

Relationship between family-related social determinants and dental caries in preschoolers from Anapoima, Cundinamarca¹

Relación entre determinantes sociales del ámbito familiar y caries dental en niños preescolares de Anapoima, Cundinamarca¹

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ABSTRACT

Objective: identify social determinants of health in families of preschoolers from Anapoima, Cundinamarca, and their relationship with prevalence of caries experience. **Methods:** in the framework of the Alliance for a Caries-Free Future - Colombia Chapter (Alianza por un Futuro Libre de Caries-Capítulo Colombia, AFLC-CC), the prevalence of caries experience in preschool children from Anapoima, Cundinamarca, was assessed using the International Caries Detection and Assessment System (ICDAS) and the dmft (decayed, missing, filled teeth) index, characterizing their families and homes. Descriptive analysis was done, using χ^2 to explore associations between dmft and ICDAS with socioeconomic and infrastructure conditions, as well as health practices in families. **Results:** 120 kindergarten children from the municipality of Anapoima were assessed and their homes were visited. The prevalence of caries experience (dmft) was 33.3% (average: 1.3 ± 2.5); when initial lesions were included, the prevalence reached 46.7% (4.3 ± 7.0). There was a relationship between the presence of caries and type of oral health problems referred to by parents, kin relationship with caregiver, visits to the oral health service, and availability of a space for the toothbrush ($p < 0.05$). **Conclusions:** the assessed children showed low caries experience compared to national benchmarks, which can be explained by the intermediate determinants identified in their family environments, with economic, infrastructure and family structure conditions favorable to health practices. It is necessary to better understand the relationship between social determinants and oral health from a structural point of view and to strengthen health strategies, in order to achieve caries-free populations.

Keywords: dental caries, children, primary prevention, social determinants of health, risk factors, oral health.

RESUMEN

Objetivo: identificar determinantes sociales de salud, en el ámbito familiar, en preescolares de Anapoima, Cundinamarca, y su relación con la prevalencia de experiencia de caries. **Metodología:** en el marco de la Alianza por un Futuro Libre de Caries-Capítulo Colombia (AFLC-CC), se valoró la prevalencia de experiencia de caries en niños preescolares de Anapoima, Cundinamarca, usando el Sistema Internacional de Detección y Valoración de Caries (ICDAS) y el índice ceod (cariados, extraídos y obturados, por diente), y se caracterizaron sus familias y viviendas. Se hizo un análisis descriptivo y usando χ^2 se exploraron asociaciones entre ceod e ICDAS y condiciones socioeconómicas, de infraestructura y prácticas de salud en las familias. **Resultados:** se valoraron 120 niños de jardines infantiles del municipio de Anapoima y se visitaron sus hogares. La prevalencia de experiencia de caries (ceod) fue de 33,3% (promedio: $1,3 \pm 2,5$); al incluir lesiones iniciales, fue de 46,7% ($4,3 \pm 7,0$). Se encontró relación entre presencia de caries y tipo de problemas de salud bucal referidos por los padres, relación filial con el cuidador, asistencia al servicio de salud bucal y disponibilidad de un espacio para el cepillo ($p < 0,05$). **Conclusiones:** los niños valorados presentaron baja experiencia de caries, en comparación con referentes nacionales, lo cual se explica por los determinantes intermedios identificados en su ámbito familiar, en los que se evidencian condiciones económicas, de infraestructura y de conformación familiar favorables para las prácticas de salud. Es necesario profundizar en la comprensión de la relación entre determinantes sociales y salud bucal desde la esfera estructural y fortalecer las estrategias en salud, con miras a lograr poblaciones libres de caries.

Palabras clave: caries dental, niños, prevención primaria, determinantes sociales de la salud, factores de riesgo, salud bucal.

