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ORIGINAL ARTICLE

Early Childhood Caries and Family-Related Determining Factors in a Southern Brazilian City

Daniel Demétrio Faustino-Silva[1], Marcela Obst Comassetto[2], Alexandre Baumgarten[3], Rafaela Soares Rech[3], Márcia Cançado Figueiredo[4], Juliana Balbinot Hilgert[5]

[1]Professional Master's Program in Technology Evaluation and Production for SUS (Public Healthcare System), Grupo Hospitalar Conceição, Porto Alegre, RS, Brazil.
[2]Dentistry Graduate Program, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.
[3]PhD Student, Epidemiology Graduate Program, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.
[4]Professor, School of Dentistry, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.
[5]Professor, Epidemiology Graduate Program, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.

Author to whom correspondence should be addressed: Daniel Demétrio Faustino-Silva, Grupo Hospitalar Conceição, Gerência de Ensino e Pesquisa, Av. Francisco Trein, 596, 3º andar, Bloco H, sala 11, Porto Alegre, RS, Brazil. 91350-200. E-mail: ddemetrio@gmail.com.

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Abstract

Objective: To evaluate the factors associated to Early Childhood Caries (ECC) in a population of children under 5 years old in Porto Alegre, Brazil. **Material and Methods:** Cross-sectional study conducted at 10 Primary Healthcare Units during the 2008 Nationwide Multi-Vaccination Campaign. A questionnaire was administered to parents and guardians to look into their social-demographic and economic variables, along with their dental health practices. The children underwent dental examination. The presence of visible plaque and dental caries was evaluated using the DMFS index. Chi-Square tests and Poisson regression were conducted, with robust variance for prevalence ratios (PR). **Results:** 560 children were evaluated, most of them male (51.6%) and at the average age of 32.6 (±16.2) months. Their average family income was 3.21(±4.8) Brazilian minimum monthly salaries. Paternal schooling, number of children, and living conditions were not significantly associated to the dental caries and visible plaque outcomes. According to our multivariate analysis, greater maternal schooling resulted in fewer cavities (PR=0.26; CI95%0.09-0.81) and less visible plaque (PR=0.40; CI95%0.21-0.79). On the other hand, children enrolled in day care or taken care by "others" showed higher caries prevalence (PR=1.58; CI95%1.00-2.48) (PR=1.90; CI95%1.23-2.95), respectively, and those whose families were the mother/child type showed higher visible plaque prevalence (PR=1.44; CI95%1.07-1.95). **Conclusion:** It is important to recognize that issues related to maternal schooling, the care given, and family organization are factors associated to ECC in a population of under 5-year-olds in Porto Alegre, Brazil.

Keywords: Child, Preschool; Child Health; Dental Caries; Family Characteristics.

Introduction

Dental caries remain one of the most prevalent chronic diseases and are considered a serious public health issue in several countries [1,2]. It has been well established that underprivileged children are more greatly affected by caries and even less likely to use dental healthcare services, especially with respect to prevention [3]. Studies have consistently stated that this disease in childhood negatively impacts the quality of life of children and their parents [4], as well as their ability to learn and develop [5]. Additionally, families can ill afford the financial costs of a problem that is considered preventable [6] but which occurs due to the complex interaction of biological, behavioral, and social issues, given the literature mentions over 100 risk factors involved in the development of caries in children.

Beyond individual biological factors, we can safely say that Early Childhood Caries (ECC) is recognized as a disease featuring a heavy behavioral aspect, as it is greatly influenced by a family's lifestyle [7,8]. Issues related to income, schooling, housing, and even family makeup may be included in the social context. Aspects such as the number of siblings [9], one- or two-parent families [10], and brushing frequency are also mentioned. Furthermore, it is known that other influences, such as the mother's psychological functioning and the quality of the family environment, also play an important role in children's development [11]. Some authors also say that children's pattern of access to a dentist is positively correlated to their parents' [12].

Given this is an ideal age bracket for the development and establishment of healthy habits, the National Oral Health Policy guidelines advise that care in the first years of life should focus on prevention and be directed at children's parents and/or carers [13]. However, we can safely say that prevention-oriented initiatives in the country have not done enough, given the latest national survey shows the prevalence is 2.43 decayed teeth at 5 years old [14].

