

# Inequalities in indicators of early childhood caries experience in the municipality of Andes (Antioquia, Colombia)<sup>1</sup>

## Desigualdades en los indicadores de experiencia de caries dental en la primera infancia en el municipio de Andes (Antioquia, Colombia)<sup>1</sup>

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### ABSTRACT

**Introduction:** identifying inequalities in health is a step towards inequity analysis, a topic that concerns various oral health stakeholders. The aim of the present study was to identify the distribution of indicators of early childhood caries experience. **Methods:** descriptive study based on data obtained from the baseline study on health indicators in 623 children under six years of age from the municipality of Andes (Antioquia) in 2015. The presence and severity of dental caries lesions were recorded following the International Caries Detection and Assessment System (ICDAS), calculating the indexes of decayed, missing, and filled surfaces due to caries ( $d_{ICDAS5-6}$  *mfs* and  $d_{ICDAS1-6}$  *mfs*), as well as Lorenz curves and Gini coefficients for the accumulated frequencies of both indicators. **Results:** an average  $d_{ICDAS5-6}$  *mfs* of  $3.3 \pm 7.4$  was found as follows:  $3.5 \pm 8.0$  in the rural area and  $2.7 \pm 5.7$  in the urban area. The average  $d_{ICDAS1-6}$  *mfs* was  $14.3 \pm 15.1$ , with statistically significant differences by area of residence:  $15.7 \pm 15.8$  in the rural area and  $11.3 \pm 12.8$  in the urban area. The analysis with Lorenz curves showed inequality in distribution of caries experience. The Gini coefficients were 0.412 for  $d_{ICDAS5-6}$  *mfs* and 0.284 for  $d_{ICDAS1-6}$  *mfs*. **Conclusion:** the analyses show a skewed distribution of dental caries in children under the age of six, and a greater inequality in terms of indicators of dental caries experience in its severe form in the municipality of Andes.

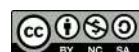
**Key words:** dental caries, oral health, inequity, child

### RESUMEN

**Introducción:** la identificación de desigualdades en salud es un paso hacia el análisis de inequidades, tema que preocupa a diversos actores relacionados con la salud bucal. El objetivo del presente estudio consistió en identificar la distribución de los indicadores de experiencia de caries dental por superficies en la primera infancia. **Métodos:** estudio descriptivo a partir de los datos obtenidos en el estudio de línea de base de indicadores de salud en 623 niños y niñas menores de seis años de edad del municipio de Andes (Antioquia) en 2015. La presencia y severidad de las lesiones de caries dental se registraron en el Sistema Internacional para la Detección y Evaluación de Caries (ICDAS). Se calcularon los índices de superficies cariadas, obturadas y perdidas por caries dental ( $c_{ICDAS5-6}$  *ops* y  $c_{ICDAS1-6}$  *ops*), las curvas de Lorenz y los coeficientes de Gini para las frecuencias acumuladas de ambos indicadores. **Resultados:** se encontró un  $c_{ICDAS5-6}$  *ops* promedio de  $3,3 \pm 7,4$ , así:  $3,5 \pm 8,0$  en la zona rural y  $2,7 \pm 5,7$  en la urbana. El promedio del  $c_{ICDAS1-6}$  *ops* fue  $14,3 \pm 15,1$ , con diferencias estadísticamente significativas por zona de residencia:  $15,7 \pm 15,8$  en la rural y  $11,3 \pm 12,8$  en la urbana. El análisis de la curva de Lorenz mostró desigualdad en la distribución de la experiencia de caries. Los coeficientes de Gini fueron 0,412 para el  $c_{ICDAS5-6}$  *ops* y 0,284 para el  $c_{ICDAS1-6}$  *ops*. **Conclusión:** los análisis evidencian una distribución sesgada de la caries dental en los niños y niñas menores de seis años, y una mayor desigualdad en los indicadores de experiencia de caries dental en su forma severa en el municipio de Andes.

**Palabras clave:** caries dental, salud bucal, inequidad, niño

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## INTRODUCTION

There is mounting evidence that oral pathologies affect the most disadvantaged population in society, increasing the disease burden of these groups.<sup>1</sup> In the case of dental caries, which used to affect a large part of the general population in the past and is currently concentrating on a segment of it, the efforts are now focused on non-biological aspects beyond the individual ones. Some authors state that overall improvements in dental caries and periodontal disease indicators in middle- and high-income countries have not modified the relationship of these indicators with social conditions and health inequalities. Various studies associate caregivers' low schooling levels and low family income with a higher prevalence and severity of dental caries.<sup>2,3</sup>