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INTRODUCTION

The economic, environmental, and nutritional conditions of people and their relationship with health status have incited interest since the 17th century, but it was not until the 19th century when this relationship became evident, with workers in large urban factories in Europe experiencing health incidents. The fields of Public Health and Epidemiology emerged in the same period, driven by the need to control the infectious diseases that were causing high rates of mortality in the working class.¹ Explaining the health process in relation to living conditions is the base for the social determinants approach, understood as “The circumstances in which people are born, grow up, live, work, and age, and the systems put in place to deal with illness. These circumstances are in turn shaped by a wider set of forces: economics, social policies, and politics”.² This approach has enabled the understanding of the health-disease process with elements beyond individual risk factors.³

In this context, the World Health Organization (WHO) and other institutions founded the Commission on Social Determinants of Health in 2005, defining an interconnected and interdependent network of dimensions that frame people’s lives and in which living takes place. These include the intermediate dimension, dealing with working, environmental, and educational factors, as well as access to social and health services, which are evidenced within the family, influence the material conditions of life and are connected to behavioral and biological aspects of individual order.^{4, 5}

On the other hand, current evidence promotes the understanding of dental caries as a dynamic, reversible, reemerging, complex, and multifactorial demineralization

process resulting from an imbalance between tooth minerals and biofilm fluid. While microbiologically induced, this process is also related to social factors of individuals and groups.^{6, 7} Thus, this understanding goes beyond mere biological considerations of the pathology and recognizes environmental factors that can condition it. The indicators of this disease have decreased globally, but it remains a public health problem⁶ that needs to be included as a priority in public health policies under a renewed concept, in accordance with the current understanding of the disease. This could help promote oral health based on the real needs of each population and individual, through participatory interventions in areas of everyday life like the family, which is a critical social determinant of child health.⁸ All this is in connection with the primary health care (PHC) approaches, which recognize the need for comprehensive health strategies beyond the provision of services, based on structural aspects of a social, economic and political order.⁴

One of the goals of the PCH-based Alliance for a Caries-Free Future – Colombia Chapter (Alianza por un Futuro Libre de Caries-Capitulo Colombia AFLC-CC) is to achieve cohorts of children with no dental caries experience by the year 2026. Within this project, Universidad El Bosque connected with the demonstrative territory of Anapoima, Cundinamarca, in 2012. Located in western Cundinamarca, with tourism and agriculture as economic activities, the municipality had 13,106 inhabitants in 2014, according to projections of the National Statistics Administrative Department (Departamento Administrativo Nacional de Estadística, DANE).⁹

The Alliance’s project started out in this town by assessing the oral and general health of

children under 6 years and exploring their socioeconomic conditions by means of surveys, finding out a prevalence of caries experience (dmft) close to 53%, averaging 2.4 ± 2.0 in 5-year-olds—a percentage very close to that of the joint goal of the International Dental Federation (IDF) and the WHO for the year 2000, consisting of 50% of the population free from caries experience.¹⁰ This initial diagnosis in the municipality was followed by the local management of early childhood policies and the simultaneous implementation of actions of health promotion, specific prevention, and monitoring of institutionalized children in Anapoima, in accordance with current paradigms of caries.

Two years later, as a contribution to the achievement of caries-free generations under a PHC approach, more knowledge about the children's oral health conditions was already available but there was scarce information on the socioeconomic factors of the town's families—where care practices are mainly developed—. The development of this research project was then proposed with the intention of identifying social determinants of health within the families of preschool children from Anapoima, Cundinamarca, that could be related to the presence of dental caries.

MATERIALS AND METHODS

A descriptive quantitative study was carried out between the first semester of 2014 and the first semester of 2016, prior approval of the Universidad El Bosque Ethics Committee Act 2011-149 UEB. The study included a convenience sample of 120 children under the age of six years attending six pre-school institutions, including Children's

Development Centers (Centros de Desarrollo Infantil, CDI), community homes of the ICBF (Instituto Colombiano de Bienestar Familiar), and private kindergartens in the territory of Anapoima participating in the Alliance for a Caries-Free Future – Colombia Chapter.