It is clear that, over the past few decades, there has been an increase in studies focusing on prevention and looking into the factors associated to ECC development. More and more, we need to acknowledge that educational and family organization aspects may be decisive and intimately related to oral health conditions and use of dental services by children. Although some ECC-associated factors have been firmly identified, the issues related to carers and environments in which children live have yet to be fully understood.

Considering how severe and highly prevalent the early childhood caries issue is in Brazil, prevention-oriented strategies need to be devised based on scientific grounds. However, Brazilian studies looking into ECC-associated factors in order to identify the contexts, which make children more susceptible are few and far between. In that regard, the purpose of this study was to evaluate the factors associated to Early Childhood Caries in a population of children under 5 years old in Porto Alegre, Brazil.

Material and Methods

Study Design

This is an exploratory, cross-sectional study conducted at primary healthcare units run by the Porto Alegre City Health Office, state of Rio Grande do Sul, Brazil, during the 2008 Nationwide Multi-Vaccination Campaign via the administration of a structured questionnaire and clinical exams.

Population and Sample

Ten primary healthcare units were selected based on block randomization between the city's 11 healthcare districts. Along the healthcare unit randomization process and in order to secure a representative, stratified sample from the entire city, this study looked at the areas and health districts in such a way as to consider each area's population proportionality. Vaccination locations were randomly picked in a systematic manner, based on the number of children vaccinated at each unit in the previous year's campaign.

Children in the sample were evaluated. Inclusion criteria required them to be under the age of 5 years and have at least one tooth visible in their mouth. Children were selected via a consecutive sample, meaning their parents were approached while waiting for the vaccine and invited to take part in the study in an alternating sequence, that is, one was invited but the next one was not. In case they refused, the next parent in line was invited, and so on and so forth until the sample for the primary healthcare unit under evaluation was complete.

To calculate sample sizes, we considered a dental caries prevalence index (DMFS>=1) of 27%, according to data for the population of children under the age of 3 years, as per SB-Brasil 2003 [14]. Considering a 5% variation and 99% confidence interval for this study, along with a standardized interval range and a two-tailed hypothesis test, we estimated a sample with 517 subjects.

Data Collection

The people in charge of the children were interviewed by previously trained field workers using a structured questionnaire. Then, dental exams were carried out by 13 trained, calibrated examiners. The exams were carried out under natural light with the aid of wooden spatulas meant to clear and remove occasional debris on teeth. Gauze was used when necessary. Dental caries were calibrated through an in vitro method using exfoliated and/or extracted deciduous teeth [15]. Visible bacterial plaque was calibrated through the in lux method in which each examiner individually evaluates 20 photos depicting each condition under study. Both processes are repeated after seven days. For intra and inter-examiner reproducibility, Kappa ≥ 0.7 scores were accepted.

The social-demographic variables collected were: i) maternal and paternal schooling (elementary school dropouts; elementary school graduates; high school dropouts; high school graduates; undergraduate or graduate degree); ii) age of mother and father (21 or younger; 22-39 years; 40 or older); iii) number of children (1; 2-3; 4 or more); iv) age of child (0-24 months; 25-36 months; 37 months or more); v) child's primary carer (mother; day care; others); vi) family structure (nuclear; expanded; mother/children); vii) living situation (homeowners; tenants/guests/others).

The oral hygiene variables were: i) child's oral hygiene frequency (up to three times a week; once a day; twice or more a day); person most often in charge of oral hygiene (child; parent; day care/others); child's reaction to oral hygiene (receptive; unreceptive; variable); child has seen a dentist (no; yes); carer has been given advice on child oral hygiene and care (no; yes). Children's nursing variables were investigated as well: daytime breastfeeding (0; 1 or more times); nighttime breastfeeding (0; 1 or more times); daytime bottle-feeding (0; 1 or more times); nighttime bottle-feeding (0; 1 or more times).

The outcomes studied were the presence of caries and visible bacterial plaque, based on clinical dental evaluations. The clinical variables collected were: i) visible plaque; ii) prevalence of caries established via the DMFS index – corresponding to the number of teeth decayed, filled or to be extracted due to caries, not including missing teeth given it is difficult to tell them apart from the natural tooth exfoliation process (0 index for cases when no deciduous teeth were decayed and an index higher than or equal to 1 when one or more deciduous teeth were decayed). The criteria used were the DMFS indices [16], as well as visible plaque [17].

Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows Software, version 20 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to calculate the absolute and relative frequencies, along with a Chi-Square test to compare proportions. Prevalence ratios (PR) were calculated by means of Poisson regression with robust variance. The null hypothesis rejection value was 0.05.

Ethical Aspects

The study was approved by the Research Ethics Committee of the Porto Alegre City Health Office, state of Rio Grande do Sul (Protocol No. 001.037460.07.2) for ethically and methodologically complying with its Resolution 466/12 and supplementary resolutions by Brazil's National Health Council.

Results

The sample studied comprised 560 children, most of them male 289 (51.6%) at an average age of 32.6 (±16.2) months, and whose average family income was 3.21 (±4.8) Brazilian minimum monthly salaries. The overall prevalence of caries in the sample was 19.1% (n=107) and of visible bacterial plaque was 37.1% (n=208), with an average 1.12 DMFS. When broken down per age bracket, children aged 0-36 months showed a 4.6% (n=26) prevalence of caries, and children aged 37-60 months, 14.5% (n=81), respectively. In those same age brackets, the average DMFS indices were 0.46 and 2.07, respectively.

The social-demographic characteristics of the population in the study are presented in Table 1. By observing the presence of caries outcome, statistically significant differences were found for

higher occurrence in: paternal schooling (p=0.006), age of child (p=0.013), and family type (p=0.011). For the visible bacterial plaque outcome, we found statistically significant differences in: maternal schooling (p=0.003), paternal schooling (p=0.027), age of child (p=0.000), and family type (p=0.047).

Table 1. Relationship between social-demographic characteristics and the presence of caries and visible bacterial plaque.

Variables	Presence of Caries		p-value	Visible Bacterial Plaque		p-value
	No	Yes		No	Yes	
	N (%)	N (%)		N (%)	N (%)	
Maternal Schooling						
Elementary school dropout	105 (76.6)	32 (23.4)		78 (57.4)	58 (42.6)	
Elementary school graduate	110 (79.7)	28 (20.3)	0.057	75 (54.0)	64 (46.0)	0.003
High school graduate	145 (82.4)	31 (17.6)		98 (56.0)	77 (44.0)	
Undergraduate or graduate degree	44 (93.6)	3 (6.4)		40 (83.3)	8 (16.7)	
Paternal Schooling						
Elementary school dropout	95 (76.6)	29 (23.4)		70 (56.5)	54 (43.5)	
Elementary school graduate	74 (75.5)	24 (24.5)	0.006	51 (53.7)	44 (46.3)	0.027
High school graduate	159 (88.8)	20 (11.2)		109 (60.2)	72 (39.8)	
Undergraduate or graduate degree	38 (88.4)	5 (11.6)		35 (79.5)	9 (20.5)	
Age of Mother						
21 or younger	76 (84.4)	14 (15.6)		55 (61.1)	35 (38.9)	
22 – 39	300 (81.7)	67 (18.3)	0.077	218 (59.2)	150 (40.8)	0.571
40 or older	34 (69.4)	15 (30.6)		25 (52.1)	23 (47.9)	
Age of Father						
21 or younger	27 (84.4)	5 (15.6)		22 (68.8)	10 (31.3)	
22 – 39	280 (83.1)	57 (16.9)	0.122	198 (59.3)	136 (40.7)	0.389
40 or older	103 (75.2)	34 (24.8)		78 (55.7)	62 (44.3)	
Number of Children						
1 child	203 (83.2)	41 (16.8)		153 (61.7)	95 (38.3)	
2 – 3 children	160 (78.8)	43 (21.2)	0.481	107 (54.0)	91 (46.0)	0.200
4 children or more	47 (79.7)	12 (20.3)		38 (63.3)	22 (36.7)	
Age of Child						
0-24 months	171 (96.6)	6 (3.4)		132 (76.7)	40 (23.3)	
25-36 months	96 (81.4)	22 (28.6)	0.000	70 (55.1)	57 (44.9)	0.000
37 months or older	143 (67.8)	68 (32.2)		96 (46.4)	111 (53.6)	
Primary Carer						
Mother	220 (85.6)	37 (14.4)		151 (58.3)	108 (41.7)	
Day care	100 (79.4)	26 (20.6)	0.013	74 (58.7)	52 (41.3)	0.931
Others	90 (73.2)	33 (26.8)		73 (60.3)	48 (39.7)	
Family Type						
Nuclear	238 (84.7)	43 (15.3)		169 (60.6)	110 (39.4)	
Expanded	125 (80.1)	31 (29.9)	0.011	93 (59.2)	64 (40.8)	0.047
Mother/children	32 (66.7)	16 (33.3)		20 (41.7)	28 (58.3)	
Living Situation						
Homeowners	284 (79.1)	75 (20.9)	0.085	213 (59.3)	146 (40.7)	0.754
Tenants/Guests/Others	126 (85.7)	21 (14.3)		85 (57.8)	62 (42.2)	

