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Factors Associated with Caries and Deficient OHI-S DI-S in Preschool Children from Acapulco, Mexico

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Abstract

Introduction. Caries is a multifactorial disease that appears from nine months of age. Caries prevalence in preschool children ranges between 24% and 63%. **Objective.** To estimate the prevalence of caries and oral hygiene and associated factors in preschool children from Acapulco, Mexico. **Materials and methods.** A cross-sectional study was performed (September-November 2019), on 322 preschoolers from five public schools. Parents of the preschoolers responded to a

face-to-face questionnaire, and the prevalence of caries and oral hygiene were estimated using the DMF index and OHI-S DI-S through oral clinical examination. Trained and calibrated examiners (Kappa greater than 85%) performed the oral examination of preschoolers. Data analysis included simple frequencies of the relevant variables and estimation of the strength of association by bivariate and multivariate analysis by adjusted odds ratio (ORA) with 95% confidence intervals adjusted for clustering effect (CI95%acl). **Results.** Caries prevalence was 73% (234/322). The DMF index was 2.78; the OHI-S DI-S was good in 6% (19/322), fair in 76% (244/322), and poor in 18% (59/322) of preschoolers. The overall presence of biofilm was 52%, with a higher proportion in girls (59%) than in boys (43%), $p < 0.01$. Factors associated with caries were female gender (ORA 2.62, CI95%acl 1.41-4.86) and frequent consumption of sugary drinks (ORA 1.72, CI95%acl 1.01-2.92). Factors associated with poor OHI-S DI-S were female gender (ORA 1.92, CI95%acl 1.16-3.17) and overcrowding in the dwelling (ORA 1.41, CI95%acl 1.18-1.68). **Conclusion.** The female gender was associated with a higher prevalence of caries and deficient OHI-S DI-S. It was also found that the frequent consumption of sugary drinks was related to caries in preschool children. Reporting these results to parents or guardians is necessary to pay more attention to these population groups.

Keywords: caries, DMF Index, OHI-S DI-S, associated factors, preschool children.

INTRODUCTION

Caries is a chronic multifactorial condition[1] that may appear as early as nine months of age[2]. According to the World Health Organization (WHO), more than 530 million children worldwide suffer from caries in deciduous teeth[3]. The prevalence of caries in preschool children ranges between 24% and 63%[4,5]. In Mexico, the prevalence of caries in children between the ages of nine months and 12 years varies from 35% to 98%[6]. At 2 years of age, 47% of children have caries in deciduous teeth and the proportion increases to 73% in the 4-year-old group[7]. In 2015, in the south and southeastern areas of the country, which includes the state of Guerrero, the prevalence of caries in children aged 3 to 5 years was 62%[8]. In Mexico, the DMF index (decayed, missing, and filled teeth)[9] in preschool children had values from 1.0 to 7.2[10], and the OHI-S DI-S[11] was estimated to be adequate in 65% of preschoolers, regular in 31%, and deficient in 3%[12].

The factors associated with a higher prevalence of caries are consumption of foods with a high sugar content[13,14], older age of the child[15,16], low educational level of the parents[17,18], and prolonged breastfeeding for more than 24 months[19], although the latter is controversial[20]. Other factors that have also been reported to be associated with caries are the presence of dental biofilm[21], consumption of sugary drinks[22], frequency of toothbrushing during the day[23], toothbrushing without parental supervision[17], and low socioeconomic level of the family[18]. The factors associated with dental biofilm in preschoolers have been poorly studied; it has been found that older infants, the number of infants in the family, and the low educational level of the mother are associated with dental biofilm [24].

There are few studies on caries and OHI-S DI-S index in the child population of Acapulco and the state of Guerrero. The present study aimed to estimate the prevalence of caries and oral hygiene and associated factors, such as family sociodemographics and dietary and hygienic habits in preschoolers in Acapulco, Guerrero, Mexico.

MATERIAL AND METHODS

This cross-sectional study was conducted between September and November 2019 in five public preschools in Acapulco, Guerrero, Mexico. The study universe consisted of preschoolers aged 3 to 5 years enrolled in the participating schools. The selection of the preschools was by convenience. With the total size of the preschool population (n=383) we estimated the effect to be detected, using the following data: 50% proportion with caries in the unexposed group; significance level of 95%; and study power of 80%; resulting in a minimum odds ratio to be detected of 1.9.

The study area was the upper area of Acapulco, in the center of the city, characterized by a population of low-to-medium socioeconomic level. The units of observation or analysis were the children and the children's parents. The inclusion criteria were preschool children enrolled in the selected school, attending on the day of the study, whose parents agreed to their participation and allowed the oral examination. Exclusion criteria were children with disabilities or the presence of any condition that prevented clinical examination of the oral cavity. The elimination criteria were that the parent or guardian did not complete the questionnaire or an incomplete or illegible clinical examination record.

