.4%) indicated that they brush 3 to more times a day, and 15.2% only 1 time a day. Most respondents (98.5%) reported using toothpaste while brushing. 62.4% of children reported access to oral health and hygiene information. Regarding providers of oral health information, the public sector

was the main provider with MINSA (32.1%) and EsSalud (7.2%), followed by the private sector with 11.4%. Concerning demographic characteristics, there was a predominance of males with 51.1% and the 6-11-year-old group with 63.6%. As for natural region, Lima Metropolitan area showed the highest concentration with 31.7% and the urban area accounted for 75.8% of the sample (Table 1).

**Table 1.** Sample characteristics

Variable	n	%
<b>Received information on oral hygiene</b>		
Yes	14,679	62.4
No	9,397	37.6
<b>Source of information</b>		
No information received	9,397	37.6
MINSA	8,659	32.1
ESSALUD	1,559	7.2
FF. AA. and FF. PP.	41	0.2
Private sector	1,935	11.4
Mass Media	1,213	5.8
Institutional education	1,272	5.8
<b>How many times a day</b>		
1 time a day	3,329	15.2
2 times a day	7,805	42.50
3 or more times a day	7,606	42.4
<b>Use of toothpaste when brushing</b>		
No	421	1.5
Yes	2,1746	98.5
<b>Sex</b>		
Male	12,200	51.1
Female	11,876	48.9
<b>Age</b>		
0-5 years	11,137	36.4
6-11 years	12,939	63.6
<b>Natural region</b>		
Metropolitan Lima	2,604	31.7
Coast	7,397	25.4
Highlands	7,823	27.5
Jungle	6,252	15.4
<b>Area of residence</b>		
Urban	16,775	75.8
Rural	7,301	24.2

n: Absolute frequency

%; Proportion with weights

Source: by the authors

The bivariate analysis showed that all associations were significant ( $p < 0.001$ ) in evaluating daily toothbrushing against other variables: getting oral health and hygiene information, providers of oral hygiene information, age, natural region, and area of residence, with the exception of gender. When analyzing toothbrushing frequency

against all variables, it was found that the associations were statistically significant ( $p < 0.05$ ). Regarding to the for association of the use of toothpaste while brushing with all variables, these were not significant except for age ( $p < 0.001$ ), finding out that 87.8% of children aged 0-5 years did not use toothpaste when brushing (Table 2).

**Table 2.** Analysis of toothbrushing against the study variables

	DAILY TOOTHBRUSHING					TOOTHBRUSHING FREQUENCY						USE OF TOOTH PASTE					
	No		Yes		<i>p</i>	1 time a day		2 times a day		3 or more times		No		Yes		<i>p</i>	
	N	%	N	%		N	%	N	%	N	%	N	%	N	%		
<b>Received oral hygiene information</b>																	
No	1,362	41.42	6,941	35.73	<0.001	1,469	43.02	2,910	36.08	2,562	32.77	<0.001	160	40.43	8,143	36.42	0.216
Yes	2065	58.58	11,799	64.27		1,860	56.98	4,895	63.92	5,044	67.22		261	59.56	13,603	63.57	
<b>Oral hygiene information providers</b>																	
Didn't receive information	1,362	41.41	6,941	35.73	<0.001	1,469	43.01	2,910	36.08	2,562	32.77	<0.001	160	40.43	8,143	36.42	0.203
MINSA	1,343	33.83	6,729	32.01		1,087	29.33	2,671	30.43	2,971	34.54		146	30.71	7,926	32.27	
EsSalud	176	5.69	1,312	7.55		194	6.16	541	7.08	577	8.52		37	7.33	1,451	7.31	
FF. AA. and FF. PP.	2	0.05	38	0.25		1	0.0	15	0.2	22	0.4		0.0	0.0	40	0.23	
Private Sector	194	7.79	1,676	12.33		235	9.6	756	13.14	685	12.48		42	10.56	1,828	11.75	
Mass Media	189	5.95	946	5.88		179	6.47	429	6.43	338	5.13		27	8.68	1,108	5.86	
Educational Institutions	161	5.24	1,098	6.22		164	5.39	483	6.61	451	6.13		9	2.28	1,250	6.15	
<b>Sex</b>																	
Male	1,754	51.18	9,449	51.02	0.9073	1,733	52.11	4,007	52.529	3,709	49.12	0.014	218	49.89	10,985	51.06	0.73
Female	1,673	48.82	9,291	48.976		1,596	47.88	3,798	47.47	3,897	50.87		203	50.1	10,761	48.93	
<b>Age</b>																	
0-5 years	1,924	45.99	7,488	31.54	<0.001	1,604	38.2	3,211	32.73	2,673	27.96	<0.001	384	87.79	9,028	32,636	<0.001
6-11 years	1,503	54.01	11,252	68.46		1,725	61.79	4,594	67.26	4,933	72.03		37	12.2	12,718	67.36	
<b>Natural region</b>																	
Metropolitan Lima	287	25.76	2,160	33.15	<0.001	306	28.4	914	33.34	940	34.66	0.001	44	30.6	2,403	32.2	0.081
Rest of Coast	836	20.06	6,003	26.16		988	23.49	2,572	26.35	2,443	26.92		162	32.11	6,677	25.26	
Highlands	1,680	42.79	5,460	24.89		1,151	32.37	2,211	25.39	2,098	21.71		154	31.06	6,986	27.19	
Jungle	624	11.38	5,117	15.79		884	15.73	2,108	14.9	2,125	16.7		61	6.22	5,680	15.34	
<b>Area of residence</b>																	
Urban	2,157	68.39	13,442	77.77	<0.001	2,266	73.25	5,792	79.19	5,384	77.96	0.012	323	80.35	15,276	76.47	0.134
Rural	127	31.61	5,298	22.23		1,063	26.74	2,013	20.81	2,222	22.03		98	19.64	6,470	23.52	