Table 2 shows the relationship between the oral hygiene variables and the outcomes studied. No significant differences were observed for the greater occurrence of caries and visible bacterial plaque. Also in Table 2, from the data on the relationship between the breastfeeding/bottle-feeding variables and the presence of caries and visible bacterial plaque, we see a statistically significant

difference for the greater occurrence of visible bacterial plaque and nighttime bottle-feeding (p=0.039).

Table 2. Relationship between oral hygiene and breastfeeding/bottle-feeding variables and the presence of caries and visible bacterial plaque.

Variables	Presence of Caries		p-value	Visible Bacterial Plaque		p-value
	No N (%)	Yes N (%)		No N (%)	Yes N (%)	
Child's Oral Hygiene Frequency						
Up to 3 times a week	4 (57.1)	3 (42.9)	0.221	2 (28.6)	5 (71.4)	0.214
Once a day	61 (78.2)	17 (21.8)		51 (63.0)	30 (37.0)	
Twice or more a day	278 (81.0)	65 (19.0)		205 (59.9)	137 (40.1)	
Person most often in charge of Oral Hygiene						
Child	34 (69.4)	15 (30.6)	0.084	23 (47.9)	25 (52.1)	0.164
Parent	255 (82.8)	53 (17.2)		191 (61.6)	119 (38.4)	
Day Care/Others	121 (81.2)	28 (18.8)		84 (56.8)	64 (43.2)	
Child's Reaction to Oral Hygiene						
Receptive	253 (81.6)	57 (18.4)	0.182	183 (59.6)	124 (40.4)	0.869
Unreceptive	69 (73.4)	25 (26.6)		55 (57.9)	40 (42.1)	
Variable	40 (83.3)	8 (16.7)		30 (62.5)	18 (37.5)	
Child has seen a Dentist						
No	277 (82.2)	60 (17.8)	0.251	202 (59.9)	135 (40.1)	0.412
Yes	130 (79.3)	34 (20.7)		92 (56.1)	72 (43.9)	
Carer has been given advice on Child Oral Hygiene and Care						
No	181 (80.4)	44 (19.6)	0.355	127 (55.9)	100 (44.1)	0.251
Yes	221 (82.2)	48 (17.8)		163 (61.0)	104 (39.0)	
Daytime Breastfeeding						
0	343 (80.9)	81 (19.1)	0.502	246 (58.3)	176 (41.7)	0.539
1 or more times	67 (81.7)	15 (18.3)		52 (61.9)	32 (38.1)	
Nighttime Breastfeeding						
0	354 (81.0)	83 (19.0)	0.563	249 (57.6)	183 (42.4)	0.166
1 or more times	67 (81.7)	15 (18.3)		52 (61.9)	32 (38.1)	
Daytime Bottle-feeding						
0	92 (78.6)	25 (21.4)	0.265	65 (55.1)	53(44.9)	0.337
1 or more times	318 (81.7)	71 (18.3)		233 (60.1)	155 (39.9)	
Nighttime Bottle-feeding						
0	186 (79.1)	49 (20.9)	0.187	127 (54.0)	108 (46.0)	0.039
1 or more times	224 (82.7)	47 (17.3)		171 (63.1)	100 (36.9)	

The final adjusted model is shown in Tables 3 and 4. Children whose mothers hold undergraduate or graduate degrees had fewer caries (PR=0.26; CI95%0.09-0.81) and less visible plaque (PR=0.40; CI95%0.21-0.79). Those who are taken care at day care centers (PR=1.58; CI95%1.01-2.48) or by "others" (PR=1.90; CI95%1.23-2.95) instead of by their mothers, showed greater prevalence of caries, respectively. Additionally, children from single-parent, mother/child-type families showed greater prevalence of visible plaque (PR=1.44; CI95%1.07-1.95).

Table 3. Gross and adjusted prevalence ratios (PR) relative to the presence of caries.