The purpose and methodology of the study were communicated to the schools' coordinators first and later to the kids' parents in meetings held at the schools, thus obtaining approvals from the institutions and informed consents from parents, who authorized not only the oral health assessment of their children but also the home visits.

Four undergraduate students were trained in ICDAS criteria by a professor with experience in early caries diagnosis using the system (kappa interexaminer reproducibility 0.60-0.61. Perfect agreement 76-78%; intraexaminer reproducibility 0.82-0.83. Perfect agreement 80-88%).

The trained students and professor performed the dental clinical examinations of the preschoolers using the dmft index and the modified ICDAS system (ICDAS-mod: combining codes 1/2, 3/4 and 5/6). The examinations were done in the morning hours, in conventional chairs, using basic instruments including an OMS probe (Hu-Friedy. periodontal detector probe-PCP 11.5 B6), an intraoral mirror (Hu-Friedy. Double mirror-MIR4DSHD6 with an MH6 handle), wooden tongue depressors (Ziboject), drying with cotton rolls (New Stetic), and lighting with a headlight (Welch Allyn Portable Diagnostic Headlight, 20 lumens).

Afterwards, the researchers visited the families of children who were clinically assessed and accepted the visit, recording data on a previously adapted survey of family char-

acterization forms with a PCH focus, of the District Secretariat of Health of the city of Bogotá, which was reviewed by a qualitative research expert. This instrument contained 38 questions distributed in seven components, like this: location of home (three), conformation of the family group (ten), family economic activities (one), housing conditions (six), spaces for hygiene practices (three), public services and basic sanitation (four), and health practices (eleven).

The visits were made in the first semester of 2014. Appointments with the families were made by telephone, and an undergraduate student visited the families, applying the survey to an adult household member.

The information gathered from the oral assessment and family characterization was recorded in databases and analyzed according to the components previously defined. Concerning caries diagnosis, descriptive statistics was carried out by means of averages and standard deviations for the dmft index and modified ICDAS. The statistical analysis of the findings obtained in family visits were performed using descriptive statistics (proportions and frequencies).

Analysis of the social determinants of health from a given field (family, socioeconomic, and infrastructure conditions, and hygiene practices) and their relationship with dental caries conditions in children was made classifying the population into two groups: caries-affected (ICDAS ≥ 1) and caries-free (ICDAS = 0) individuals, using the χ^2 test to search for associations, with 95% significance. Statistical calculations were made with version 10.1 of the Stata® software.

RESULTS

Situation of the children's oral health

This study assessed 120 preschool children, finding out a prevalence of caries experience (dmft) of 33.3% with an average of 1.3 ± 2.55 , which increased to 2.0 ± 2.5 if surfaces were also assessed. By including initial lesions, the prevalence of modified caries experience was 46.7% with a dmft average of 4.3 ± 7.0 , in which the *d* component accounted for 30.8%.

Family visits

Visits to the 120 homes of the children clinically evaluated showed aspects of the social determinants within the families, corresponding to intermediate factors. The most relevant data showing some statistical relation to the children's caries condition are shown below.

Socio-economic conditions of families

50.2% (n = 63) of families resided in the urban area and 49.8% (n = 57) in the rural area. Of the 120 preschoolers, 45% were girls, and the average age in both sexes was 3.6 years ± 0.9 .

Most children (61.7%) belonged to nuclear families, mainly with four members (34.2%) (Table 1). Concerning working conditions, 59.2% of fathers and 40.8% of mothers were employees, while 24% of fathers and 23% of mothers said they were self-employed.

