RELATIONSHIP BETWEEN ORAL HEALTH IN CHILDREN AND POVERTY RELATED FACTORS

Aldo Squassi[1,2], Silvia Mauro[1], María José Mauro[1], Gabriel Sánchez[2], Noemí Bordoni[1,3]

[1]Preventive and Community Dentistry, School of Dentistry, University of Buenos Aires, Argentina.
[2]Clinic for High Risk Patients Care, School of Dentistry, University of Buenos Aires, Argentina.
[3]Master in Public Health, University of Buenos Aires, Argentina.

ABSTRACT

The aim of this investigation was to analyze the variables related to poverty and its influence on oral health in children living in a suburban area of Buenos Aires, Argentina.

The study population consisted of 1,049 children. 579 children at social risk (Group I) were recruited from five neighborhoods with critical lacks (Katzman, 1989) and divided into 2 subgroups according to age: (A) preschool children and (B) school children. 470 preschool and school children from the same district but living in homes without critical lacks served as controls (Group II). The following variables associated with poverty were analyzed: (a) parents' instructional level, (b) employment conditions, and (c) accessibilty to regular oral health care. Group I comprised children from five neighborhoods categorized according to the incidence rate of each variable. Clinical examinations were performed under similar conditions by three calibrated investigators. DMFS, dmfs, total DMFS + dmfs, DS + ds, Care Index and Loe & Silness plaque index were recorded and analyzed using Student's t test, ANOVA and Chi square test (level of significance $p < 0.05$).

Dental indicators were significantly higher in Group I than in Group II. The dental caries indicators increased as the incidence rate of the poverty-related variables rose. The highest number of children with high cariogenic risk was observed in neighborhoods with the highest social risk ($c2 = 30.48$; $p < 0.005$).

The analyzed poverty-related variables seemed to be associated with factors that play a role in the dental caries development process in school and preschool children living in the Metropolitan area of Buenos Aires.

Key words: *Poverty, dental caries, epidemiology, children, caries risk.*

RELACIÓN ENTRE VARIABLES ASOCIADAS A POBREZA Y SALUD BUCAL EN NIÑOS

RESUMEN

El propósito de este trabajo fue analizar las variables relacionadas con la pobreza y su influencia sobre la salud bucal de niños residentes en un área suburbana de la ciudad de Buenos Aires, Argentina. La población bajo estudio consistió en 1049 niños. 579 niños (Grupo I) con riesgo social fueron seleccionados de 5 barrios con necesidades críticas (Katzman,1989) y divididos en 2 subgrupos de acuerdo con su edad: (A) Niños preescolares y (B) niños en edad escolar. 470 niños preescolares y escolares residentes en el mismo distrito pero provenientes de hogares sin necesidades críticas fueron utilizados como controles (Grupo II). Las siguientes variables asociadas con pobreza fueron analizadas: a) nivel educativo de los padres; b) condiciones laborales; c) acceso a cuidados regulares de salud bucal. El Grupo I comprendió niños de los cinco barrios categorizados de acuerdo con resultados obtenidos para cada una de estas variables. Los exámenes clínicos fueron realizados bajo condiciones similares por tres investigadores calibrados. Se registraron los índices CPOS, ceos, CPOS + ceos, componentes CS y cs, Indice de Necesidad de Tratamiento de Caries e índice de placa de Silness y Löe, y se analizaron utilizando la prueba de t de Student, ANOVA y la prueba de chi cuadrado ($p < 0.05$). Los resultados revelaron que los indicadores de estado dentario fueron significativamente superiores en el Grupo I que en el Grupo II. Los indicadores de estado dentario aumentan al incrementarse la tasa de incidencia de las variables relacionadas con la pobreza. El mayo número de niños con alto riesgo cariogénico fue observado en barrios con el mayor riesgo social ($c2 = 30.48$; $p < 0.005$). Podemos concluir que las variables relacionadas con pobreza analizadas parecen estar asociadas con factores que juegan un papel en el proceso de desarrollo de caries dental en niños preescolares y escolares que viven en el área metropolitana de la ciudad de Buenos Aires.