Variables	Caries		p-value (Adjusted)
	Gross PR (CI95%)	Adjusted PR (IC95%)	
Maternal Schooling			
Elementary school dropout	1	1	-
Elementary school graduate	0.87 (0.55-1.36)	0.91 (0.58-1.46)	0.693
High school graduate	0.75 (0.48-1.17)	0.69 (0.45-1.07)	0.102
Undergraduate or graduate degree	0.27 (0.09-0.85)	0.26 (0.09-0.81)	0.019
Carer			
Mother	1	1	-
Day care	1.43 (0.91-2.26)	1.58 (1.00-2.48)	0.049
Others	1.86 (1.23-2.83)	1.90 (1.23-2.95)	0.004
Family Type			
Nuclear	1	1	-
Expanded	1.30 (0.85-1.97)	1.11 (0.73-1.70)	0.631
Mother/children	2.17 (1.34-3.54)	1.63(0.97-2.71)	0.064
Living Situation			
Homeowners	1	1	-
Tenants/Guests/Others	0.68 (0.44-1.06)	0.66 (0.43-1.03)	0.065
Reaction to Oral Hygiene			
Receptive	1	1	-
Unreceptive	1.44 (0.96-2.18)	1.35 (0.88-2.06)	0.159
Variable	0.91 (0.46-1.78)	1.00 (0.54-2.21)	0.787

CI95%: Confidence Interval of 95%; PR: Prevalence Ratio.

Table 4. Gross and adjusted prevalence ratios (PR) relative to the visible bacterial plaque.

Variables	Visible Bacterial Plaque		p-value (Adjusted)
	Gross PR (IC95%)	Adjusted PR (IC95%)	
Maternal Schooling			
Elementary school dropout	1	1	-
Elementary school graduate	1.08 (0.83-1.41)	1.04 (0.79 -1.36)	0.766
High school graduate	1.03 (0.80-1.33)	0.99 (0.76-1.30)	0.973
Undergraduate or graduate degree	0.40 (0.20-0.76)	0.40 (0.21-0.79)	0.009
Carer			
Mother	1	1	-
Day care	0.99 (0.77-1.27)	1.00 (0.76-1.31)	0.998
Others	0.95 (0.73-1.24)	0.95 (0.64-1.43)	0.825
Family Type			
Nuclear	1	1	-
Expanded	1.03 (0.81-1.31)	0.97 (0.76-1.24)	0.816
Mother/children	1.48 (1.12-1.96)	1.44 (1.07-1.95)	0.016
Living Situation			
Homeowners	1	1	-
Tenants/Guests/Others	1.04 (0.83-1.30)	0.98 (0.78-1.23)	0.841
Reaction to Oral Hygiene			
Receptive	1	1	-
Unreceptive	1.04 (0.79-1.37)	1.02 (0.77-1.33)	0.915
Variable	0.92 (0.63-1.37)	0.94 (0.71-1.23)	0.635

CI95%: Confidence Interval of 95%; PR: Prevalence Ratio.

Discussion

This study investigated factors associated to the development of ECC in a sample of children under the age of 5 years in a southern Brazilian capital. Understanding the contextual issues

associated to ECC and oral hygiene is essential because they allow for more in-depth discussions about the central role played by families when it comes to children's oral health [18]. Studies traditionally relate the development of caries in early childhood to parents' self-care practices, or yet to the families' income or schooling [19]. This study's findings are original because they stem from the association between family makeup and the oral health profile in this age bracket.

The epidemiology of early childhood caries varies from country to country. However, for a long time it has been described as the most prevalent chronic disease in children, especially in those living in poorer social-economic conditions, regardless of race, ethnicity or culture [20]. Two decades ago, the prevalence of ECC in developed countries was described to range between 1 and 12%. On the other hand, in developing countries and even within underprivileged populations living in developed countries, the prevalence was reported to reach 70% of preschoolers at the time [20]. The problem is considered serious to this day because it affects babies and preschoolers across the world and creates a situation of inequality, which is described as one of the priorities to be tackled in terms of public health [21]. From the current literature we find this scene has changed very little over the years and the polarization of caries remains a challenge to be faced in many countries [22]. In Brazil, the latest national epidemiological survey completed in 2010 showed the prevalence of caries in 5-year-old children was 53.4%, with an average of 2.43 teeth affected [23]. Such value exceeded the target recommended by the World Health Organization, which expected 90% of those individuals to be free of caries in 2010 [24]. The prevalence found in children by this study was 19.1%, which is similar to a population of immigrants in Oslo, Norway, in which 19.9% of 3-year-olds had caries [25]. Therefore, we underscore the importance of consolidating the investigation into new possible factors in order to devise strategies for this situation, such as approaches focused on family life and child care so that caries may no longer be considered a serious childhood problem in the coming decades.