Dental caries in children under the age of six—early childhood caries—commonly affect groups with higher poverty levels. In addition, the indicators of the disease experience at these ages are in contrast with the improvements in indicators among the school-age population, and have even increased in low- and middle-income countries.<sup>4,5</sup> Hence the World Health Organization (WHO) states that this is a public health problem, impacting overall health and quality of life.<sup>6,7</sup> Some authors point out that a large number of unmet oral health needs during early childhood and the presence of the disease during this stage of life is an indication of other inequalities in health.<sup>8,9</sup>

According to the latest National Oral Health Survey (Estudio Nacional de Salud Bucal 2013-2014, ENSAB IV), the oral health situation of this population group in Colombia has remained unchanged in the last two decades, considering that by

2014 a total of 62.1% of five-year-olds had experienced dental caries compromising cavities in dentine, compared with 60.4% reported in the III Estudio Nacional de Salud bucal, ENSAB III, 1998. The ENSAB IV also found out that 29.3% of children experience dental caries by the age of one year, 6% of them with severe lesions; by the age of three, dental caries experience involving dentin gets to 47.1%, a value that increases to 83% when all lesions are considered, and at five years of age the percentage of children with dental caries experience reaches 88.8%.<sup>10</sup>

This latest national survey shows some differences in caries experience in primary dentition by region and type of coverage by the General System of Health Social Security, but the data do not allow further analysis, nor do they suggest differences in terms of inequality. On the other hand, a higher proportion of dental caries has been found in low-income children in the city of Medellín,<sup>11,12</sup> and the latest population study, carried out in 2009 with a sample from all the city's schools, yielded statistically significant differences in both experience and prevalence of the disease in five-year-olds attending schools located in middle- and high-income neighborhoods, in contrast with those in schools located in low-income neighborhoods.<sup>13</sup>

An epidemiological study was recently conducted in the municipality of Andes, finding out differences in terms of basic indicators of dental caries experience and prevalence by area of origin and social segments identified in the study population.<sup>14,15</sup>

The issue of social inequalities and health inequities is complex and not usually connected to conceptual and methodological controversies. The present study stems from

the Pan American Health Organization's proposal to use methods for measuring inequalities in health based on basic health indicators clustered by geopolitical units. In this proposal, the term 'inequities' refers to unnecessary, unjust, and avoidable unequal conditions, and this requires deeper analyses, as it can be the origin of health inequalities. Measuring such inequalities is a first step not only towards their identification but also for decision making.<sup>16</sup>

The aim of this article was to identify the distribution of indicators of dental caries experience in children under the age of six in the municipality of Andes, a population group that in Colombia has been defined as early childhood.

## MATERIALS AND METHODS

An analysis was conducted using the records from a database created during a cross-sectional study for the construction of a baseline of health indicators in children aged 0 to 5 years,—a project conducted in 2014 in the municipality of Andes (Antioquia) and approved by the Ethics Committee of the Universidad de Antioquia School of Dentistry (Act No. 22 of 2013).

The records correspond to 623 children from urban and rural areas, from a sample calculated based on a reference population of 3,525 individuals, with 95% confidence interval, 2% sampling error, and proportional allocation per area of residence. The final selection of children in the urban area was made by probabilistic sampling, and in the rural area a call for participation was done in health centers.

The information was recorded by two dentists calibrated in the IV National

Oral Health Survey based on the criteria of the International Caries Detection and Assessment System (ICDAS).<sup>10</sup> The proposal to merge the ICDAS lesions code 1 with those of code 2 was considered as the data were recorded.<sup>17, 18</sup> Prior to the clinical examination, an adult brushed the child's teeth; the dental surfaces were dried with a gauze, conducting a detailed visual inspection of each surface.

The presence of one or more decayed (either cavitated or non-cavitated), filled or missing surfaces of primary teeth due to caries in the examined children was considered as early childhood caries (ECC), following the definition of the American Academy of Pediatric Dentistry,<sup>19</sup> which includes children under six in this group, coinciding with the definition of early childhood by the Colombian state in Law 1098 of 2006.

The different progression levels of dental caries lesions proposed by the ICDAS system were taken into account, differentiating among initial or A lesions (ICDAS 1 and 2), moderate or B lesions (ICDAS 3 and 4) and extensive or C lesions (cavities that compromise the dentin, ICDAS 5 and 6).<sup>20, 21</sup> Additional records included the condition of healthy surfaces (with no caries experience), as well as missing and filled teeth due to caries.