N: Absolute frequency

*P*-value: The  $\chi^2$  and  $\chi^2$  linear trend test was used

\* FF. AA. and FF. PP. were not considered to assess association

%: Proportions with weights

Source: by the authors

The multivariate analysis showed that, in analyzing the relationship between daily brushing information and access to oral hygiene information in the crude model, children who received oral hygiene information were 3% more likely to brush their teeth daily (95% CI 1.02-1.05;  $p < 0.001$ ). In the final model, after adjusting for the covariables, the estimates remained, finding out that children who received information were 4% more likely to brush their teeth daily (95% CI 1.02-1.06;  $p < 0.001$ ), compared to children who did not receive oral hygiene information. The analysis of association of brushing frequency and access to oral hygiene information in the unadjusted model showed that children who received information were 6% more likely to brush their teeth 2 or more times a day (95% CI 1.04-1.08;  $p < 0.001$ ),

compared with children who did not receive oral hygiene information. In the final model, after adjusting by covariables, the estimates remained virtually unchanged. No statistically significant association was found in the crude model (95% CI 1.00-1.01;  $p = 0.238$ ) nor in the adjusted model (95% CI 1.00-1.01;  $p = 0.187$ ) among children who received oral hygiene information and use toothpaste while brushing. When evaluating all the associations analyzed in the final models, sex was not a significant variable, while age was significant, with the older group most likely to practice brushing compared to the younger age group ( $p < 0.001$ ). In addition, the Highlands region and the rural area were less likely to brush daily and have a lower frequency of brushing compared to Metropolitan Lima and the urban area (Table 3).

**Table 3.** Multivariate analysis using Poisson models

Variable	DAILY TOOTHBRUSHING			TOOTHBRUSHING FREQUENCY			USE OF TOOTHPASTE		
	Model 1 Crude		Model 2 Adjusted	Model 1 Crude		Model 2 Adjusted	Model 1 Crude		Model 2 Adjusted
	PR	95% CI	p	PR	95% CI	p	PR	95% CI	p
<b>Received oral hygiene information</b>									
No	Ref.			Ref.			Ref.		
Yes	1.03	1.02-1.05	<0.001	1.04	1.02-1.06	<0.001	1.06	1.04 - 1.08	<0.001
<b>Sex</b>									
Male				Ref.			Ref.		
Female				1	0.99-1.01	0.916			
<b>Age</b>									
0-5 years				Ref.			Ref.		
6-11 years				1.1	1.08-1.11	<0.001			
<b>Natural Region</b>									
Metropolitan Lima				Ref.			Ref.		
Coast				1	0.99-1.03	0.513			
Highlands				0.9	0.88-0.92	<0.001			
Jungle				1.02	1-1.04	0.049			
<b>Area of residence</b>									
Urban				Ref.			Ref.		
Rural				0.96	0.95-0.98	<0.001			

Source: by the authors

## DISCUSSION

The findings of the present study showed a significant association between daily toothbrushing and frequency of brushing with access to oral care and hygiene information in children under the age of 12 in Peru. It is worth noting that the extent of this association may be considered as either irrelevant or strong because of the obtained results (4% and 6% more compared to their counterparts). This result might suggest that other factors not included in this analysis, in addition to oral hygiene information, may be more relevant for the practice of toothbrushing. The literature shows that the Social Determinants of Health (SDOH), specifically the structural ones, such as socioeconomic conditions and public policies, can influence intermediate determinants such as personal habits and lifestyles.<sup>13</sup> It is therefore necessary to focus on the SDOH as it is fundamental to achieve a substantial change. However, health education cannot be neglected. The acquisition of knowledge on the improvement of oral health depends to a large extent on the programs, institutions and health policies produced.<sup>14</sup> One of the basics for the prevention of tooth decay is oral hygiene, which includes proper toothbrushing accompanied by the proper use of toothpaste as it contains fluoride. All this oral care and hygiene information can be acquired from various sources, but the literature shows that it is mainly acquired through the dental professional,<sup>10</sup> as shown in the present study.