Table 1. Socio-economic conditions of families

	N	%
Family group		
Nuclear family	74	61.7
Extended family	37	30.8
Single-parent family	8	6.7
Child cared for by other relatives	1	0.8
Number of people in the household		
< 4 members	35	27.7
4 members	45	35.2
> 4 members	40	32.7
Number of adults in the household		
2 people	77	64.2
> 2 People	43	35.8
Number of children under the age of 6 in the household		
1 child under 6 years of age (early childhood)	90	75.0
More than 1 child under 6 years of age (early childhood)	30	25.0
People in charge of the child at home		
Parents	98	81.7
Other relatives	22	18.3

Housing infrastructure and sanitation conditions

It was found out that most houses are built with cinder blocks and cement (91.7%) and have floors of tiles or cement (90.8%). They generally have two bedrooms (65%) and up to two bathrooms (94.2%) and are provided with gas for cooking (89.2%). They also have drinking water (92.5%), supplied by the municipal aqueduct in 48.3%, as well as sewer system (83.3%) and solid waste collection, also by the municipality (84.2%). These and other housing conditions are shown in Table 2.

Table 2. Housing infrastructure and sanitation conditions

	N	%
Housing construction material		
Block and cement	110	91.7
Wood or zinc	10	8.3
Material of floors		
Tile or cement	109	90.8
Soil	11	9.2

	N	%
Number of bedrooms		
Two bedrooms or less	78	65.0
Three bedrooms or more	42	35.0
Number of bathrooms		
No bathroom	1	0.8
2 or less	113	94.2
3 to 4	4	3.3
> 4	2	1.7
Stove		
Firewood or gasoline	3	2.5
Gas	107	89.2
Electric	3	2.5
Other	7	5.8
Utilities and basic sanitation		
Drinking water	111	92.5
No drinking water	9	7.5
Water source		
Municipal aqueduct	58	48.3
Local aqueduct	53	44.2
Other	9	7.5
Sewer system		
Yes	100	83.3
No	20	16.7
Solid waste disposal		
Collected by the municipality	101	84.2
Buried or burnt	19	15.8

Hygiene practices and infrastructure

All households had a physical space for tooth brushing and hand washing. All children had a toothbrush at home and 50.8% had a toothbrush holder. 73% had fluoridated toothpaste available. The children's tooth brushing was accompanied by parents in 90%. Table 3 shows these and other conditions.

Table 3. Hygiene practices and infrastructure

	N	%
Toothbrush availability		
Yes	120	100.0
No	0	0.0
Tooth brushing space		
Adequate (mirror, light, and ventilation)	103	85.8
Inadequate	17	14.2

	N	%
Location of toothbrush		
Toothbrush holder	61	50.8
Glass	53	44.2
On washbasin or sink	6	5.0
Number of brushings per day		
1 time/day	10	8.3
2 times/day	63	52.5
3 or more times/day	47	39.2
Availability of fluoride toothpaste		
Yes	87	72.5
No	33	27.5
Person who accompanies the child during brushing		
Parents	108	90.0
Other family members	11	9.2
No company	1	0.8
Place for hand washing		
Adequate	106	88.3
Inadequate	14	11.7

Access to health services

Of the studied population, only 0.8% reported not being covered by the health system; the remaining percentage was covered by some kind of health insurance.

When asked about dental visits, 74% of parents reported attending the oral health services for a control visit (53.3%), because their children required treatment due to caries (17%), for dental trauma (2.5%) or because a dental certificate was needed (0.8%); the remaining 25.8% admitted they have never been to a dentist.

Relationship between health condition and intermediate determinants

The presence of caries in this population was significantly associated with the following variables: oral health problems referred to by parents, kin relationship with guardians, reason for dental visits, and availability of public services and toothbrush holder (Table 4).

Table 4. Relationship between health conditions and intermediate social determinants of health

Condition		Caries-affected (%)	Caries-free (%)	p
Oral problems referred to by parents	Yes	55.4	18.7	0.000
	No	44.6	81.2	
Kin relationship with guardians	Parents	73.2	89.1	0.025
	Other	26.8	10.9	
Reason for dental visits	Control	32.6	64.9	0.012
	Caries	27.9	9.1	
	Other	39.5	26.0	
Availability of public services	Yes	70.0	89.9	0.006
	No	30.0	10.1	
Availability of toothbrush holders	Yes	45.0	53.7	0.047
	No	55.0	46.2	