The definition of dental caries experience was taken from the IV National Oral Health Survey, as the proportion of people who at the time of examination show signs of treated or untreated caries at some point in their lives, including the presence of carious lesions in any of its phases (initial, moderate or advanced) or any sequelae of it (filled or missing surfaces due to caries). Similarly, calculations were performed for the  $d_{ICDAS5-6}$  *mfs* index, which include the experience

of extensive lesions, and  $d_{ICDAS1-6}$  *mfs* index, when the initial stages of caries were also included.<sup>10</sup>

Data were analyzed in version 23.0 of the IBM-SPSS® software, as well as Excel and Epidat 4.1, calculating the mean and median values of the affected dental surfaces for the different ICDAS codes, and estimating the  $d_{ICDAS5-6}$  *mfs* and  $d_{ICDAS1-6}$  *mfs* indexes. The quantitative variables of the indexes components were subjected to normality tests by age, finding out no normal distribution; therefore, the data were analyzed by means of non-parametric tests (Kruskal-Wallis). If these yielded no statistically significant differences, multiple range analyses (Games-Howell) were performed to determine which ages showed differences.

The Mann-Whitney U test was used to compare the medians of  $d_{ICDAS5-6}$  *mfs* and  $d_{ICDAS1-6}$  *mfs* indexes between urban and rural areas in each age.

Inequality in distribution of early childhood caries was assessed through the Lorenz curve and the Gini index, sorting out the population in a hierarchical manner by means of the cumulative proportion distribution of the  $d_{ICDAS5-6}$  *mfs* and  $d_{ICDAS1-6}$  *mfs* indexes (Y-axis) and the cumulative proportion of the studied population (X-axis).<sup>16, 22</sup>

## RESULTS

In total, 551 children (88% boys and 89% girls) had early childhood caries. When considering the number of surfaces with cavitated carious lesions compromising dentine and the number of filled and missing surfaces due to tooth decay, an average  $d_{ICDAS5-6}$  *mfs* index of  $3.3 \pm 7.4$  was observed, with values of  $3.5 \pm 8.0$  in the rural area and  $2.7 \pm 5.7$  in the urban area, although the differences were not significant. When initial and moderate carious lesions were included, the  $d_{ICDAS1-6}$  *mfs* index increased to  $14.3 \pm 15.1$ , reaching  $15.7 \pm 15.8$  in the rural area and  $11.3 \pm 12.8$  in the urban area—statistically significant differences according to the Mann-Whitney U test ( $p$  value < 0.001)—. Table 1 shows the values of  $d_{ICDAS5-6}$  *mfs* and  $d_{ICDAS1-6}$  *mfs* indexes and their standard deviations, as well as the medians with their interquartile range by age and area of residence.

The distribution of the components of  $d_{ICDAS5-6}$  *mfs* and  $d_{ICDAS1-6}$  *mfs* indexes shows a greater share of surfaces with initial dental carious lesions compared to moderate and extensive lesions and to filled or missing surfaces due to dental caries. Table 2 shows the indexes values and their components by age.

**Table 1.**  $d_{ICDAS5-6}$  mfs and  $d_{ICDAS1-6}$  mfs indexes mean ( $\bar{X}$ )  $\pm$  standard deviation (SD) and median (Q2) with their interquartile range (IQR) by age and area of residence in children under 6 years from the municipality of Andes, 2014

INDEX	AGE	AREA				U Mann-Withney <i>p</i> value	TOTAL	
		Rural		Urban			$\bar{X} \pm SD$	Q2(IQR)
		$\bar{X} \pm SD$	Q2(IQR)	$\bar{X} \pm SD$	Q2(IQR)			
$d_{ICDAS5-6}$ mfs	0	0.0 $\pm$ 0.0	0.0(0-0)	0.0 $\pm$ 0.0	0.0(0-0)	1.00	0.0 $\pm$ 0.0	0.0(0-0)
	1	0.1 $\pm$ 0.4	0.0(0-0)	0.6 $\pm$ 2.9	0.0(0-0)	0.726	0.2 $\pm$ 1.7	0.0(0-0)
	2	1.9 $\pm$ 4.8	0.0(0-1)	1.4 $\pm$ 4.1	0.0(0-0)	0.363	1.8 $\pm$ 4.6	0.0(0-1)
	3	4.0 $\pm$ 6.4	1.0(0-6)	2.0 $\pm$ 4.0	0.0(0-3)	0.092	3.4 $\pm$ 5.8	0.0(0-5)
	4	3.2 $\pm$ 6.7	0.0(0-3)	5.2 $\pm$ 7.7	1.0(0-8)	0.166	3.9 $\pm$ 7.1	0.0(0-5)
	5	7.8 $\pm$ 13.0	2.0(0-8)	4.8 $\pm$ 7.2	2.0(0-6)	0.377	7.0 $\pm$ 11.8	2.0(0-8)
Total		3.5 $\pm$ 8.0	0.0(0-3.3)	2.7 $\pm$ 5.7	0.0(0-3.0)	0.248	3.3 $\pm$ 7.4	0.0(0-3)
$d_{ICDAS1-6}$ mfs	0	0.6 $\pm$ 1.4	0.0(0-0)	0.3 $\pm$ 0.7	0.0(0-0)	0.778	0.5 $\pm$ 1.2	0.0(0-0)
	1	2.7 $\pm$ 4.3	1.0(0-3.8)	2.3 $\pm$ 5.1	1.0(0-2)	0.320	2.6 $\pm$ 4.6	1.0(0-3)
	2	12.9 $\pm$ 13.9	7.0(4-18)	5.8 $\pm$ 8.3	3.0(1-6)	0.000	10.9 $\pm$ 13.0	5.0(3-15)
	3	21.1 $\pm$ 16.2	16.5(10-28.8)	13.9 $\pm$ 10.8	11.0(5-23)	0.015	18.8 $\pm$ 15.1	14.0(8.5-26.5)
	4	17.6 $\pm$ 13.6	14.0(9-24)	18.4 $\pm$ 15.6	13.5(7.8-26.3)	0.907	17.8 $\pm$ 14.2	14.0(8-25)
	5	23.2 $\pm$ 17.9	20.0(10-30.8)	17.0 $\pm$ 12.9	13(6.5-23.5)	0.087	21.6 $\pm$ 16.9	17(9.5-28.5)
Total		15.7 $\pm$ 15.8	11.0(4-22)	11.3 $\pm$ 12.8	7.0(1.5-16)	0.000	14.3 $\pm$ 15.1	10(3-21)

