

TERRITORIAL INEQUALITIES IN ORAL HEALTH AMONG CHILDREN AND ADOLESCENTS: THE CASES OF BIOBÍO AND ÑUBLE AS RISK FACTORS IN CHILE

Desigualdades territoriales en salud bucal infantojuvenil: el caso de Biobío y Ñuble como factores de riesgo en Chile

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Health equity requires drawing attention to neglected territories. The physical infrastructure, services, and public policies in each area shape conditions that either increase or reduce exposure to risks and influence collective response. A territory, recognized as a key axis of inequality in relation to childhood and adolescent caries,¹ often concentrates deprivation and restricts access to preventive resources, as Watt and Sheiham noted in 1999.² In Chile, the Ñuble and Biobío regions have historically shown poor indicators of child and adolescent oral health, as analyzed below.

Danke *et al.*,³ report that, between 2012 and 2019, the Health Services of Arauco, Biobío, Concepción, Talcahuano, and Ñuble recorded prevalences of caries-free 6-year-old children below 25%, compared with a national average of 35.4%. In Arauco, the figure was only 17.7%, with no significant improvement over time.

On the other hand, in the national diagnosis by macro-zones, Soto *et al.*,⁴ report that zone 3 (which includes the Biobío and Ñuble Regions) presents the worst national indicators, with 75.5% of six-year-old children having a history of caries ($p=0.003$) and a dmft index of 4.30 ($p<0.005$). The study also reports the greatest need for restorative treatments (an average of 2.39 teeth; $p=0.002$) and the highest prevalence of dental emergencies (21.9%; $p<0.001$).

In the study by Espinoza-Espinoza *et al.*,⁵ the critical situation of children's oral health in the Biobío Region (including the current territory of Ñuble, prior to its administrative separation) is confirmed, with a caries prevalence of 63%, significantly higher than the national average of 49% ($p<0.001$). Likewise, the severity indices dmft (3.51) and DMFT (2.09) were the highest in the country, exceeding the national averages of 2.48 and 1.55, respectively ($p<0.001$ for both cases).

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Beyond the individual: the weight of the territory

Even after controlling for multiple individual factors such as age, socioeconomic status, oral hygiene practices, and consumption of sugary drinks, residence in Biobío–Ñuble is identified as an independent determinant of increased risk of childhood caries.

Hoffmeister *et al.*,⁶ reported that living in this area was associated with an adjusted prevalence ratio of 1.65 (95% CI: 1.10–2.47) in two-year-olds and 1.44 (95% CI: 1.18–1.75) in four-year-olds, compared with the Aysén-Magallanes area, selected as the reference for having the lowest national caries prevalence. These results reinforce the hypothesis that territory itself, and not only individual characteristics, constitutes a structural axis of inequality in early oral health in Chile.

Taken together, the available evidence highlights the need to incorporate the territorial dimension into the analysis of inequities in childhood oral health. Aravena-Rivas *et al.*,⁷ in a national study of more than 112,000 schoolchildren, showed that 14% of the total variability in the DMFT and dmft indices was explained by differences between municipalities (VPC = 0.14).

At the individual level, belonging to a household in extreme poverty was associated with a 17% increase in the DMFT and dmft indices (PR = 1.17), after adjusting for age, sex, and rurality. Similarly, Monsalves *et al.*,⁸ in a study of 2,275 preschool children across 13 municipalities of the Metropolitan Region, found that living in rural areas tripled the prevalence of untreated caries (PR=3.0) compared with urban areas.

Table 1.

Comparison of child and adolescent oral health indicators between Biobío/Ñuble and the national average of Chile.

