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Access to oral health services in children under twelve years of age in Peru, 2014

Acceso a servicios de salud dental en menores de doce años en Perú, 2014

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ABSTRACT The aim of the study was to explore the patterns of dental health services access in children under twelve years of age in Peru. Data from 25,285 children under 12 years who participated in the Demographic and Family Health Survey of 2014 were reviewed. An exploratory spatial analysis was performed to project the proportions of children with access to dental health services, according to national regions, type of health service and urban or rural place of residence. The results show that of the total sample, 26.7% had access to dental health services in the last six months, 39.6% belonged to the age group 0-4 years, 40.6% lived in the Andean region and 58.3% lived in urban areas. The regions of Huancavelica, Apurimac, Ayacucho, Lima and Pasco had the highest percentages of access nationwide. In conclusion, there is low access to dental health services in the population under 12 years of age in Peru. The spatial distribution of access to dental health services allows regions to be identified and grouped according to similar access patterns, in order to better focus public health actions.

KEY WORDS Geographic Information Systems; Health Services Accessibility; Oral Health; Dental Care for Children; Peru.

RESUMEN El objetivo del estudio fue explorar los patrones de acceso a servicios de salud dental en menores de doce años en Perú. Se revisaron datos de 25.285 niños menores de 12 años que participaron en la Encuesta Demográfica y de Salud Familiar 2014. Se realizó un análisis exploratorio espacial para proyectar las proporciones de menores con acceso a servicios de salud dental según regiones a nivel nacional, tipo de servicio de salud y lugar de residencia urbana o rural. Los resultados muestran que el 26,7% de la muestra tuvo acceso a los servicios de salud dental en los últimos seis meses. El 39,6% pertenecía al grupo etario de 0 a 4 años, el 40,6% habitaba en la zona andina y un 58,3% residía en zonas urbanas. Las regiones de Huancavelica, Apurímac, Ayacucho, Lima y Pasco tuvieron los mayores porcentajes de población que accedió a servicios de salud dental a nivel nacional. En conclusión, existe un bajo acceso a los servicios de salud dental para la población menor de 12 años en Perú. La distribución espacial del acceso a los servicios de salud dental permitiría identificar y agrupar regiones según patrones comunes de acceso para enfocar acciones en materia de salud pública.

PALABRAS CLAVES Sistemas de Información Geográfica; Accesibilidad a los Servicios de Salud; Salud Bucal; Atención Dental para Niños; Perú.

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INTRODUCTION

Dental caries is the most prevalent condition among oral diseases and is very common in pediatric age.[1] Non-treatment of this and other oral conditions may have physical, psychological, nutritional, and economic consequences and even consequences on the systemic health of the person who suffers from them.[2,3] In Peru, the prevalence of dental caries has been estimated in 90.4% of the school population under the age of 15, which places the country in a disadvantaged position with respect to children's oral health in neighboring countries such as Venezuela and Colombia.[4,5] The American Academy of Pediatric Dentistry (AAPD) recommends at least one visit to the dentist's office every six months to maintain good oral health through exams and preventive methods.[6] However, such appointments should be based on the dental caries risk of each child becoming monthly visits for high-risk children.[7]

Despite the fact that over the years international health agencies have recommended the prevention of dental caries as the best strategy to reduce their prevalence, the scientific production in oral health at the global level devotes little attention to public health issues from a preventive-promotional approach and mostly focuses on restorative dentistry.[8,9]

In Peru, since 2013, the National Institute of Statistics and Informatics (INEI) [*Instituto Nacional de Estadística e Informática*] has included in the health questionnaire of the Demographic and Family Health Survey (ENDES) [*Encuesta Demográfica y de Salud Familiar*] certain aspects related to oral health. One of them is access to dental health services at certain stages of life, which represents a great opportunity to assess the current oral health scenario based on adequate data analysis.