Palabras clave: *Caries, factores sociales, epidemiología.*

INTRODUCTION

International health organizations have pointed out that it is necessary to decrease the rate of children with dental caries and/or dental untreated caries. The World Health Organization (WHO), the Pan American Health Organization (PAHO) and the Center for Disease Control and Prevention (CDC) are committed to accomplish these goals in order to

reduce the existing inequalities. The governments agreed to achieve these goals through policies and programs to be made concrete through human resources development and funds allocations.
The aim of this study was to analyze the association between poverty-related variables and oral health in children living in a suburban area of Buenos Aires (Argentina).

- **Studies on poverty measurement**

Poverty is a multi-dimensional concept. It focuses on various aspects of deprivation, both income and non-income. It reflects disempowerment, insecurity when faced with shocks, lack of opportunities, income deprivation, shortfalls in consumption and inadequate supply of nutrition, poor access to education and low physical asset bases, dismal health status and health care access. It is expressed in each and all of them together. Poverty as a social construct cannot be reduced to quantitative aspects of measurement alone. Human Poverty Index (HPI) may be viewed as the synthetic expression of non-income dimensions of poverty[1,2]. Different perspectives have been employed for the measurement of poverty: (a) the biological approach[3] (b) the inequality approach[2], and (c) the absolute/relative deprivation approach[4-6]. Three measures were used to reveal different aspects of poverty: incidence (*head-court index*), depth (*poverty-gap index)*, and severity (*squared poverty-gap index*)[2,7].
The poverty measurement according to the global incidence rate does not measure the extent of the gap between incomes and the poverty threshold and it is insensitive to incomes distribution among poor people. In order to avoid this deficiency, the proposal is to calculate the incidence rate of each individual variable to be analyzed, goods or characteristics[1.] This latter approach supports the decision to assess poverty from multi-dimensional perspectives.

- **Relationship between poverty related variables and dental caries**

The relationship between dental health and poverty has been documented in studies conducted in underdeveloped countries and in vulnerable groups of developed countries with different health systems[8-13]. Sweeney *et al.*[14] found that children from the higher deprivation areas showed a significantly higher amount of missing and untreated teeth.
Prendergast *et al.*[15] conducted an analytical study using stratified samples of school children and questionnaires for parents, categorized according to the deprivation index of Townsend[5]. The results showed significant differences in the dmft index between poor and not poor children, but a relationship with ethnicity was not found.
Truin *et al*.[16] analyzed the caries experience in Dutch children. They found an increasing tendency in the percentage of caries-free children in families with middle or high income.
In developing countries, studies conducted in Argentina by Squassi *et al.*[17] and Bordoni *et al.*[18] showed a significant correlation between poverty and/or absence of dental health care and prevalence of dental caries. Freire *et al.*[19] studied the prevalence of caries and the need of dental treatment in Brazilian school children.

MATERIALS AND METHODS

The study population consisted of 1,049 children.
579 children (Group I) were recruited from five different neighborhoods of Buenos Aires metropolitan area (Pilar County). These neighborhoods were identified as neighborhoods with critical lacks as they showed at least two of the following attributes[20]:

- No sanitary facilities
- No access to drinkable water from the general network in the neighborhoods or in the house.
- 4 or more people living in one room (bathroom and kitchen not considered)
- House built on inappropriate lands, without permission or payments.
- More than one family per house.

The children and their families participated voluntarily, once they were contacted by an institution (Ronald Mc Donald Foundation) associated with the local hospital (Austral Hospital). Informed written consent was obtained from each participant according to the criteria of the School of Dentistry Ethical Committee, UBA.

470 children from the same district but living in residential neighborhoods without critical lacks served as controls (Group II). The children and their families participated voluntarily once they were contacted by a private institution that provides them with oral health care. Similar informed written consent was obtained.

