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ORIGINAL ARTICLE

Demographic and behavioral characteristics of mothers, caregivers, and economic caretakers in relation to the early childhood caries history in Colombian children, ENSAB IV.

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ABSTRACT

Background: The multifactorial nature of dental caries in children during early childhood (1, 3, and 5 years old) allows for the analysis of various potential external factors that could be influencing oral hygiene and the prevalence of early childhood caries directly or indirectly. The data obtained in ENSAB IV enable the examination of each sociodemographic and behavioral characteristic of those children who had a history of caries in the year of the national survey.

Objective: To establish the presence or absence of a relationship between the history of caries in children aged 1 to 5 years in Colombia and the sociodemographic and behavioral characteristics of their mothers, caregivers, and economic caretakers.

Materials and methods: A non-experimental cross-sectional quantitative study was proposed for the statistical analysis of variables taken from the 6,446 data points collected in ENSAB IV, involving children aged 1, 3, and 5 years, along with their caregivers.

Results: The caries history variable (COP) in the data distribution with categories was unbalanced, as it presented three children with a history of NO caries for each child with a history of caries. This introduces a learning bias to the AI recognition model in category determination, driven by the precipitation of majority values. This is largely corroborated by the multiple correspondence analysis.

Conclusion: The unbalanced distribution of the caries history variable (COP) creates bias in the AI model, with three children without caries for every one with caries, impacting accuracy in category determination.

INTRODUCTION

The development of dental caries is influenced by various risk factors that indiscriminately affect different social, environmental, and behavioral spheres, with a significant impact at the population, community, and individual levels. For a comprehensive understanding of this context, it is essential to address fundamental issues related to the problem at hand.[1,2,3,4,5]

First, it is crucial to analyze the Colombian health system, which plays an essential role in oral health care and prevention among the population. This system is subject to government regulations under the jurisdiction of the Ministry of Health and Social Protection, governed by Law 100 of 1993.[6] The financing of the system involves the payment of contributions by the population, taking into account income and ability to pay, thus dividing it into a contributory regime and a subsidized regime.[8]

The contributory regime establishes the rules for joining the General Social Security System for Health through the payment of individual and family contributions or financial contributions financed by the member or jointly with their employer. For its part, the subsidized regime focuses on guaranteeing access to health care for the country's poor and vulnerable population.[5] The administration of health insurance in Colombia falls to the Health Promotion Entities (EPS), both in the contributory and subsidized regimes, which may be public or private in nature.

Similarly, to fully understand the possible relationship between the sociodemographic and behavioral characteristics of caregivers and the history of caries in children, it is necessary to consider the social determinants of health. According to the World Health Organization's definition, the social determinants of health encompass the circumstances in which people are born, grow up, work, and live, including the influences of policies, economic systems, development programs, social norms, and political systems on their daily living conditions. These conditions can vary significantly among different subgroups of the population, leading to inequalities in health outcomes. Some of these inequalities are preventable and are considered inequities, leading to the need for policies aimed at increasing equity.[7]

It is also important to note the sequence of tooth development and eruption, which is intrinsically linked to children's oral health. It begins with the formation of the tooth germ, encompassing the appearance of both primary and permanent teeth. This dynamic process, subject to a specific chronology, can be influenced by various factors, advancing or delaying eruption. It is during the transition from primary to permanent dentition, a critical phase in childhood, where susceptibility to poor nutritional and oral hygiene practices is observed. These practices are mostly linked to the prevalence of dental caries in young children, a crucial aspect in the scope of this study.

At the same time, dental caries, conceptualized as a complex process, begins with the loss of minerals on the tooth surface, initially manifesting as opacity or discoloration of the enamel. This deterioration progresses to the formation of cavities with visible dentin. The relationship between dental development and the incidence of caries underscores the importance of understanding the interconnection between tooth eruption and the pathological processes that affect dental tissues in childhood.

The National Oral Health Study, ENSAB IV, reveals an increase in the experience of caries in children aged 1 to 5 years in Colombia.[2] This unprecedented national study highlighted that 6.02% of one-year-old infants showed signs of dental caries, with conditions such as advanced untreated caries, teeth filled due to caries, or tooth loss related to this condition. This percentage increases significantly with age, reaching 47.10% at age three and 62.10% at age five.[2] The progression revealed by these data underscores the need to address dental caries at an early age.