Category	Indicator	Age group	Biobío/ Ñuble	National average	Year	Source
Prevalence of caries	Caries-free children (%)	6 years old	23.0%	35.4%	2022	Danke <i>et al.</i> ³
	Prevalence of caries (%)	6 years old	75.5%	70.3%	2014	Soto <i>et al.</i> ⁴
	Prevalence of caries (%)	Schoolchildren (4–14 years old)	63.0%	49.0%	2021	Espinoza-Espinoza <i>et al.</i> ⁵
Severity indices	dmft index	6 years old	4.30	3.71	2014	Soto <i>et al.</i> ⁴
	dmft index	Schoolchildren (4–14 years old)	3.51	2.48	2021	Espinoza-Espinoza <i>et al.</i> ⁵
	DMFT index	Schoolchildren (6–14 years old)	2.09	1.55	2021	Espinoza-Espinoza <i>et al.</i> ⁵
	DMFT index	12 years old	2.07	1.90	2021	Ulloa <i>et al.</i> ⁷

Note: dmft: rate of decayed, missing (extracted), or filled primary teeth. DMFT: rate of decayed, missing, or filled permanent teeth. “Schoolchildren” refers to the age range reported in each study (approximately 4–14 years). Data are from regionally or nationally representative cross-sectional studies. The years correspond to the date of data collection or publication, as reported by the authors.

However, when structural indicators such as the Community Human Development Index, school type, and family income were included, the variance attributable to territory was drastically reduced, suggesting that geographic inequalities in caries are largely the result of gaps in social investment and community development.

This finding is especially relevant for interpreting the persistent disparities observed in regions such as Biobío and Ñuble. The association between territorial residence and a higher caries prevalence persists beyond early childhood and extends into later stages of development, as evidenced among 12-year-old children in the Biobío Region.

In this age group, the DMFT index reaches 2.07, exceeding the national average of 1.9, as reported by Ulloa *et al.*⁹ Their study projects that implementing a water fluoridation program in the region would reduce caries prevalence by 15%, decrease the average number of dental visits from 5.07 to 4.75 per child, and lower the need for invasive interventions. From an economic standpoint, the intervention is estimated to be not only effective for public health but also cost-effective, generating savings in dental care, transportation, and lost workdays.

Collectively, this evidence highlights the importance of understanding the epidemiological impact of territorial residence, to determine, at a causal level, what fraction of oral health damage can be attributed to place of residence.

Towards a territorial agenda for oral health research

The scarcity of studies analyzing territorial influences on children's oral health through robust methodological approaches is consistent with the lack of updates to the National Oral Health Survey, whose last edition dates back to 2007. As a result, current indicators derive from fragmented, non-standardized studies or rely on outdated data.

This gap limits a comprehensive understanding of the factors that sustain territorial inequalities, potentially biasing ongoing interventions and, unintentionally, exacerbating the "reverse equity" phenomenon described by Victora *et al.*¹⁰ In the context of Biobío and Ñuble, this implies that the benefits of universal oral health policies may initially concentrate among less vulnerable populations, thereby widening the very gaps such policies are intended to reduce.

Faced with this knowledge gap, it is essential to generate robust evidence to guide both research and intervention policies. Producing solid epidemiological knowledge on child and adolescent oral health in Biobío and Ñuble should be a strategic priority, consistent with the Chilean National Oral Health Plan 2018–2030.¹¹ It is urgent to allocate resources to longitudinal studies that include both rural and urban areas, applying advanced statistical models to identify critical points of inequality and to estimate the health and economic impacts of preventive strategies. Research should be oriented not only toward describing phenomena, but also toward transforming realities and influencing health planning.

Achieving greater equity in oral health requires that authorities incorporate territorial criteria when defining priorities, that regional universities lead relevant research, and that funding agencies actively promote the study of the social de-

terminants of territory.

Only through a solid territorial research and intervention agenda will it be possible to transform living in Ñuble or Biobío from a risk factor into a guarantee of the right to oral health equity.

CONFLICT OF INTERESTS

The author declare no conflict of interest.