Low access to dental health care is a major public health concern in most developing countries, and it is more pronounced in vulnerable groups and at extreme ages of life.[10] Adequate care coverage in dental services is essential for the application of preventive measures and oral treatments. However, the countries with a marked geographic and socioeconomic diversity present significant territorial inequalities in oral health indicators of the population.[11,12] Specifically, in Peru, the fragmented health system exacerbates such inequalities, which is why it is relevant to improve access to dental health care in order to apply the various cost-effective strategies for reducing caries.[13,14,15,16,17]

The improvement of oral health in Peruvian children would depend, to a certain extent, on a rethinking of health programs and policies that promote access to dental health services according to the group of the population to which they are directed.[18,19] In this sense, being acquainted with the regional distribution of this health concern would make possible a better understanding of the facts causing it and help to make decisions,[20] which would facilitate the formulation and implementation of public policies according to the national health reality.[21]

Currently, geographic information systems (GIS) are applied to health research studies with a spatial or territorial perspective.[22,23] However, in Peru, relevant research studies in oral health issues that incorporate these tools have not yet been developed. For these reasons, the aim of this study was to explore the access patterns to dental health services in children under twelve years of age in Peru.

MATERIALS AND METHODS

Research design

Using data from a national survey, an analysis taking as the area of study the 25 regions of Peru was conducted to evaluate the access to dental health services, which we define as *having received at least one dental visit in the last six months*. The results of the analysis were represented by thematic maps of each of the regions grouped by quantiles, with each of the variables studied.

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Area of study

According to the World Bank, the Peruvian population by 2014 was approximately 30 million inhabitants and, by 2013, the total health expenditure was around 5.3% of gross domestic product.[24] In Peru, after a process of decentralization, the territory was divided geopolitically in 25 regions that are distributed in three natural regions: the Coast, with its vicinity to the Pacific Ocean, the Andean region, which is circumscribed to the Andes mountain range, and the Amazon, with its tropics (Figure 1)

Similarly, the Peruvian health system is characterized by being one of the most fragmented systems in Latin America, with four subsystems: the public subsystem, which subsidizes health services to the population with the lowest-income and has establishments located even in the small communities; the social security system (EsSalud), which provides services to formal workers and their dependents, whose most distant establishments are in the capital cities of the provinces; the health sector of the armed and police forces; and the private sector, for those willing to pay directly for the service or to a private insurance company.[25,26] Thanks to the creation of Comprehensive Health Insurance and the enactment of the Universal Insurance Act, 66% of the population is affiliated with public health insurance and is treated in public health facilities that report to the Ministry of Health (MINSA).[27]

Figure 1. Geopolitical division of Peru consisting of 25 regions and each of the three natural regions they belong to.

Source: Own elaboration based on the regional cartography of the Ministry of Environment of Peru (MINAM).

According to the estimates of the National Institute of Statistics and Informatics (INEI) [*Instituto Nacional de Estadística e Informática*], in Peru, there are 6,952,948 children under the age of 12 (3,545,273 girls and 3,407,675 boys), 84.5% of whom are affiliated with some health insurance, 56.9% to Comprehensive Health Insurance, 22.7% to EsSalud social insurance and 4.9% to other types of insurance.[28]

Sources of Information

The source of information used in this study is the Demographic and Family Health Survey - ENDES 2014, which was developed by the National Institute of Statistics and Informatics (INEI) [*Instituto Nacional de Estadística e Informática*]. The survey was conducted in the 25 regions of Peru and the results obtained represent the whole region. Sampling is two-stage, probabilistic and independent, self-weighted at a regional level and by rural and urban areas. The sample size of ENDES 2014 was 29,806 households, of which 18,382 correspond to the urban area and 11,424 to the rural area, so that these estimates are representative at national, urban and rural levels, in the natural regions (Coast, Andean region and Amazon) and in each of the 25 regions. The surveyed

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target population included children from 0 to 11 years of age; therefore, after excluding missing data, a sample of 25,285 children under 12 years of age was included in both urban and rural areas of the 25 regions that make up the Peruvian territory.