In relation to this phenomenon, the study should also consider sugar consumption, which is associated with the development of tooth decay in children. High intake of free sugars, common in ultra-processed foods and beverages, is linked to noncommunicable diseases and the development of cariogenic lesions. The World Health Organization's recommendation to limit free sugar intake to less than 10% of total caloric intake is particularly relevant for preschool-aged children.[10,11] In this context, the increase in sugar

consumption among children has sparked debate about the relationship between the amount, timing, and frequency of added sugar consumption and the high incidence of caries.[12]

Therefore, this study seeks to analyze the association and impact that these factors may have on the history of caries in children aged 1 to 5 years in Colombia. The results will contribute to the understanding of the determinants of oral health in the population and will provide valuable information for the implementation of policies and strategies for the prevention and promotion of oral health in the country, while also recognizing the most relevant risks for the development of caries according to sociodemographic and behavioral characteristics in young children.

MATERIALS AND METHODS

Study design

This is a quantitative, cross-sectional, non-experimental study that seeks to associate the history of caries in children aged 1 to 5 years with the heterogeneity of risk factors to which it is committed. The microdata for the analysis were obtained through surveys conducted by interviewers and clinical examinations performed by trained and calibrated dentists.

Study participants

The study population includes mothers and caregivers interviewed in the 4th edition of the National Oral Health Study (ENSAB IV), as well as Colombian children aged 1, 3, and 5 years who underwent clinical evaluation during the study in 2014. The sample collected includes 2,092 children aged 1 year, 2,080 aged 3 years, and 2,274 children aged 5 years.

Data source

It is also worth mentioning that the source of information was the ENSAB IV microdata base, corresponding to Annex 4 - ENSAB IV Instruments, Module 1 “Home” and Module 3 “Mother or Caregiver of Children Aged 1, 3, and 5,” plus the microdata base on children contained in form 1 “clinical evaluation of children aged 1 to 3 years” and form 2 “clinical evaluation of children aged 5 years.” This is considered a secondary source of information, so the individual identification of participants was previously anonymized by the Ministry of Health and Social Protection (MSPS).

The microdata base from the MSPS population surveys and studies corresponding to ENSAB IV was then used, making public and free use of the “Form for downloading microdata from population surveys and studies” from the MSPS website, available at https://enlinea.minsalud.gov.co/Encuestas/Microdatos.aspx?E=ENSABIV.

It also mentions the “Guide for secondary analysis of population surveys by the Ministry of Health and Social Protection,” available at:

https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/VS/ED/GCFI/guia-analisis-secundario-sistema-encuestas.pdf which will follow guidelines, regulations, and methodologies to ensure the correct analysis of the microdata to be selected, with the aim of "generating new knowledge in health, new relationships between factors, and analyses that go beyond the exploratory and descriptive analysis presented in the final report of all studies".[13]

Inclusion criteria

Thus, to be included in this study, the records of Colombian children aged 1, 3, and 5 who participated were taken into consideration, as well as the records of mothers and/or caregivers who responded to the surveys and the records of Colombian children aged 1, 3, and 5 who had dental caries.

Exclusion criteria

Data from participants in the ENSAB IV study who were over five years of age were excluded from this study, as were data from children aged 1, 3, and 5 who had conditions other than dental caries.

Study variables

The variables provided by the household, the mother or caregiver, the child, and the breadwinner were then taken. These are illustrated in Table 1, Table 2, Table 3, and Table 4, respectively.

Data analysis

A multiple correspondence analysis was performed to generate dimensional reductions and group individuals. Subsequently, those that contributed at least 60% of the data variation were selected, the variables were given context, and the differences between them were identified.

RESULTS

The principal dimensions explain a significant proportion of the variance in the data, highlighting the importance of these dimensions in the underlying structure of the relationships between household variables (Table 1).

Tabla 1. Resultados del Análisis de Correspondencias para Variables del Hogar.

eigenvalue	variance.percent	cumulative.variance.percent	
Dim.1	0.5396116	11.360245	11.36025
Dim.2	0.5137940	10.816717	22.17696

Dim.3	0.5008910	10.545073	32.72203
Dim.4	0.5002733	10.532070	43.25410
Dim.5	0.5000356	10.527066	53.78117
Dim.6	0.3447793	7.258511	61.03968

Dimension 1, with the highest eigenvalue, stands out as the dimension that explains the greatest variability in the data, with 11.36% of variance explained.

Dimension 2 also contributes significantly, explaining 10.82% of the variance, closely followed by Dimension 3.