It is a fact that education may lead to a host of conditions that are not only economic but also social, given that learning more may even prompt the adoption of healthy habits and even improve people's living standards. In that regard, studies have associated carers' low educational level to the development of caries in children [26]. It has also been observed that children whose parents have lower schooling see a dentist less often [27,28], which may result in fewer preventative and curative actions with respect to children's oral health. With greater emphasis, low maternal schooling is seen as an important risk factor for the development of ECC. That is even more evident in children whose mothers are illiterate. Accordingly, this study found that children of more highly educated mothers showed lower prevalence of caries and visible bacterial plaque. Higher education levels may mean parents have a greater ability to access proper sources of knowledge and a better understanding of information, which may impact behaviors in the family. Such association may also explain the hard time less educated parents have to instill good oral hygiene habits in their children [29]. Additionally, parents' education may also be associated to lower family income and difficulty in accessing healthcare services [28]. It may even compromise their ability to buy healthy food [30].

It is a known fact that children require attention and special care in terms of oral health. In that regard, carers' ability to maintain children's oral health impacts various aspects of the family. Some studies have found a significant association between families with a higher number of members and/or children and increased ECC [26,31], given that parents' attention is divided between the children in larger families. Another study found that crowded families make children more susceptible to dental caries [32]. Additionally, psychosocial factors that impact parents' ability to maintain their children's oral health can be observed in several variables related to family structure and organization. This study looked into the influence exerted by the main carer, meaning the person who spends the most time taking care of the child. We found that children whose care is delegated to third parties and whose mother is not their main carer showed a greater prevalence of ECC. We believe children enrolled in day care or taken care of by "others" may present with worse oral health conditions because of the lack of individual, personal attention, which may make it harder to set proper care routines. A review conducted with great methodological accuracy and published by the World Health Organization states that improper, interrupted or negligent care brings adverse consequences to children's healthy development [33].

The various definitions used to categorize families in studies make it difficult to hold a more in-depth discussion. Some authors found that small children living in single-parent families are less likely to pay preventative visits to their dentist [10] and tend to have more tooth decay compared to two-parent families [10]. Families headed by single mothers are even more vulnerable [34]. The findings in this study are in agreement with that, given that families whose mothers are raising their children on their own presented with higher prevalence of visible bacterial plaque, an etiological factor of early childhood caries. These findings seem to indicate that single mothers are less efficient when it comes to maintaining their children's oral health than other mothers, which perhaps may be explained by their difficult compounded burden of running a home and holding a job without support from a partner. Children of mothers suffering from psychological disorders [35] or even anxiety about seeing a dentist [36], for instance, show greater prevalence of dental caries. That is why we must emphasize how important the social support provided to mothers by healthcare services is.

This study has some limitations. Its cross-sectional design does not allow for an investigation into causality. Additionally, conducting examinations exclusively during a vaccination campaign may make the population more homogenous, considering that those who take part in vaccination campaigns perhaps have a similar family organization. Other factors related to family makeup are likely involved in the high prevalence of caries in early childhood. Therefore, longitudinal studies taking a more in-depth look into which contextual factors are associated to the development of ECC over time are necessary. Paying greater attention to the family effect on child oral health will surely be highly useful for the understanding of this topic. Building on that, it is important to note that healthcare based on the principle that families play a central role requires medical professionals to change their practices through a healthcare approach founded on the understanding of family structures and respect for each family's reality, beliefs, and specific needs.

Conclusion

The findings in this study show ECC is related to social-economic and child care aspects, and that child oral health is influenced by their family type. This investigation found that children of more highly educated mothers showed lower prevalence of caries and visible plaque. It also found that children who are not cared for by their mothers and those living in single-parent, mother/child-type families presented with worse oral health conditions. Given that caries and bacterial plaque are strictly related and controllable conditions, it is essential to identify children showing these characteristics and put in place effective preventative actions to help these families maintain their children's oral health.

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