TABLE 1. Children's distribution in the different groups and sub-groups		
GROUPS	**SUB-GROUPS**	
	A PRE-SCHOOL CHILDREN	B SCHOOLCHILDREN
I SOCIAL RISK	313 children aged 3.6 ± 1.12 y (age range: 2 to 6 y)	266 children aged 8.83 ± 1.1 y (age range: 6 to 14 y),
II NO SOCIAL RISK	200 children aged 3.9 ± 0.5 y (age range: 1.8 to 6 y)	270 children aged 8.0 ± 1.5 y (age range: 6 to 13 y)

Both groups were divided into 2 sub-groups according to age: pre-school children (Group A), and schoolchildren (Group B).

The composition of the studied sample is shown in Table 1.

The following conditions were investigated in all children and accompanying persons of Group I, and the incidence rate of each condition was calculated and expressed as percentage:

- The *family labor activity:* number of homes with members older than 15 years without salaried employment or independent workers who work less than 20 days a month.
- The *schooling level*: number of homes with one or more members older than 15 years with incomplete primary or elemental schooling and/or with one or more children from 6 to 15 years oldnot registered in an educational institution.
- The *oral health care*: number of homes where no member receives regular oral health care (at least once a year excluding emergencies).

Clinical examinations were performed using visual and tactile methods under similar conditions by three previously calibrated investigators (Kappa score = 0.90), using similar dental instruments (Dental mirror and Hu Friedy No. 5 dental explorer). Decayed, missing and filled primary and permanent surfaces were recorded[21] and epidemiological analysis was performed (DMFS, dmfs, total DMFS + dmfs). Cariogenic risk was determined assessing dental plaque index, sugar intake daily frequency, tooth brushing frequency and the presence of active caries lesions including white spots[22,23]. The Care Index (FT / DMFT) x 100) was calculated to measure the accessibility to health service[24].

The mean, standard deviation and/or the frequency of distribution of each variable were calculated. The level of significance of the differences in dental indicators between both groups was analyzed using Student's "t" test with suitable software applications (Primer 3.01, Mc Graw Hill, St. Louis, USA and Statistix 4.1, The Software Laboratory Inc, USA).

The level of significance of the difference in dental indicators among the five marginal neighborhoods (Group I B) was analyzed using ANOVA. Tables of contingence for Chi square test were employed to test differences in the gender and cariogenic risk distributions. Pearson correlation coefficient was used to test the correlation between the total decayed teeth and age. In all cases, a significance level of $p < 0.05$ was used.

RESULTS

Group I A consisted of 313 children, 162 girls (51.75%) and 151 boys (48.24%). Group II A included 200 children, 102 girls (51%) and 98 boys (49%).

Group I B comprised 266 children, 135 girls (50.75%) and 131 boys (49.25%). Group II B included 270 children, 135 girls (50%) and 135 boys (50%).

The incidence rate of the poverty-related conditions in the different neighborhoods is shown in Table 2. The general data recorded from the study population and the corresponding comparisons are shown in Tables 3, 4, 5 and 6.

Significant differences were found among the five neighborhoods at social risk (Group I B) when com-

TABLE 2. incidence rate # of the poverty related conditions in the different neighborhoods

Family Condition / Neighborhood	15 y.o.-members or older without employment at least 20 days a month	Adult members with incomplete elemental schooling or child members not registered in educational institutions	Members not provided with annual oral health care, excluding emergencies
El Toro	86%	100%	100%
Los Tilos	73%	100%	92%
Villa Lujan	69%	96%	90%
Santa Ana	68.5%	87%	91%
Open Door	66%	74%	70%