In addition to the medians and their interquartile range, this table shows the means and standard deviations because these are the benchmarks of comparison with other studies.

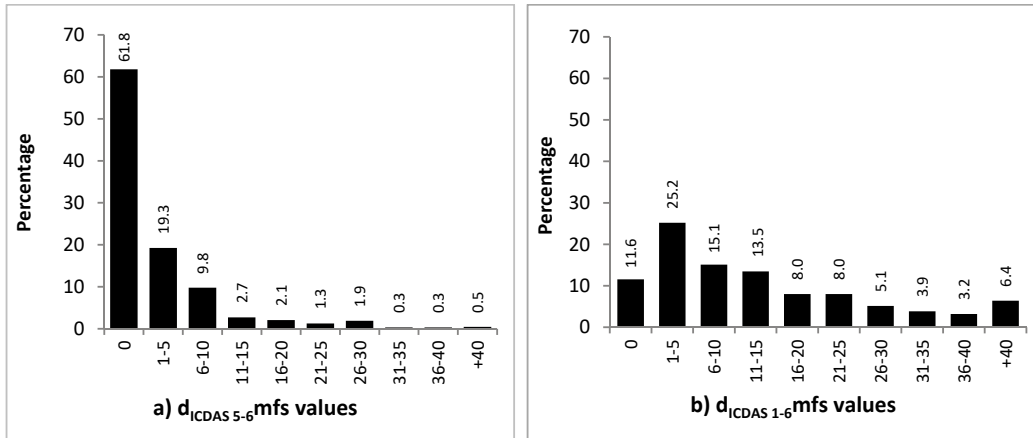
**Table 2.** Surfaces mean ( $\bar{X}$ ) and standard deviation (SD), median (Q2) and interquartile range (IQR) by dental status per age in children under 6 years, municipality of Andes, 2014

Dental status	Statistics	Age							Total	<i>p</i> value*
		0	1	2	3	4	5			
Surfaces with initial caries lesion (A) (ICDAS 1, 2)		0.5 <sup>a</sup>	2.2 <sup>b</sup>	8.1 <sup>c</sup>	14.2 <sup>d</sup>	12.7 <sup>d</sup>	13.1 <sup>d</sup>	10	0.000	
	SD	1.2	3.6	8.4	10.2	8.3	8.4	9.2		
	Q2	0.0	1.0	5.0	12.0	11.0	12.0	8.0		
	IQR	0-0	0-3	3-11	8-19	7-17	7-18	3-14		
Surfaces with moderate caries lesion (B) (ICDAS 3, 4)		0.0 <sup>a</sup>	0.1 <sup>a</sup>	1.0 <sup>b</sup>	1.3 <sup>b</sup>	1.3 <sup>b</sup>	1.5 <sup>b</sup>	1.0	0.000	
	SD	0.0	0.4	2.4	2.2	2.1	2.0	2.0		
	Q2	0.0	0.0	0.0	0.0	0.0	1.0	0.0		
	IQR	0-0	0-0	0-1	0-2	0-1	0-2	0-1		
Surfaces with extensive caries lesion (C) (ICDAS 5, 6)		0.0 <sup>a</sup>	0.2 <sup>a</sup>	1.8 <sup>b</sup>	3.2 <sup>b</sup>	3.5 <sup>b</sup>	5.0 <sup>b</sup>	2.8	0.000	
	SD	0.0	1.7	4.6	5.7	6.9	9.9	6.6		
	Q2	0.0	0.0	0.0	0.0	0.0	1.0	0.0		
	IQR	0-0	0-0	0-1	0-4	0-4	0-6	0-3		
Filled surfaces		0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.1 <sup>a</sup>	0.3 <sup>b</sup>	1.1 <sup>c</sup>	0.3	0.000	
	SD	0.0	0.0	0.3	0.8	1.1	2.5	1.4		
	Q2	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	IQR	0-0	0-0	0-0	0-0	0-0	0-1	0-0		
Missing surfaces due to caries		0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.1 <sup>a</sup>	0.9 <sup>b</sup>	0.2	0.000	
	SD	0.0	0.0	0.0	0.0	0.6	3.5	1.6		
	Q2	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	IQR	0-0	0-0	0-0	0-0	0-0	0-0	0-0		