Together, the first six dimensions explain approximately 61.04% of the total variance, suggesting that these dimensions capture a considerable proportion of the relevant information in the relationships between household variables.

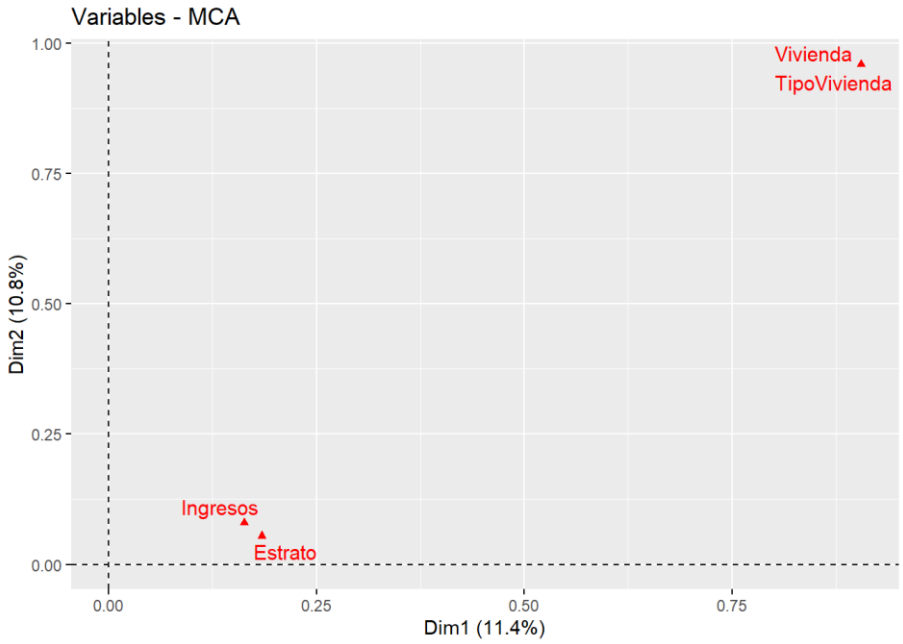

Figure 1. Variability in the data with an eigenvalue for Dimension 1 in the variable “Caregiver member of the household.”

Dimension 1 explains the greatest variability in the data with an eigenvalue of 0.6875, representing 17.19% of the variance. This dimension highlights the most important relationships in the variable "Caregiver household member" (Table 2).

Table 2. Results of the correspondence analysis for the variable caregiver household member

	eigenvalue	variance.percent	cumulative.variance.percent
Dim.1	0.6875291	17.188227	17.18823
Dim.2	0.3607902	9.019754	26.20798
Dim.3	0.3481953	8.704882	34.91286
Dim.4	0.3333333	8.333333	43.24620
Dim.5	0.3333333	8.333333	51.57953
Dim.6	0.3333333	8.333333	59.91286

The following dimensions also contribute significantly, although with a decrease in eigenvalue and explained variance.

Together, the first six dimensions explain approximately 59.91% of the total variance, suggesting that these dimensions capture most of the relevant information in the relationships between the categories of the variable "Caregiver Household Member."

Dimension 1 is the most informative, showing a clear differentiation between the "No" and "Yes" responses. In addition, it indicates a positive association with categories related to educational level. Dimensions 2 and 3 suggest associations with educational level, but these are weaker and do not show a clear differentiation between the "No" and "Yes" responses. Dimensions 4 and 5 do not show clear associations with the categories analyzed (Figure 2).