DISCUSSION

The prevalence of caries experience found in this study (33.3%) was lower than that of the baseline (37.4%) that served as the

basis for the project at the demonstrative territory of Anapoima within the Alliance for a Caries-Free Future two years earlier, in 2012, and than the prevalence described

in the IV National Oral Health Survey (ENSAB IV) for children aged 1, 3, and 5 years (38.3%).¹¹ By including initial lesions, caries experience reached 46.6%, 65.2% and 66.9% in the three studies, respectively. These data suggest that the studied early childhood population in the municipality of Anapoima has acceptable oral health conditions that even meet international goals like those defined by the IDF and the WHO for the year 2000.¹⁰ These findings differ from those obtained by Mac as et al in 2016¹² in a population of children aged 24 to 60 months from community homes in the Zipaquir area with similar social conditions, showing a caries prevalence of 64.3%, which increased to 92% when initial caries lesions were included in the analysis.¹² These specific clinical conditions in children from Anapoima can be associated to the factors surveyed during family visits, connected to specific social determinants. The most relevant determinants, especially those showing a statistically significant relationship with the presence of caries, are discussed below.

Concerning the characterization of families' socioeconomic conditions, a similar distribution was found between the rural and urban areas, with no statistically significant differences for caries-affected or caries-free conditions; this is relevant because various studies, like those conducted in Victoria, Australia, in 2008 and Colombia in 2015 state that living in rural areas is associated with a higher probability of caries.^{11, 13} In this sense, the findings of the present study can be associated to health and social conditions evenly distributed in the territory, most probably in relation to the fact that the participating rural families live in populated areas of the town, with access to adequate infrastructure for health

and education services, making their living conditions comparable to those of the town center. This situation should be addressed in more detail in further specific studies on the relationship between social determinants and early childhood caries in families living in more distant parts of the town's rural area, since this population is generally not institutionalized and has not been benefitted by the actions of the Alliance for a Caries-Free Future project.

As for households composition, the findings show that family groups are generally made up of four members, and 75% of them have only one child under the age of six, suggesting that more education and monitoring in health practices can be offered, since the adult/child proportion in both single-parent and overcrowded households may pose greater challenges and require additional tasks in child upbringing and therefore in the child's oral health conditions.¹⁴ In this sense, it has been stated that family structure is a parameter influencing the development and establishment of oral health habits in the child population¹⁵ and that children from single-parent families are more likely to have high levels of caries and to attend dental services more frequently.¹⁶

In close connection to family structure, our findings suggest that 81.7% of children are cared of by their parents, a relevant fact with a statistically significant relationship with caries conditions ($p = 0.025$) that can be explained not only by the fact that families have one adult caregiver only, but also that this caregiver has a kin relationship with the child. This is in turn related to the fact that oral health problems in early childhood are usually identified by adults either as direct observation or because of expressions of discomfort by the children; the adults are therefore the ones who make deductions

about the situation according to their own criteria and personal experience, deciding whether such situation is a real problem or not, and seeking for a solution accordingly. This is corroborated by findings in studies dealing with the relationship between the child's dental health status and that of the caregiver.¹⁷⁻¹⁹

Adults are crucial not only in the identification of problems but also in the promotion of long-lasting care and hygiene practices at home, as suggested by Nelson et al, 2012;²⁰ Dorri et al, 2010²¹ and Muirhead et al, 2013.²² In this sense, dental caries, clearly cavitation in nature, is identified by parents as a problem requiring attention—a fact that was statistically related to caries experience ($p = 0.000$)—. The identification of the disease in advanced stages can be explained by the historical constructions within the dental practice, which have been transmitted to parents in their personal experience, education background, and own history.²³⁻²⁴