\* Kruskal-Wallis test. Different superscript letters indicate mean differences among ages (Games-Howell's multiple range test)

The values distribution of the  $d_{ICDAS5-6} mfs$  index shows that 61.8% of the examined children did not have experience of extensive dental caries lesions; and of the remaining 38.2%, 19.3% had indexes of 1 to 5, while

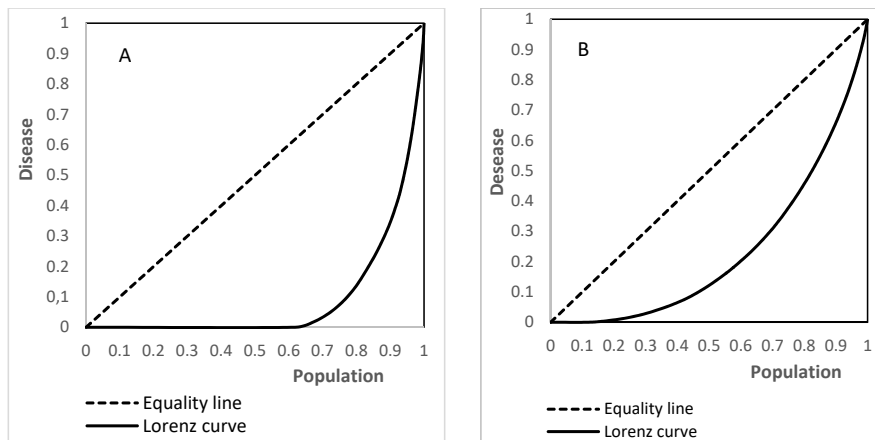
the values ranged from 6 to 10 in 9.8% (Figure 1a). When all dental caries lesions were included, the  $d_{ICDAS1-6} mfs$  index was 1 to 5 in 25.2% of the examined children, and 15.1% showed values of 6 to 10 (Figure 1b).



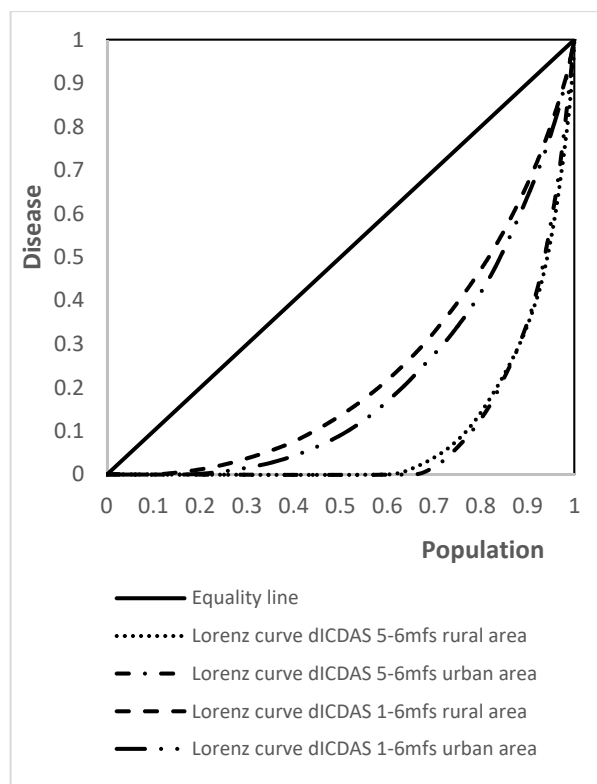
**Figure 1.** Percentage distribution per the  $d_{ICDAS5-6} mfs$  and  $d_{ICDAS1-6} mfs$  index values in children under 6 years of age from the municipality of Andes, 2014

The analysis of inequality in the distribution of the disease among the evaluated children was carried out by means of Lorenz curves and the calculation of the Gini coefficient for the accumulated distribution of values of the  $d_{ICDAS5-6} mfs$  and  $d_{ICDAS1-6} mfs$  indexes, in accordance with the proposal of the Pan American Health Organization (Figure 2). The curves show greater inequality when

built based on the more extensive lesions than when all lesions are included. Figure 3 shows the Lorenz curves of the  $d_{ICDAS5-6} mfs$  and  $d_{ICDAS1-6} mfs$  indexes by area of residence, and Table 3 displays the Gini coefficients values for the accumulated frequencies of the  $d_{ICDAS5-6} mfs$  and  $d_{ICDAS1-6} mfs$  indexes, with a similar distribution by area of residence in the most extensive lesions.