Data analysis

The methodological design used for data analysis was divided into two phases: the first, a quantitative, descriptive, and cross-sectional analysis of the survey modules, obtained from the INEI web portal, which were imported into the Stata 14.1 statistical software. After the database was imported, the survey sampling was specified, which included the weights according to strata, expansion factors, and design effect using the *svy* command.

The variables included in the analysis were: has the child ever received dental care (qs803), when was the last time the child received dental care (qs804c), age (qs802d), regions (hv024), dental care venue location (qs805) and place of residence (hv025). Another variable included was *dental care in the last six months,* which stemmed from the variables, *has the child ever received dental care* and *when was the last time the child received dental care service*. This phase made possible the processing of the survey to obtain absolute frequencies, medians and proportions with 95% confidence intervals for each of the categories (age groups, area of residence, natural regions, dental care venue location, and regions) that were included in a Microsoft Excel® spreadsheet, version 2013.

The second phase consisted of an exploratory spatial analysis of the regional proportions of children having limited access to dental health services according to the regions at the national level, type of health service and place of residence using the layers in ArcGIS for Desktop software version 10.4. For this purpose, a map with the regional boundaries was obtained from the website of the Ministry of the Environment (MINAM) of Peru, in shapefile format under the WGS 1984 UTM Zone 17S coordinate system. In order to obtain a better visualization of the thematic maps, the 25 regions were grouped into five categories, according to quintiles, the blue category was the one with the lowest access proportion.

Ethical Considerations

This study did not require the approval of an ethics committee because it is a secondary analysis of a survey in which the data is freely accessible and readily available to the public and does not permit the identification of the minors who participated in the survey.

RESULTS

Of the total sample of children under twelve included in ENDES 2014, 39.6% belonged to the 0 to 4 year-age group, 40.6% lived in the Andean region and 58.3% lived in urban areas (Table 1).

A percentage of 26.7% [95%CI (26.2; 27.3)] had access to dental health services in the last six months. Access to dental care was lower in children from 0 to 4 years of age, accounting for 18.3% [95%CI (17.5; 19.0)] and 22.3% in children from the rural area [95%CI (21.6, 23.2)]. Of the children between 5 to 11 years, 32.3% had access to dental health services (Table 1).

The regions of Huancavelica, Apurímac, Ayacucho, Pasco (all of them in the central Andean region) and Lima (central coast) were the ones that had the largest number of children under twelve years of age with access to dental services. Table 1 of this research study shows that the highest percentage of the population who had access to dental health services was 45.9% in Huancavelica, and the lowest was 13.5% in Ucayali (in the south of the Amazon region). Figure 2 shows the spatial distribution of individuals who had access to dental health services. It can be seen that of the 25 regions that make up the Peruvian territory, there was

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Table 1. General characteristics of children under 12 years of age who had access to dental health services in the last six months (n = 25,285).