All this highlights the changes needed in terms of considerations of the normal and the pathological, both by practitioners and parents, in order to understand dental caries as a process that, if timely identified, can be stopped, controlled, and even reversed. There is ample evidence of this being part of the current paradigm of dental caries,²⁵ which is fundamental for the actions within the Alliance for a Caries-Free Future project implemented in this town and should be expanded by strengthening educational processes with parents and further professional development.²⁶

Concerning socioeconomic conditions, most parents said they were salaried employees (59.2% of fathers and 40.8% of mothers), suggesting some degree of financial stability in families, including

social security coverage—which does not necessarily mean access to health or education services, or to timely and quality social services in general—. Considering the determinants, and in relation to the findings, this suggests that the socioeconomic conditions, determined by a specific position in a social scale and working conditions, may influence the availability of infrastructure, elements, knowledge, and professional guidance in the development of quality hygiene practices at home, as suggested by authors describing the association between low socioeconomic conditions and risk for caries lesions due to low educational level, poor access to preventive measures offered by health professionals, limited financial resources to procure oral care implements, lack of public services, and unemployment, just to name a few conditions.^{19, 27-30} In this regard, a group of researchers studied a Colombian population, finding out high levels of coincidence between dental caries prevalence and the presence of sociodemographic factors, like social stratum and schooling, as well as family factors like family type and household income, without these results being statistically significant.³¹

As the WHO points out (2009), “Access to quality housing and accommodation, drinking water and sanitation services is a right of every human being and an essential condition for a healthy life”.² In this sense, the fact that most of the study population lives in houses built with bricks and tiles, with access to water and sanitary services connected to a sewer system, is an indication of favorable living conditions that can be associated with better conditions and oral health practices.^{14, 32} This was validated in the present study since adequate spaces for oral hygiene were found in 85% of households, as well as access to a toothbrush in 100%,

located in well-defined places (toothbrush holders) in 50% of cases. This last item showed a statistically significant relationship with the presence or absence of caries in children, suggesting not only access to health education but also that there is a place for oral health in the social and everyday life of the families visited.

Access to health services in the country as a whole is closely related to health insurance, which in the study population was almost universal, with 99.2% coverage in different insurance systems. Although this does not necessarily mean effective, timely and quality access to health care services, it is important to highlight the fact that 74% of parents said they had brought their children to one dental appointment—in contrast to other populations, which identified dental visits in only 7,5%—.26 In addition, it is noteworthy that two thirds have kept their control visits, which had a statistically significant relation with the absence of caries in children, since the parents were seeking to identify the presence of dental caries in their kids ($p = 0.012$).

These relationships, resulting from a quantitative approach and statistically analyzed, suggest the existence of direct relationships between the social situation and health conditions of a given population. As such, they cannot be conclusive because social realities are complex and therefore cannot be explained and understood exclusively from statistics. However, these results offer relevant insights to suggest a relationship between some social determinants and caries conditions in children. This should be further analyzed and supplemented with information collected through additional tools and other research

techniques, like qualitative or mixed approaches.

Finally, advancing the understanding of social determinants of oral health is important in guiding efforts to promote health and quality of life. The implication for oral health professionals is to continue seeking a change in paradigms, moving from a strictly biological approach to a broader perspective of their social environment.¹⁵

CONCLUSIONS AND RECOMMENDATIONS

The characterization and analysis of intermediate social determinants in relation to the presence or absence of dental caries present us with the picture of a local population of children with favorable oral health conditions for this disease, statistically related with equally favorable social and family conditions. This is an important finding since research usually focuses on highly vulnerable populations with poor health conditions.

All this suggests that certain specific conditions of a community can be used to identify favorable oral health conditions by means of deeper analysis as suggested in this study, with explanations based in other intermediate determinants as well as structural determinants. The expansion of these approaches to broader levels should be aimed at influencing the reformation of public policies, in order to strengthen collective and individual actions in areas of everyday life like the family, in such a way that, in a participatory and creative way, the dream of caries-free generations can become a reality.

CONFLICT OF INTEREST

One of the authors (SM) is part of the Editorial Committee of *Revista Facultad de Odontología 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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