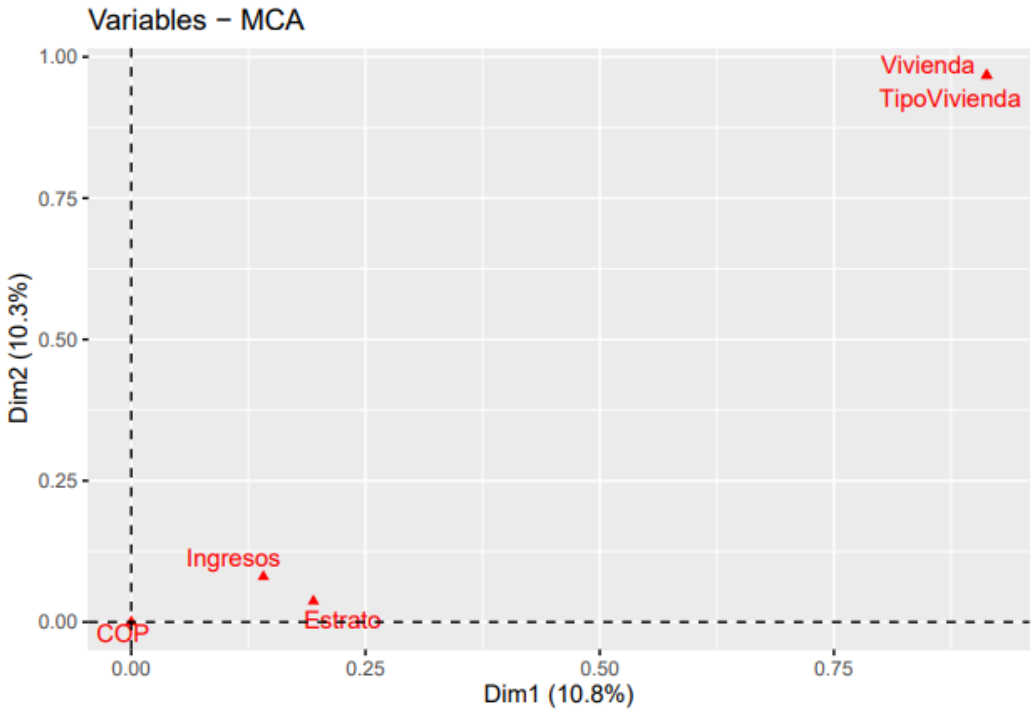

Figure 2. Variability in the data with an eigenvalue for Dimension 1 in the variable "type of housing."

Once the main dimensions were established, multiple correspondence analysis was performed with the caries history variable. This low contribution value of the caries history dimension is repeated in relation to all the main dimensions: Home, Mother or Caregiver, Child, and Financially Responsible Person.

This defines that the caries history variable (COP) was not balanced in the distribution of the data with the categories, as for each child with a history of caries, there were three with a history of NO caries, which implies a learning bias for the AI recognition model in determining the categories, due to the precipitation of majority values, corroborating this, to a large extent, with the multiple correspondence analysis.

DISCUSSION

Dental caries in children is a global public health problem that affects children between their first year of life and twelve years of age. It is a multifactorial disease whose prevalence varies between countries and is influenced by a number of social and individual factors. Commonly identified determinants include economic, political, and sociocultural factors, as well as personal characteristics such as educational level, income, high-sugar diet, oral hygiene, and others. However, the relationship between these characteristics and the history of caries in children may differ from what some previous studies suggest.

A recent study in Mexico found that 92% of children without caries had good oral hygiene and mothers with higher levels of education.[14] This finding highlights the importance of considering education and oral hygiene practices in the prevention of caries in children. In contrast, the results of the present study, based

on data from Colombia, indicate a lack of relationship between the characteristics of mothers and/or caregivers and the history of caries in children aged 1 to 5 years.

Similarly, the study by Molina and Durán [14] addresses the influence of socioeconomic status and health insurance coverage, noting that low economic status, depending on the study area, translates into limited access to dental care services, where only 7.32% of children in a population with low socioeconomic status received oral care, mainly those with mothers with higher levels of education. This perspective contrasts with the results of our research, which suggest that health system affiliation does not directly correlate with the history of caries in children in Colombia, challenging the idea that access to health services is the only determining factor.

Furthermore, when exploring other possible factors related to the presence of caries in children, the findings of Corchuelo and Soto15 in six municipalities in Valle del Cauca are mentioned, where the results showed that belonging to a certain population such as Afro-descendants, poor oral hygiene, and age are related to a higher history of caries. 15 For its part, the acceptable level of COP was found to be associated with gender, age, hygiene level measured through the community bacterial plaque index, and social security.15 These results highlight the need to consider ethnic and behavioral factors when analyzing dental caries in children, characteristics that were not directly related to COP in the present study.

Thus, while the scientific literature often highlights the importance of factors such as education, care, and oral hygiene in caries prevention, our findings suggest that these associations may vary significantly depending on the context. Although these factors are crucial, the results indicate that the sociodemographic and behavioral characteristics of caregivers analyzed in the present study are not directly linked to the history of caries in children, highlighting the complexity of the determinants of children's oral health.

SOURCES OF FUNDING

The costs of the study were covered by the authors.

CONFLICT OF INTEREST

This study was conducted impartially and without any conflict of interest. There are no financial relationships or connections that could influence the results or interpretations presented in this scientific article.