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REFERENCES

1. Peres MA, Macpherson LMD, Weyant RJ, Daly B, Venturelli R, Mathur MR, Listl S, Celeste RK, Guarnizo-Herreño CC, Kearns C, Benzian H, Allison P, Watt RG. Oral diseases: a global public health challenge. *Lancet.* 2019;394(10194):249-260. [https://doi.org/10.1016/S0140-6736\(19\)31146-8](https://doi.org/10.1016/S0140-6736(19)31146-8). Erratum in: *Lancet.* 2019;394(10203):1010. [https://doi.org/10.1016/S0140-6736\(19\)32079-3](https://doi.org/10.1016/S0140-6736(19)32079-3). PMID: 31327369.
2. Watt R, Sheiham A. Inequalities in oral health: a review of the evidence and recommendations for action. *Br Dent J.* 1999;187(1):6-12. <https://doi.org/10.1038/sj.bdj.4800191>. PMID: 10452185.
3. Danke K, Carvajal C, Borgeat M, Carvajal P. Tendencia de niños y niñas de 6 años libres de caries en Chile entre los años 2012 y 2019. *Int J Interdiscip Dent.* 2022;15(1):33-8. <https://doi.org/10.4067/S2452-55882022000100033>
4. Soto L, del Valle C. Diagnóstico nacional de salud bucal de los niños de 6 años, análisis por macrozona. Ministerio de Salud de Chile; 2014. https://diprece.minsal.cl/wrdprss_minsal/wp-content/uploads/2015/05/Diagnostico-Nacional-6a%C3%B1os_analisis-por-macrozona.pdf
5. Espinoza-Espinoza G, Pineda P, Atala-Acevedo C, Muñoz-Millán P, Muñoz S, Weits A, Hernandez B, Castillo J, Zaror C. Prevalencia y Severidad de Caries Dental en los Niños Beneficiarios del Programa de Salud Oral Asociados a Escuelas de Chile. *Int J Odontostomatol.* 2021;15(1):166-74. <https://doi.org/10.4067/S0718-381X2021000100166>
6. Hoffmeister L, Moya P, Vidal C, Benadof D. Factors associated with early childhood caries in Chile. *Gac Sanit.* 2016;30(1):59-62. <https://doi.org/10.1016/j.gaceta.2015.09.005>. Epub 2015 Dec 3. PMID: 26655206.
7. Aravena-Rivas Y, Monsalves MJ, Espinoza-Espinoza G, Weitz A, Hernández B, Castillo J, Zaror C. Impact of socioeconomic inequalities on dental caries in deprived children: a multilevel analysis. *Community Dent Health.* 2022;39(3): 191-6. https://doi.org/10.1922/CDH_00020Aravena-Rivas06. PMID: 35852232.
8. Monsalves MJ, Espinoza I, Moya P, Aubert J, Durán D, Arteaga O, Kaufman JS, Bangdiwala SI. Structural determinants explain caries differences among preschool children in Chile's Metropolitan Region. *BMC Oral Health.* 2023;23(1):136. <https://doi.org/10.1186/s12903-023-02778-6>. PMID: 36894931; PMCID: PMC9996898.
9. Ulloa C, de la Puente C, Rojas F, Irigoyen S, Flores-Cartes R. Cost-Benefit Analysis of Drinking Water Fluoridation in 12-Year-Old Children in the Biobío Region, Chile. *Journal of Oral Research,* 2021; 10(1): 1-10. <https://doi.org/10.17126/joralres.2021.003>
10. Victora CG, Vaughan JP, Barros FC, Silva AC, Tomasi E. Explaining trends in inequities: evidence from Brazilian child health studies. *Lancet.* 2000;356 (9235):1093-8. [https://doi.org/10.1016/S0140-6736\(00\)02741-0](https://doi.org/10.1016/S0140-6736(00)02741-0). PMID: 11009159.
11. MINSAL. Plan Nacional de Salud Bucal 2021-2030. 2021. <https://diprece.minsal.cl/wp-content/uploads/2022/01/PLAN-NACIONAL-DE-SALUD-BUCAL-2021-2030.pdf>