The number of events (registered variables) divided by 100 families at risk

TABLE 3. Dental status in preschool children

VARIABLE	GROUP I A (Social Risk) (X ± SD)	GROUP II A (No Social Risk) (X ± SD)	$t_{(511)}$
DMFS	0.96 ± 0.23	0.28 ± 0.11	2.09*
D	0.96 ± 0.23	0.28 ± 0.11	2.09*
M	0	0	-
F	0	0	-
dmfs	3.82 ± 0.32	2.83 ± 0.63	23.47*
d	3.82 ± 0.32	1.00 ± 0.5	26.05*
m	0	0	-
f	0	1.83 ± 0.5	51.80*
DMFS + dmfs	4.78 ± 0.54	3.11 ± 0.33	5.17*
DS + ds	4.78 ± 0.54	2.11 ± 0.22	28.73*
Decayed occlusal surfaces	3.12 ± 0.28	2.11 ± 0.22	26.14*
Decayed smooth surfaces	0.54 ± 0.21	0	37.26*
Decayed proximal surfaces	1.12 ± 0.36	0	46.18*
Care Index (FT+fT/DMFT+dmft).100	0	63.8 %	-
Plaque Index (Loe & Silness)	0: 10 %	0: 25 %	$\chi^2 = 11.56$*; df = 3
	1: 23 %	1: 27 %	
	2: 35 %	2: 25 %	
	3: 37 %	3: 23 %	

* Statistically significant ($p < 0.05$)

paring the total number of decayed primary and permanent surfaces ($F = 6.56$; $p < 0.05$): *Open Door*: 1.05 ± 0.93; *Santa Ana*: 1.21 ± 0.88; *Villa Lujan*: 1.63 ± 0.82; *Los Tilos*: 2.73 ± 1.06; *El Toro*: 2.86 ± 1.50). The higher values were recorded in those neighborhoods with the higher incidence rate of the poverty-related conditions. *El Toro* and *Los Tilos* neighborhoods showed the highest unemployment rates, along with the lowest educational level and no oral health coverage. The tooth brushing frequency was lower than 1 time/day and the sugar intake was 4.7 times/day, not being significantly different among neighborhoods ($F = 2.28$, $p > 0.05$). The highest number of children with high cariogenic risk was also observed in the neighborhoods with the highest social risk indicators ($c^2 = 30.48$; $df = 8$; $p < 0.005$). Only 4.5% of the children in Group I B were caries-free individuals.

The children in Group I did not show treated teeth ($F = 0$; $f = 0$) and the most prevalent component of DMFS and dmfs were DS (permanent decayed sur-

TABLE 4. Dental status in school children			
VARIABLE	**GROUP I B (Social Risk) (X ± SD)**	**GROUP II B (No Social Risk) (X ± SD)**	$t_{(534)}$
DMFS	3.25 ± 0.83	1.33 ± 1.00	20.48*
D	3.25 ± 0.83	0.25 ± 0.20	57.71*
M	0	0.03 ± 0.01	48.92*
F	0	1.05 ± 0.41	41.76*
dmfs	2.75 ± 0.14	3.41 ± 0.66	16.24*
d	2.75 ± 0.14	1.55 ± 0.15	11.26*
m	0	0.06 ± 0.03	32.61*
f	0	1.79 ± 0.13	64.56*
DMFS + dmfs	6.00 ± 0.35	4.74 ± 1.00	19.70*
DS + ds	6.00 ± 0.35	1.90 ± 0.22	69.27*
Decayed occlusal surfaces	2.83 ± 0.11	0.20 ± 0.06	71.78*
Decayed smooth surfaces	0.41 ± 0.17	0.20 ± 0.06	19.12*
Decayed proximal surfaces	1.38 ± 0.21	0.39 ± 0.06	74.42*
Care Index (FT+fT/DMFT+dmft).100	0	62.1 %	--
Plaque Index (Loe & Silness)	0: 3 %	0: 19 %	χ^2 = 149.13*; df = 3
	1: 20 %	1: 56 %	
	2: 37 %	2: 17 %	
	3: 40 %	3: 8 %	
* Statistically significant (p < 0.05)			