Characteristics	Number of minors included in the survey		Numbers and percentage of minors with access to dental health services		
	n	%	n	%	95% CI
Age groups					
0 - 4 years	10,016	39.6	1,828	18.3	17.5; 19.0
5 - 11 years	15,269	6.4	4,934	32.3	31.6; 33.1
Area of residence					
Urban	14,739	58.3	4,405	29.9	29.2; 30.6
Rural	10,546	41.7	2,357	22.3	21.6; 23.2
Natural Region					
Cost	9,471	37.5	2,638	27.9	27.0; 28.8
Andean region	10,267	40.6	3,089	30.1	29.2; 31.0
Amazon	5,547	21.9	1,035	18.7	17.6; 19.7
Institution of access[1]					
Ministry of Health	-	-	3,681	54.4	53.2; 55.6
EsSalud	-	-	1,068	15.8	14.9; 16.7
Privados	-	-	1,820	26.9	25.9; 28.0
Regions					
Amazonas	1,035	4.1	189	18.3	16.0; 20.8
Ancash	1,145	4.5	224	19.6	17.3; 22.0
Apurímac	899	3.6	378	42,0	38.8; 45.4
Arequipa	794	3.1	250	31.5	28.3; 34.8
Ayacucho	972	3.8	370	38.1	35.0; 41.2
Cajamarca	963	3.8	215	22.3	19.7; 25.1
Callao	783	3.1	240	30.7	27.4; 34.0
Cusco	844	3.3	230	27.3	24.3; 30.4
Huancavelica	850	3.4	390	45.9	42.5; 49.3
Huánuco	993	3.9	270	27.2	24.4; 30.1
Ica	922	3.6	276	29.9	27.0; 33.0
Junín	840	3.3	234	27.9	24.8; 31.0
La Libertad	970	3.8	220	22.7	20.1; 25.4
Lambayeque	889	3.5	170	19.1	16.6; 21.9
Lima	2,616	10.3	954	36.5	34.6; 38.3
Loreto	1,364	5.4	224	16.4	14.5; 18.5
Madre de Dios	939	3.7	258	27.5	24.6; 30.5
Moquegua	609	2.4	188	30.9	27.2; 34.7
Pasco	983	3.9	346	35.2	32.2; 38.3
Piura	1,189	4.7	191	16.1	14.0; 18.3
Puno	984	3.9	182	18.5	16.1; 21.1
San Martín	1,016	4.0	203	20.0	17.6; 22.6
Tacna	647	2.6	215	33.2	29.6; 37.0
Tumbes	846	3.3	184	21.7	19.0; 24.7
Ucayali	1,193	4.7	161	13.5	11.6; 15.6

Source: Own elaboration based on the Demographic and Family Health Survey - ENDES 2014.
[1]n = 6.762.
95%CI = 95% confidence interval.

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greater access in Huancavelica, Apurímac, Ayacucho and Pasco, which belong to the central area of Peru. Similarly, Lima, the capital of the country, had a percentage of population with access to dental health services of 36.5%, being the only region of the coast within the quintile of regions with greater access in our research study. The general percentages of the population who had access to dental health services per natural regions were higher in the coast and mountain range regions of Peru, with 27.9% [95% CI (27.0, 28.8)] and 30.1% [95% CI 29.2, 31.0)] respectively. At the coast level, the highest percentage of population with access to dental health services was observed in Lima, Tacna, Arequipa, Moquegua and Callao whereas the Amazon was the region with the lowest percentage with only 18.7% [95% CI (17.6, 19.7)] (Table 1).

In general, the percentage of population under the age of twelve who had access to dental services through the Ministry of Health (MINSA), through EsSalud and through private services at a national level was 54.4% [95% CI (53.2; 55.6)], 15.8% [95% CI (14.9; 16.7)] and 26.9% [95% CI (25.9; 28.0)] respectively. However, when the rates of access for type of service per regions were estimated, the highest rate of access to dental health care service through MINSA was found in Huancavelica, Apurímac, Huánuco, Ayacucho and Cajamarca; and the lowest rate was found in Lambayeque, Lima, Ica, Arequipa and Moquegua. With regard to the health care through EsSalud, the regions of Madre de Dios, Pasco, Moquegua, Lambayeque and Tumbes had the highest rate of access, while the lowest rate was found in Huánuco, Huancavelica, Ayacucho, Apurímac and Puno. The highest rate of access to private dental health services was found in the coastal regions of Lambayeque, La Libertad, Lima, Ica and Arequipa, while Huancavelica, Apurímac, Pasco, Huánuco and Loreto had the lowest rate (Figure 3).

Figure 3 shows that the lowest percentages of the population having access to dental health services through MINSA, EsSalud and private services were 25.3%, 5.9% and 5.4%, respectively. Thus, the percentage difference between MINSA and EsSalud was 19.4% and the percentage difference between MINSA and private services was 19.9%. Moreover, a difference of 0.5% was observed between EsSalud and private services. The highest percentage of children under the age of twelve who had access to dental health services were the followings: for MINSA, 88.7%; for EsSalud, 33.6%; and for the private services, 54%, having percentage differences of 55.1% between MINSA and EsSalud, and of 34.7% between MINSA and private services.