According to the data from this study, the prevalence of access to oral hygiene information in children under 12 years of age was 62.4%. Villavicencio-Montenegro and León-Manco conducted a research

project with ENDES between 2013 and 2016, reporting that access to oral care and hygiene information increased over the years, being 61.7% for the last year of their study; our findings in 2017 show a slight increase.<sup>15</sup> Caldeira et al found that schoolchildren who received information on how to avoid oral problems had optimal oral health behaviors.<sup>16</sup> Similarly the present study showed that children who received oral hygiene information were more likely to brush their teeth, compared to children who did not receive such information. This study found that the main providers of oral health information were public sector institutions: MINSA with the highest coverage percentage (32.1%), followed by EsSalud with 7.2% and Armed and Police Forces with 0.2%, while the private sector accounted for 11.4%. On the contrary, a study conducted in Brazil found that the main provider of information was the private sector.<sup>14</sup> Both studies and others conducted in Europe show that the main provider of hygiene and oral care information is the dental professional.<sup>10</sup>

The frequency of toothbrushing is an important component. The literature recommends brushing at least twice a day using a fluoridated toothpaste  $\geq 1000$  ppm.<sup>2,7</sup> In this study, brushing 2 or more times a day was more prevalent than brushing once a day. A research project in Brazil in 12-year-olds found similar results. In the present study, children who received oral hygiene information were 6% more likely to brush their teeth 2 or more times a day; this could be due to the fact that several years ago Peru released a technical standard which emphasizes that toothbrushing should be performed 2 or more times a day, and this is the information currently being provided.<sup>2</sup> Most interviewees reported using toothpaste when brushing their teeth. No statistically significant association was

found between children who received oral care and hygiene information and the use of toothpaste while brushing, suggesting that its use may be associated with simple repetition of behaviors or habits, or also that people infer its use when brushing their teeth.

In adjusting by covariables, age was the only significant variable, finding out that the use of toothpaste while brushing was less prevalent in children aged 0-5 years. The MINSA's "Clinical Practice Guideline for the Prevention, Diagnosis and Treatment of Tooth Decay in Children" ("Guía de práctica clínica para la prevención, diagnóstico y tratamiento de la caries dental en niñas y niños") differentiates the amount of toothpaste by children, emphasizing that, in kids under 3 years of age, it should be the size of a "grain of rice", while in kids over 3 years of age it should be the size of a "pea".<sup>2,7</sup> However, the literature is scarce regarding the start of brushing with toothpaste. The evidence shows that the sooner the brushing and use of toothpaste starts, the less likely tooth decay will occur. Toothbrushing that starts before the age of one year keeps 88% of children free from carious lesions, while starting after age 2 keeps only 66% of children free of carious lesions.<sup>17,18,19</sup> The same database of the 2017 ENDES survey shows that 35.9% of children in their first year of life had visited a dental service (results not shown). Some findings agree with these results, such as those by Schwendler et al in Brazil, where educational actions aimed at the population receiving Primary Health Care were prioritized, with 35% having their first visit during the first year of life,<sup>20</sup> similar to the situation in Peru. By contrast, a population study in the UK found that 57% of children under the age of 1 visited a dentist,<sup>9</sup> a situation that contrasts with that of Latin America, where less

access to health services, fewer resources, more social inequities, and less emphasis on prevention and more on treatment delay the first visit to the dental professional, thus reducing the access to health care and oral hygiene information.

To the authors' knowledge, this is the first national study that evaluates the association of access to oral care and hygiene information with toothbrushing practices. New and useful information was offered to public health policymakers. However, the study had certain limitations, as a large proportion of data was lost due to incomplete information on the variables of interest. Nevertheless, being a national survey, with stratification and weights, the information is reliable, of quality, and representative of the population. The present study is highly important because it shows Peru's reality regarding access to information on oral care and hygiene and the reported information on toothbrushing practices in children under the age of 12, showing a significant association even after adjusting for possible confounding factors.

It is critical for children to receive dental care during the eruption of the first deciduous tooth following the MINSA's recommendations, because it serves as an opportunity to evaluate the eating habits and risk factors children may be exposed to;<sup>21</sup> in addition, there is a wealth of information that they can receive from their parents to contribute to the prevention of oral diseases and the development of proper oral hygiene habits. A correct approach to national oral health policies is recommended to improve access to information by parents of children in deciduous teeth. It is also recommended for future studies on access to information and toothbrushing in children to take into account the socioeconomic position when



evaluating these variables, in order to determine its impact.

## CONCLUSIONS

It can be concluded that there was an association between access to oral hygiene information and daily toothbrushing and brushing frequency in children under 12 years of age in Peru in 2017, even after adjusting for possible confounding factors such as age, sex, natural region, and area of residence, with children aged 6 to 11 and living in the urban area being the ones who most practice dental brushing and at an appropriate frequency. However, no association was found between access

to oral hygiene information and use of toothpaste while brushing.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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