**Figure 2.** Lorenz curve for the accumulated distribution of the  $d_{ICDAS5-6} mfs$  (A) and  $d_{ICDAS1-6} mfs$  (B) indexes in children under the age of six. Municipality of Andes, 2014



**Figure 3.** Lorenz curve for accumulated distribution of the  $d_{ICDAS5-6} mfs$  and  $d_{ICDAS1-6} mfs$  indexes in children under the age of six, by area of residence. Municipality of Andes, 2014

**Table 3.** Gini coefficients for the accumulated distribution of the  $d_{ICDAS5-6} mfs$  and  $d_{ICDAS1-6} mfs$  indexes in children under the age of five, by area of residence. Municipality of Andes, 2014

Area	Gini coefficient	
	$d_{ICDAS5-6} mfs$	$d_{ICDAS1-6} mfs$
Rural	0.444	0.294
Urban	0.484	0.380
Total	0.412	0.284

## DISCUSSION

The presence of early childhood caries in a high proportion of children aged 0 to 5 years from the municipality of Andes is a challenge for the design of programs, plans and policies.<sup>14</sup> In addition, the performed analyses show differences in terms of

severity of the disease, according to the indicators calculated by surfaces, their distribution in the examined children, and the use of measuring methods, suggesting the existence of inequalities in both urban and rural areas.

The severity of the disease, expressed in the number of decayed, filled or missing surfaces due to caries, reflects not only the cumulative character of the disease but also the unmet health care needs in this population group. An average of 0.2 surfaces with dental caries in dentine at the age of one year increases to 7.0 at the age of five, with higher values if including initial enamel lesions, which require other types of treatment options to control their progress. The analysis of lesions per tooth surface also shows the tendency to increase with age and a greater presence of the decayed component (largely represented by initial and moderate dental caries lesions) than filled and missing teeth due to cavities.<sup>14</sup> It is not possible to compare the data in Andes with the national survey, since no indicators by surfaces have been published yet ; however, these data are higher than those reported in an area of low and medium socioeconomic stratum of the city of Medellin with the same indicators.<sup>12</sup>

What is most striking, however, is the presence of large variations in the disease values among the examined children. This variations are expressed in high standard deviation values with respect to the means and in a skewed distribution of the disease—and these values become higher if the analyses focus on the most severe lesions (ICDAS 5 and 6 already compromising dentin) instead of considering all lesions—. This phenomenon has already been identified; in fact, Bratthall highlighted the issue,<sup>23</sup> and other authors have incorporated

it in their analyses<sup>24</sup> because it reflects how, while the majority of the population is free of dental caries lesions compromising dentine and can be treated with simpler measures (61.8% in the present study), the greatest burden and severity of the disease concentrates in a segment of the population.

Analyzing differences in a population can be useful not only to identify the challenges faced by dental services but also to identify situations of inequality, which not only stem from the assessment of health indicators but have also been suggested in this population in evaluating the averages of the disease by social segment. This has marked implications for how to address oral health problems,<sup>3</sup> especially in early childhood. In addition, the Lorenz curve calculation showed that the area between the distribution of dental caries in the examined population and the equality line reflects an uneven distribution of dental caries indicators—a situation also reported in Brazil by the age of twelve.<sup>25</sup>

As is the case with the disease distribution, the Lorenz curve shows a greater inequality when considering the most severe lesions than when all lesions are included, and the same occurs with the Gini coefficients, which move further away from zero when the disease is analyzed in its most severe forms. This shows that the greatest differences occur in terms of severity of early childhood caries rather than in prevalence of all lesions, regardless of progression—a first step towards the identification of inequalities that may reflect inequities in access to goods and services.

The present study describes a finding regarding inequality in the distribution of dental caries in the general population—a situation observed in urban and rural areas—and is not aimed at verifying the hypothesis

of inequality per area of residence. It is not a measurement of inequities either; the analysis of inequalities using the Lorenz curves and the Gini index is based exclusively on a basic indicator of oral health, without considering other aspects of living conditions.