Figure 2. Percentage of children under the age of twelve who had access to dental health services per regions. Peru, 2014.

Source: Own elaboration based on Demographic and Family Health Survey (ENDES) of 2014 and on the regional cartography of the Ministry of Environment of Peru (MINAM)

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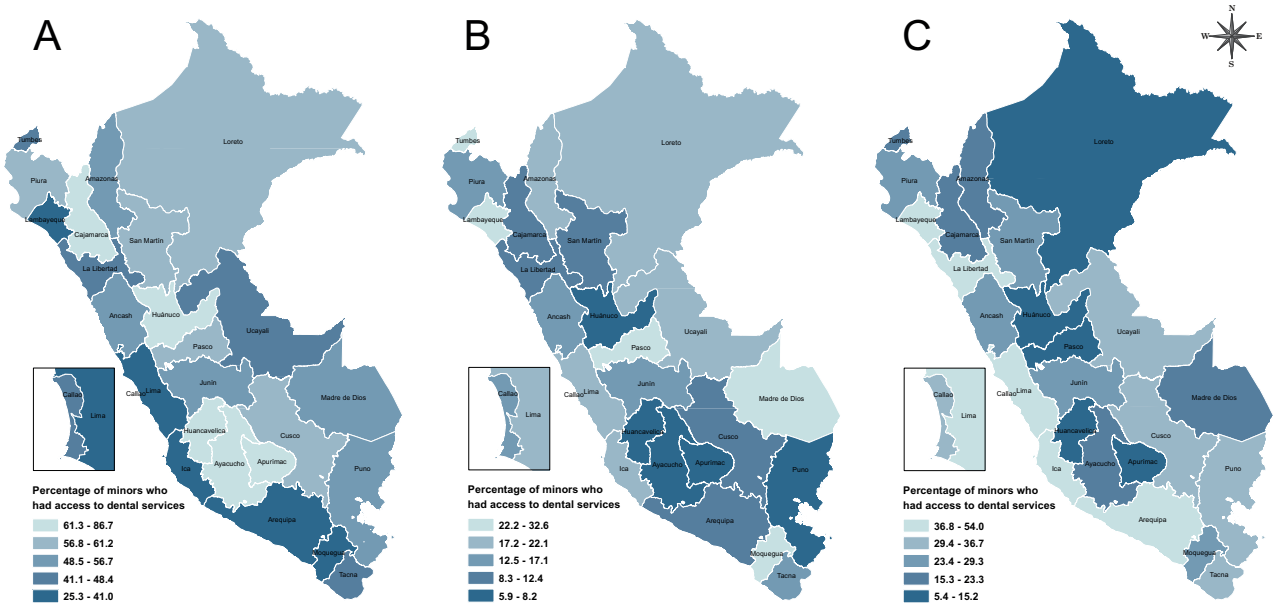

Figure 3. Percentage of children under the age of twelve who had access to dental health services according to type of services and regions. Peru, 2014.

Source: Own elaboration based on Demographic and Family Health Survey (ENDES) of 2014 and on regional cartography of the Ministry of Environment of Peru (MINAM).
A. Ministry of Health (public)
B. EsSalud (social security)
C. Private services.