CONCLUSION

In conclusion, the importance of considering the diversity of factors that influence childhood dental caries is highlighted, and the need for further research to fully understand the complexity of this public health

problem in the Colombian context is emphasized. These results do not provide a solid basis for the design of specific interventions and oral health policies tailored to the particular needs of the child population in Colombia, due to the unbalanced distribution of the caries history variable (COP), which generated a bias in the AI model, with three children without caries for every child with caries, affecting the accuracy in the determination of categories.

REFERECES

1. Montserrat Catalá Pizarro y Olga Cortés Lillo. La caries dental: una enfermedad que se puede prevenir; Departamento de Estomatología. Universidad de Valencia. España An Pediatr Contin. 2014;12(3):147-51
2. Ministerio de Salud y Protección Social, MINSALUD. IV Estudio Nacional De Salud Bucal - ENSAB IV.
3. Yolanda Ayala Pérez , Leyanis de la Caridad Carralero Zaldívar , Beatriz del Rosario Leyva Ayala. La erupción dentaria y sus factores influyentes. Disponible en: http://scielo.sld.cu/scielo.php?pid=S1560-43812018000400013&script=sci_arttext&tlng=en
4. Jeffrery P. Okeson. Tratamiento de Oclusión y Afecciones Temporomandibulares. Disponible en: https://www.academia.edu/45355042/Oclusi%C3%B3n_y_afecciones_temporomandibulares_Okkeson_8ed
5. Ministerio de Salud y Protección Social. Afiliación en salud. Disponible en: https://www.minsalud.gov.co/proteccionsocial/Paginas/afiliacion-en-salud.aspx
6. ¿Cómo funciona el sistema de salud en Colombia? Disponible en: https://www.colombia.com/vida-sana/salud/como-funciona-el-sistema-de-salud-en-colombia-260325#:~:text=El%20sistema%20de%20sanidad%20colombiano%20es%20una%20parte,favor%20de%20la%20salud%20de%20todos%20los%20colombianos.
7. Organización Panamericana de la Salud. Organización Mundial de la Salud. Determinantes sociales de la salud. Diponible en: https://www.paho.org/es/temas/determinantes-sociales-salud
8. Sistema de Salud en Colombia. 4to foto. Plan de desarrollo. Facultad de Salud. Universidad del Valle. Disponible en: http://uvsalud.univalle.edu.co/pdf/plan_desarrollo/documento_previo_4to_foro.pdf
9. José Julián Rodríguez-Álvarez , Dedsy Yajaira Berbesí-Fernández; Conocimientos de higiene oral de acudientes y su relación con caries en menores de 5 años; Fac. Nac. Salud pública UDEA; 2018; Disponible en: http://www.scielo.org.co/pdf/rfnsp/v36n2/0120-386X-rfnsp-36-02-00007.pdf
10. Hauner H, Bechthold A, Boeing H, Brönstrup A, Buyken A, Leschik-Bonnet E, Linseisen J, Schulze M, Strohm D, Wolfram G: Evidence-Based Guideline of the German Nutrition Society: Carbohydrate Intake and Prevention of Nutrition-Related Diseases. Ann Nutr Metab 2012;60(suppl 1):1-58. doi: 10.1159/000335326

11. De la salud OM. Ingesta de azúcares para adultos y niños [Internet]. Who.int. 2015 [citado el 25 de octubre de 2022]. Disponible en: https://apps.who.int/iris/bitstream/handle/10665/154587/WHO_NMH_NHD_15.2_spa.pdf
12. Hong J, Whelton H, Douglas G, Kang J. Consumption frequency of added sugars and UK children's dental caries. Community Dent Oral Epidemiol [Internet]. 2018;46(5):457–64. Disponible en: http://dx.doi.org/10.1111/cdoe.12413
13. Guía para análisis secundario de las encuestas poblacionales del ministerio de salud y protección social, disponible en: https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/VS/ED/GCFI/guia-analisis-secundario-sistema-encuestas.pdf
14. Molina-Frechero N, Durán-Merino D, Castañeda-Castaneira E, et al. La caries y su relación con la higiene oral en preescolares mexicanos. Gac Med Mex. 2015;151(4):485-490
15. Corchuelo OJ, Soto LL. Prevalencia de caries en preescolares de hogares comunitarios en el Valle del Cauca y factores sociales relacionados. Rev Odont Mex. 2017;21(4):229-234.