While oral health studies like this and others<sup>22,24,25</sup> are making progress in recognizing differences, and the issue of inequalities has been incorporated in the analysis of various publications and consensus, most actions and recommendations deal with interventions based on risk analyses, which may be useful in terms of individual care provided by health services, but are limited in scope. In this regard, Watt questions such approaches and, while recognizing the progress in incorporating oral health into general health, points out that the actions are still limited to proximal causes related to individual behaviors.<sup>3</sup> To this author, the evidence validates the need to impact the broader determinants and policies requiring structural changes, legislation controls, fiscal policies, a greater focus on the earlier years of life, community actions, reorientation of health services, improvements in access to health services, and prioritization of groups with greater needs, to name just a few aspects.<sup>3</sup>

Some progress has been made in Colombia with the inclusion of children aged 1, 3 and 5 years in the IV National Oral Health Survey and with the emergence of research accounting for the prevalence of dental caries in children under six years of age, like the one carried out in the municipality of Andes. This is a first step and makes part of the recommendations made by groups of experts and health agencies.<sup>6</sup> However, more attention to inequalities is required, moving forward in the analysis of inequity underlying these indicators in Colombia,



a country that has a childhood policy and prioritizes the right to comprehensive development since gestation, especially during early childhood.<sup>26</sup> The relevance of ensuring this right in the first stage of life becomes not only an essential strategy to fight poverty and the vicious circle producing it, but also a strategy for the human and social development of a country, as it helps improve living conditions.<sup>27</sup>

In conclusion, the dental caries indicators shows a skewed distribution of the disease in children under six years of age in the municipality of Andes, and a greater inequality in terms of experience of dental caries in its most severe form, based on the analysis of the Lorenz curve and the Gini coefficient.

## CONFLICT OF INTEREST

One of the authors (AMFC) is part of the Editorial Committee of *Revista Facultad de Odontología de la Universidad de Antioquia*, but transparency in the editorial processing of the manuscript has been guaranteed since she did not participate in such process.

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## REFERENCES

1. Sheiham A, Alexander D, Cohen L, Marinho V, Moyses S, Petersen PE et al. Global oral health inequalities: implementation and delivery of oral health research and strategies. *Adv Dent Res.* 2011; 23(2): 259-67. DOI: <https://doi.org/10.1177/0022034511402084>
2. Frazão P. Epidemiology of dental caries: when structure and context matter. *Braz Oral Res.* 2012; 26(Suppl 1): 108-14.
3. Watt RG. Social determinants of oral health inequalities: implications for action. *Community Dent Oral Epidemiol.* 2012; 40(Suppl. 2): 44-8. DOI: <https://doi.org/10.1111/j.1600-0528.2012.00719.x>
4. Tinanoff N, Reisine S. Update on early childhood caries since the Surgeon General's Report. *Acad Pediatr.* 2009; 9(6): 396-403. DOI: <https://doi.org/10.1016/j.acap.2009.08.006>
5. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. *Bull World Health Organ.* 2005; 83(9): 661-9. DOI: <https://doi.org/S0042-96862005000900011>
6. World Health Organization. Expert consultation on public health intervention against early childhood caries: report of a meeting, Bangkok, Thailand, 26-8 January 2016. Geneva: WHO, 2017.
7. Abanto J, Carvalho TS, Mendes FM, Wanderley MT, Becker M, Raggio DP. Impact of oral diseases and disorders on oral health-related quality of life of preschool children. *Community Dent Oral Epidemiol.* 2011; 39(2): 105-14. DOI: <https://doi.org/10.1111/j.1600-0528.2010.00580.x>
8. Vargas CM, Ronzio CR. Disparities in early childhood caries. *BMC Oral Health.* 2006; 6 (Suppl 1): S3. DOI: <https://doi.org/10.1186/1472-6831-6-S1-S3>