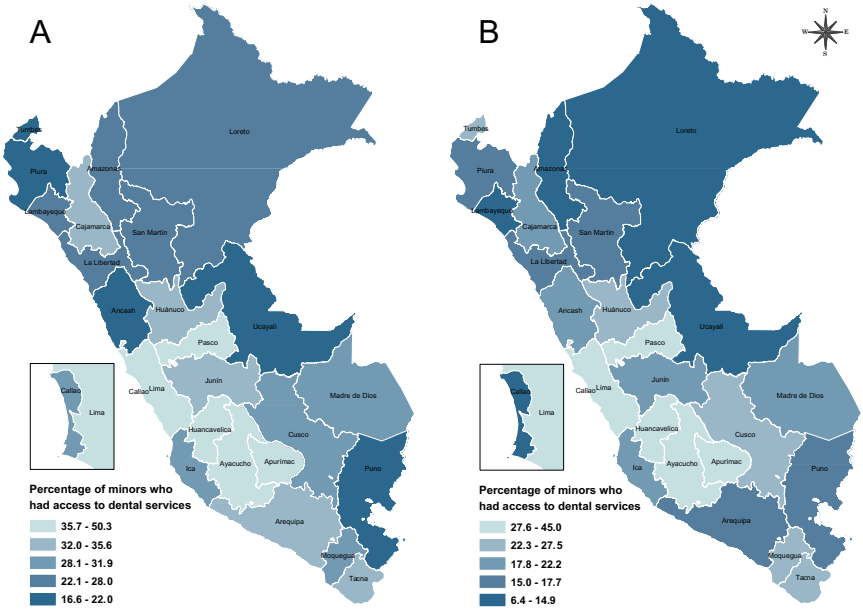

Figure 4. Percentage of children under the age of twelve who had access to dental health services according to area of residence and to regions. Peru, 2014.

Source: Own elaboration based on Demographic and Family Health Survey (ENDES) of 2014 and on regional cartography of the Ministry of Environment of Peru (MINAM).
A. Urban area.
B. Rural area.

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The regions of Huancavelica, Ayacucho, Apurímac, Pasco and Lima had the highest rates of access to dental health care service, both in urban and rural areas. The urban areas of Puno, Tumbes, Ancash, Ucayali and Piura had the lowest rates of access to dental health care as well as the rural areas of Piura, Amazonas, Ucayali, Lambayeque and Loreto (Figure 4).

Figure 4 shows that the lowest percentages of population having access to dental health services in rural and urban areas of Peru were 6.4% and 16.6% respectively, with a percentage difference of 10.2%, whereas the highest percentage of population having access to dental health services in the rural areas was 45% and in the urban area was 50.3%, which shows a difference of 5.3%. It must be mentioned that the region of Callao is the only one in Peru that does not have a rural population.

DISCUSSION

This study identified a low percentage of children under the age of twelve who had access to dental health care services in the last six months as well as a remarkable interregional heterogeneity in access to these services. There are multiple factors that shape the patterns of access to dental health services in minors, such as the child and their parents' cultural factors, urban or rural area of residence, socio-economic factors, distance to the health centers, availability and distribution of professional dental surgeons in a certain geographical area, or the implementation, or not, of social programs that promote the use of health services.[29,30] Additionally, it is known that these factors may vary depending on the geographical areas and demographic groups in the same country.[31,32] Therefore, studying all these factors is important, starting from the evaluation of the current situation and the variations that may occur within a specific area.

There are several ways to define and operationalize the concept of access to health services. Several authors focus on the population characteristics, whereas others focus on the health service offer; nevertheless, combinations of both views have been proposed. In addition, there are differences regarding the scope of the concept of "access". On the one hand, there is a narrow domain that takes into account the process from the search to the beginning of the health care service and that, at the same time, identifies factors that facilitate or hinder access to the service. On the other hand, there is a broader dominion that includes health needs, perceptions and differences of the needs, the desire for health care and the process of decision-making, as background for health care search, taking into account in several cases the continuity and the results of the initial contact.[33] In this study, the "access" variable was based on the answers given by the individuals interviewed in the ENDES that had received health care in a dental service or had been treated by a dental surgeon and the time elapsed given that the last healthcare visit either to a public or private institution in Peru, without addressing any other related aspects.