TABLE 5. Dental status in children at social risk			
VARIABLE	**GROUP I A Preschool children at social risk (X ± SD)**	**GROUP I B School children at social risk (X ± SD)**	$t_{(577)}$
DMFS	0.96 ± 0.23	3.25 ± 0.83	97.93*
D	0.96 ± 0.23	3.25 ± 0.83	97.93*
M	0	0	-
F	0	0	-
dmfs	3.82 ± 0.32	2.75 ± 0.14	50.72*
d	3.82 ± 0.32	2.75 ± 0.14	50.72*
m	0	0	-
f	0	0	-
DMFS + dmfs	4.78 ± 0.54	6.00 ± 0.35	31.62*
DS + ds	4.78 ± 0.54	6.00 ± 0.35	31.62*
Decayed occlusal surfaces	3.12 ± 0.28	2.83 ± 0.11	15.88*
Decayed smooth surfaces	0.54 ± 0.21	0.41 ± 0.17	8.09*
Decayed proximal surfaces	1.12 ± 0.36	1.38 ± 0.21	6.38*
Care Index (FT+fT/DMFT+dmft).100	0	0	--
Plaque Index (Loe & Silness)	0: 10 %	0: 3 %	χ^2 = 4.03; df = 3
	1: 23 %	1: 20 %	
	2: 35 %	2: 37 %	
	3: 37 %	3: 40 %	
* Statistically significant (p < 0.05)			

TABLE 6. Dental status in children with no social risk			
VARIABLE	**GROUP I A Preschool children No social risk (X ± SD)**	**GROUP I B School children No social risk (X ± SD)**	$t_{(468)}$
DMFS	0.28 ± 0.11	1.33 ± 1.00	14.77*
D	0.28 ± 0.11	0.25 ± 0.20	1.91
M	0	0.03 ± 0.01	42.41*
F	0	1.05 ± 0.41	35.86*
dmfs	2.83 ± 0.63	3.41 ± 0.66	9.60*
d	1.00 ± 0.5	1.55 ± 0.15	17.07*
m	0	0.06 ± 0.03	28.27*
f	1.83 ± 0.5	1.79 ± 0.13	0.80
DMFS + dmfs	3.11 ± 0.33	4.74 ± 1.00	22.17*
DS + ds	2.11 ± 0.22	1.90 ± 0.22	10.23*
Decayed occlusal surfaces	2.11 ± 0.22	0.20 ± 0.06	71.63*
Decayed smooth surfaces	0	0.20 ± 0.06	47.12*
Decayed proximal surfaces	0	0.39 ± 0.06	91.89*
Care Index (FT+fT/DMFT+dmft).100	62.5 %	64.0 %	--
Plaque Index (Loe & Silness)	0: 25 %	0: 19 %	χ^2 = 19.73*; df = 3
	1: 27 %	1: 56 %	
	2: 25 %	2: 17 %	
	3: 23 %	3: 8 %	
* Statistically significant (p < 0.05)			

faces) and ds (primary decayed surfaces) respectively. The Care Index in Group I revealed no health service accessibility.

The Group II A children presented 32.15% treated surfaces, and the DMFS+defs mean value showed significant differences with the DS+ds value (t=2.56; p > 0.01). The Group II B presented 59. 91% treated surfaces and the DMFS+defs mean showed significant differences with the DS+ds value (t= 3.78, p > 0.001).

A moderate positive correlation between the number of decayed surfaces and age was observed in preschool children with social risk (r = 0.78; p < 0.01). The total number of decayed teeth increased significantly up to 6 years of age, not showing significant differences up to 12 years of age. The frequency of pits and fissures was 0.63 ± 0.15 in Group I A (relative frequency: 0.75/child) and 1.53 ± 0.22 in Group I B (relative frequency: 2.56/child).

DISCUSSION

The measurement of poverty shows several limitations. If poverty is measured through the incidence rate of one variable, it does not account for the extent of the income deficit, whereas the poverty line is insensitive to the number of people involved. None of the variables alone determines the variations in the distribution of incomes among poor people[2]. That is why we propose the investigation of different poverty-related variables such as relative deprivation conditions that may determine variations among the different family groups living in homes with critical lacks.