9. Mouradian WE, Wehr E, Crall JJ. Disparities in children's oral health and access to dental care. *JAMA*. 2000; 284(20): 2625-63.
10. Colombia. Ministerio de Salud y Protección Social. IV Estudio Nacional de Salud Bucal ENSAB IV: para saber cómo estamos y saber qué hacemos. Bogotá : Ministerio de Salud y Protección Social, 2014.
11. Escobar-Paucar G, Ramirez-Puerta GS, Franco-Cortés AM, Tamayo-Posada AM, Castro-Aguirre JF. Experiencia de caries dental en niños de 1 a 5 años de bajos ingresos. Medellín, Colombia. *CES Odontol*. 2009; 22(1): 21-8.
12. Ramirez-Puerta BS, Escobar-Paucar G, Franco-Cortés AM, Martínez-Pabón MC, Gómez-Urrea L. Early childhood caries in 1-5 year-old children. Medellín, Colombia, 2008. *Rev Fac Odontol Univ Antioq*. 2011; 22(2): 164-72.
13. Ramirez-Puerta BS, Franco-Cortés AM, Ochoa-Acosta E, Escobar-Paucar G. Experiencia de caries en dentición primaria en niños de 5 años, Medellín, Colombia. *Rev Fac Nac Salud Pública*. 2015; 33(3): 345-52.
14. Ramirez-Puerta BS, Escobar-Paucar G, Franco-Cortés AM, Ochoa-Acosta EM, Otilvaro-Castro GJ, Agudelo-Suárez AA. Caries dental en niños de 0-5 años del municipio de Andes, Colombia. Evaluación mediante el sistema internacional de detección y valoración de caries - ICDAS. *Rev Fac Nac Salud Pública*. 2017; 35(1): 91-8. DOI: <http://dx.doi.org/10.17533/udea.rfnsp.v35n1a10>.
15. Franco-Cortés AM, Otilvaro-Castro GJ, Ochoa-Acosta E, Ramirez-Puerta S, Escobar-Paucar G, Agudelo-Suárez AA et al. Inequidades en salud de la primera infancia en el municipio de Andes, Antioquia. Un análisis desde la epidemiología crónica. *Rev Gerenc Polit Salud*. 2016; 15(31): 246-61. DOI: <http://dx.doi.org/10.11144/Javeriana.rgyys15-31.ispi>
16. Schneider MC, Castillo-Salgado C, Bacallao J Loyola E, Mujica O, Vidaurre M, et al. Métodos de medición de las desigualdades de salud. *Rev Panam Salud Publica*. 2002; 12(6): 398-414.
17. Pitts NB, Ismail AI, Martignon S, Ekstrand K, Douglas GVA, Longbottom C; ICDAS Foundation. ICCMS™. Guía de referencia rápida ICCMS™ para clínicos y educadores [online]. London: ICDAS Foundation; 2014. Available in <http://stage.iccms.appyarn.co.uk/uploads/asset/5928404ea4df6343406124.pdf>
18. International Caries Detection and Assessment System. Coordinating Committee. Rationale and evidence for the International Caries Detection and Assessment System (ICDAS II). In: Stookey G, editor. Proceedings of the 2005. Annual Indiana Conference, July 6-9, 2005. Indianapolis, IN: Indiana University School of dentistry; 2006. Revised in December 2008 in Bogotá, Colombia and in July 2009 in Budapest, Hungary. [en línea] 2011 [fecha de acceso 30 de mayo de 2017] URL Disponible en: <https://www.iccms-web.com/uploads/asset/592848be55d87564970232.pdf>.
19. American Academy of Pediatric Dentistry (AAPD). Policy on early childhood caries (ECC): classifications, consequences, and preventive strategies. *Oral Health Policies*. 2016/2017; 38(6): 52-4.
20. Pitts NB, Ekstrand KR; ICDAS Foundation. International Caries Detection and Assessment System (ICDAS) and its International Caries Classification and Management System (ICCMS) - methods for staging of the caries process and enabling dentists to manage caries. *Community Dent Oral Epidemiol*. 2013; 41(1): e41-52. DOI: <https://doi.org/10.1111/cdoe.12025>
21. Pitts NB, Ismail AI, Martignon S, Ekstrand K, Douglas GVA, Longbottom C; ICDAS Foundation. ICCMS™ Guide for practitioners and educators [online]. London: ICDAS Foundation; 2014. Available in: <https://www.iccms-web.com/uploads/asset/59284654c0a6f822230100.pdf>
22. Narvai PC, Frazão P, Roncalli AG, Antunes JL. Cárie dentária no Brasil: declínio, polarização, desigualdade e exclusão social. *Rev Panam Salud Publica*. 2006; 19(6): 385-93.

23. Bratthall D. Introducing the Significant Caries Index together with a proposal for a new oral health goal for 12-year-olds. *Int Dent J.* 2000; 50(6): 378-84.
24. Antunes JL, Narvai PC, Nugent ZJ. Measuring inequalities in the distribution of dental caries. *Community Dent Oral Epidemiol.* 2004; 32(1): 41-8. DOI: <https://doi.org/10.1111/j.1600-0528.2004.00125.x>
25. Piovesan C, Mendes F, Antunes JL, Ardenghi TM. Inequalities in the distribution of dental caries among 12-year-old Brazilian schoolchildren. *Braz Oral Res.* 2011; 25(1): 69-75.
26. Colombia. Congreso. Ley 1098 de 2006 (noviembre 8): por la cual se expide el Código de la Infancia y la Adolescencia. Bogotá : Congreso de la República de Colombia, 2006.
27. Instituto Colombiano de Bienestar Familiar (ICBF), Alcaldía Mayor de Bogotá D.C., Departamento Administrativo de Bienestar Social (DABS), Save the Children. Reino Unido, UNICEF, Centro Internacional de Educación y Desarrollo Humano (CINDE). Primera infancia y desarrollo: el desafío de la década. Bogotá : CINDE, 2003.