The results obtained in this study are similar to the ones reported in Chile in a study carried out at a national level in 2003, in which only 12.8% of children under the age of 5 and 30.9% of children between 6 and 14 years old had access to dental health care in a period of six months before taking part in the study.[34] However, the rates of health care in developed countries differ from the ones found in Peru. For instance, a study carried out in the United Kingdom in 2013 showed that 87.0% of five-year-old children, 92.0% of eight-year-old children, and 90.0% of twelve-year-old children had access to dental health services one year before taking part in the survey.[35]

The fact that only 18.3% of the 0-4 age group children in Peru had access to dental health services in the last six months is remarkable, owing to the fact that the AAPD recommends at least one visit to a dental surgeon in such time period.[6] Moreover, the presence of dental caries in this age group is a predictive factor that indicates the possible

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onset of this disease in the set of permanent teeth, which initiates an eruptive process between 6 and 7 years of age; this is why health care before, during and after this transition is important. It seems that parents still believe that the visits of early age children to a dental surgeon are unnecessary or unimportant, due to the fact that the set of primary teeth would be replaced by the permanent ones, and therefore, they only take their children to the dentist care when there is pain, abscesses or other caries complications[37]; however, these behaviors may affect children's oral health negatively when they grow up.[38]

In the 5-11 age group, a higher percentage of the population having access to dental service has been observed in relation to children under the age of 5. Nonetheless, this is insufficient, owing to the fact that most dental replacements occur in this age period and it is necessary to prevent the development of caries by visiting a dentist. Furthermore, it is during this age that habits related to oral health should be acquired; therefore, professional advice is essential. What is more, evidence reveals that the presence of caries at the age of 12 clearly indicates a possible risk of developing them at the age of 18,[39] which contributes to an increase in dental caries in adulthood in those children under the age of twelve, who had no access to dental health services.

The prevalence of caries in children in Peru and other countries could be lower, given that there are methods that have shown great effectiveness over the years (for example, topically applied fluoride and the use of pit and fissure sealants). It is a fact that both promotion and prevention as well as proper health care in children of this age group could offer significant benefits for oral and general health.[40] Applying these methods could prevent premature tooth loss and dental infections that, most of the time, cause tooth eruption disorders, pain, and malocclusions, which increase the risks of caries, periodontal disease, and other related conditions. Greater access to dental health care could increase the use of cost-effective preventive measures for dental caries in children; and achieving this increase depends on a reformulation of the current public health policies that promote access to the service because these results reveal a deficiency in this aspect.[41][42]

It should be mentioned that policies and programs have been implemented in order to improve the use of health services in Peru, such as the Universal Health Insurance (AUS) [*Aseguramiento Universal de Salud*] and the "JUNTOS" program. The latter operates under the modality of a conditional cash transfer program that started in the Andean regions having a high poverty rate and extreme poverty, providing monetary incentives on condition that affiliates attend health, nutrition, education and identity programs. In this regard, several studies indicate that the use of health services within the frame of the "JUNTOS" program has shown a slight percentage increase over the years.[43] In fact, the regions that have enrolled in the program earlier – Huancavelica, Apurímac, Ayacucho, and Huánuco[44] – showed the highest percentages of the population having access to dental service health care in rural and urban areas, which is even higher than the percentage shown in the capital city of Peru. Moreover, it should be highlighted that Andean region have greater access to MINSA and EsSalud public institutions compared to access to private institutions, which is very low. On the contrary, in Lima, the access to private institutions prevails, being extremely low in public health institutions.

With respect to the measures implemented to provide access to health services, despite the fact that the Universal Health Insurance may favor greater possibilities of access by removing the economic barrier, the main results of this study fail to reflect high percentages of the population having access to dental health services. The AUS seems to be one of the solutions to the problem of dental health and, consequently, to the great prevalence of dental caries. Nevertheless, this does neither guarantee a positive effect either on the inequities and differences in dental caries treatment[19] nor on the access to dental health care, because there are other related factors that could impact negatively[11]

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and that should be taken into account when formulating health care programs and policies. For instance, in this study, the regions of Loreto, Piura, and Ucayali that had between 60% and 80% of their population insured in 2011 had the lowest percentages of access to dental services, whereas Huancavelica, Ayacucho, and Apurímac that had a similar insurance rate showed much higher percentages of population having access to dental services, according to our study findings.[45]