Our results show that children living in social risk, determined according to parents' educational level, unemployment, and oral health care show significant differences in terms of their history of dental caries. The poverty-related conditions investigated were found to be intervening factors related to dental status in children. The analysis of the variables related to social risk in the five neighborhoods included in this study revealed higher prevalence of the disease in those with worse living conditions. Egli and Gunai[25] observed that the parents' level of education might be considered a good predictor of DMFT index in developing countries. In this study the parents'

educational level was included in the group of conditions related with the social risk category.

As regards the groups of children, 64.0% of the children in Group II B received dental care including preventive treatments, whereas 10% of those in Group I B referred having received some sort of dental care but did not show care-associated components. These findings are in agreement with studies by Vargas *et al*.[9] performed in Brazil, and by Naimar[10] on the population covered by Medicaid (USA). Peres *et al.*[26] informed that harmful social and biological risk factors accumulated in early life contributed to the development of a high level of dental caries in childhood.

Tikcle *et al.*[12] revealed that children irregularly treated showed a significantly higher dmft, d and m component than those regularly treated, and that significant inequities underlie in caries experience and the use of health services in children. These inequities recorded in marginal groups in developed countries coincide with those observed in children with health coverage, with different family socioeconomic status and educational level.

The Organization for Economic Cooperation and Development (OECD) and WHO havemade a joint publication entitled "Poverty and Health" in the Development Assistance Committee[27]. This document dedicated to health and poverty in developing countries provides a set of policy recommendations to a broad range of development agencies working on policy and operations. It provides a framework for action within the health system, and beyond it, through policies in other sectors and through global initiatives. In developing countries, breaking the vicious cycle of poverty and ill health is an essential condition for economic development and quality of life.

Some countries provide organized basic oral health services through public dental service to pre-school and school children. In the Nordic countries, between 80-95% of the children are seen by a dentist or a dental hygienist every year[28]. In other countries, screening is provided for all children or for those in certain age groups, or geographical areas or social conditions[29].

Heller *et al.*[30] concluded that when screening is not practical, readily available demographic data may provide valuable oral health surveillance information for identification of high-risk communities but these data do not identify high-risk individuals. In these analyses, demographic data were more useful than dental insurance claims data for oral health surveillance purposes.

Windstrom[28] informed that epidemiological studies show consistently higher utilization rates among those countries with higher educational levels. This study confirms these findings in a developing country.

There is considerable debate about whether to use a high-risk or a population strategy[31-33]. Widstrom[28] and Bordoni[21,22] have recommended following clinical guidelines or protocols considering not only the maximum of preventive measures, but also the goals to be reached, the actors involved, the operative strictness, their relevance and their editorial independence from the institutions.

Evidence-based treatment and patient oriented evidence should be based on reliable scientific literature showing that most available preventive measures are effective at least under some conditions. However, as the number of sensible best-practice guidelines in prevention increases, two problems remain. First, there are few studies on the cost-efficiency of different methods[34], and second, the treatment guidelines are poorly known and used by general dental practitioners[28]. Some educational methods have demonstrated efficacy to modify the clinical professional practice according to the fee for service payment model[35].

Schools of Dentistry and the providers of oral care must contribute to moving general oral disease prevention back to the people. Informed consumers must integrate preventive care to their daily routines and demand the application of rational and cost-effective clinical preventive measures.

CONCLUSIONS

Dental caries indicators were significantly higher in the group that lives in homes with critical lacks and with a high incidence rate of poverty-related conditions than in the group without social risk.

Dental caries indicators and cariogenic risk factors were higher in the group of children from families living in poor conditions, in terms of the higher incidence rate of the studied poverty conditions.

The analyzed poverty-related variables seem to be associated with factors that play a role in the dental caries development process in school and preschool children living in the Metropolitan area of Buenos Aires.

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CORRESPONDENCE
Dra. Noemí Bordoni
Av. Callao 1870 5º Floor - Buenos Aires (1024) Argentina
Phone: (5411) 4804-3615 - FAX. (5411) 4804-5581
nbordoni@ciudad.com.ar

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