It has also been found that Amazon region have the lowest percentage of access to dental health services and very high percentages of dental caries at a national level.[4] Paradoxically, in a recent study of the prevailing diseases in the Peruvian Amazon, dental caries was not considered a disease.[46] Moreover, based on the findings of our study, the issue of access to dental health care could be considered a problem in this geographical area due to the fact that the regions of Amazonas, Loreto, and Ucayali showed the lowest percentages of the population having access to dental service in Peru. As possible explanations for these results, it could be mentioned that certain customs of ethnic minorities that are typical of regions of the Peruvian Andean and Amazon regions, might be contributing to preserving bad habits related to health in these population groups.[47] Several examples of this include ignorance or indifference in searching dental health care, the use of home remedies and an insufficient offer of dental health care services and of professional dental surgeons in these regions to meet the dental health needs of this population group. Another example of this situation is that in Ucayali in 2013,[48] only 40 MINSA dental surgeons were reported for a population of approximately 432,000 inhabitants, figures that are considerably below the number of dental surgeons recommended by the World Health Organization (WHO) for this population size, especially, if it is considered that MINSA institutions are located much farther and in places that are difficult to access in comparison to EsSalud and private services institutions and that, under these circumstances, the dental care facilities capacity, if there are professionals, is still insufficient due to the provision of dental supplies and/or resources.

It is not surprising that Latin America has been characterized by having great inequities between urban and rural areas, as reported by this study. In spite of the efforts of social programs in Peru, these problems still persist. It seems that access to dental health prevails in urban areas, as observed in the percentage differences. Nonetheless, in many areas of Peru, it is noticed that health care percentages in rural areas that are coming closer to the ones in urban areas. Several studies conducted in other contexts establish that living in rural areas and far from dental health services does not seem to be an impediment to seeking treatment.[49] In general terms, there is no in-depth knowledge about the factors that cause this trend; however, in the case of Peru, it may be deduced that these programs that facilitate access to health care might be positively affecting the dental health care needs in certain regions. Thus, the factors that contribute to this success should be evaluated in order to attempt to replicate them in regions having lower access to the service.

The results of this study carried out in children under the age of twelve in Peru show the way in which the public health measures for oral health do not imply proper access to dental service for children at a national level. Therefore, it is essential to reformulate current strategies for coverage and access to dental health care, giving priority to the regions. The use of Geographic Information Systems would make it possible to have a general view of the access to dental health care at a national level, providing evidence that facilitates decision-making; thus, interventions designed to improve the current situation may start to be implemented. Moreover, it provides the means to compare future scenarios with the current ones used as baseline and to lead future research studies that complement and deepen the data obtained in this study, for instance, studies that might identify the factors behind the low access to dental health care services in different regions, given that

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these factors may not be similar, which enables to design and implement measures according to the needs.

It must be highlighted that this study has certain limitations that are typical of studies conducted by using secondary data. Errors may have been made in completing the surveys and it is possible that informants did not provide correct information about the health care received and its temporality relation. Several respondents could have confused the National Institute of Statistics and Informatics surveyors with staff from the "JUNTOS" program and could have given wrong information because of ignorance or fear of losing health insurance or economic incentives. However, the importance of this study partly lies in conducting the analysis of data provided by the Demographic and Family Health Survey, which has a national scope and guarantees regional representativeness. An interesting analysis to be carried out in the future is the study of factors of access to dental services that could explain the differences and patterns found in the regions, enabling to add variables such as "professional availability" and socio-economic indexes, among others, that could generate geographical inequity.

In conclusion, in Peru, the access to dental health services for children under the age of twelve is low and the highest percentages of the population having access to the service have been found in the Andean regions, while the lowest percentages have been found in the Amazon region. Moreover, urban areas of Peru had greater access to the service in comparison to rural areas. The analysis of the spatial distribution of access to dental services made it possible to identify and group regions according to common spatial patterns in order to focus on actions related to public health.

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