The research protocol was reviewed and approved by the ethics committee (Folio Number 2019-009) of the Centro de Investigación de Enfermedades Tropicales (CIET) of the Universidad Autónoma de Guerrero (UAGro). The educational authorities of the five schools gave their authorization. Parents or guardians gave their authorization for the preschoolers to participate in the study through a signed informed consent letter. In addition, each preschooler, who had parental or guardian authorization, was asked for verbal permission to participate in the study. The information provided was confidential but not anonymous and used exclusively for academic and research purposes. At the end of the oral examination, each preschooler received fluoride, toothpaste, and toothbrush, and the brushing technique was reaffirmed.

The measurement instruments consisted of a questionnaire for the parents or guardians of the preschoolers and a format with the odontogram of international use to measure the DMF-d9 index, the Simplified Oral Hygiene Index, and the Simplified Oral Hygiene and Disposal Index (OHI-S DI-S)[11].

The questionnaire, with 21 questions validated in other studies, obtained information from parents and preschoolers[21,23]. From the households, information was obtained on the number of members, the number of people living in the home, and the availability of drinking water. The following variables were measured for parents: age, marital status, occupation, schooling, monthly income, perception of their child's current nutritional health, and knowledge of caries and degrees of caries. The following variables were measured for preschool children: age and sex; age at ablactation; frequency of consumption of sweets and sugar-sweetened beverages; age at the beginning of toothbrushing; frequency of toothbrushing and whether it was before or after a meal; and adult supervision of toothbrushing.

The consumption of sweets was estimated by the following question: During the day, how many times does the child consume candies? The response codes were the number of times reported by the parents or guardians. The measurement of the frequency of consumption of sugar-sweetened beverages was made with the question: How often does the child drink sugar-sweetened beverages? The response codes were none or no consumption, infrequent, frequent, and very frequent.

The clinical examination of the oral cavity of the preschoolers was performed by 20 examiners, 10 operators, and 10 assistants from the Faculty of Dentistry of the Autonomous University

of Guerrero. The examiners were trained in the diagnosis of common oral cavity pathologies and in the observation and clinical examination of teeth. Only examiners who had a Kappa test greater than 85% in the diagnostic concordance of the examination of the teeth were selected.

The odontogram recorded the presence of caries in the children through the DMF-d index, which was calculated by adding the decayed, missing, and filled primary teeth[9]. The DMF-d index was classified as very low from 0 to 1.1; low, from 1.2 to 2.6; moderate, from 2.7 to 4.4; and high, from 4.5 to 6.5[10]. To estimate the OHI-S DI-S, teeth numbers 55, 51, 65, 85, 71, and 75 were checked, it was calculated with the codes, 0 no presence of debris or stains; 1, presence of soft debris covering less than one-third of the tooth surface or there is the presence of extrinsic pigmentation without other debris, regardless of the surface covered; 2, presence of soft debris covering more than one third but less than two-thirds of the exposed tooth surface; and 3, presence of soft debris covering more than two-thirds of the exposed tooth surface[11].

Two outcome variables (dependent variables) were measured, caries and the presence of dental biofilm. The operational definition of caries was the presence of a dark cavity evident in any of the teeth examined in the oral examination of the preschooler. The operational definition of preschooler with dental biofilm was when the OHI-S DI-S score in the oral examination was 1.5 to 3.0.

For the analysis of associated factors, the outcome variables were dichotomized as follows: presence or absence of caries; and presence of dental biofilm if the OHI-S DI-S score was 1.5 to 3.0 and absence of biofilm if the score was 0 to 1.4. Potentially associated variables were classified as present or absent exposure factors in the case of nominal variables, and in the case of ordinal, discrete, and continuous variables, different levels of exposure were explored until the greatest contrast was determined.

The information collected was digitized using EpiData software[25] and the statistical analysis was performed with CIETmap[26]. Simple frequencies of the relevant variables were obtained. Bivariate and multivariate analysis was performed with the Mantel-Haenszel procedure[27]. The strength of association was estimated by odds ratio (OR) and cluster-adjusted 95% confidence intervals (CI95%acl) according to Lamothe's proposal[28]. The multivariate analysis began with the saturated model with all the significant variables in the bivariate analysis, eliminating each of the variables that did not maintain 95% significance, until the final model was reached. Effect modification was assessed with X2 squared heterogeneity (X2het), as proposed by Zelen[29].

RESULTS

Of the 383 preschoolers enrolled, 51 (13%) did not attend school on the day of the study. Only three (0.78%) parents refused to allow their children to participate. Six preschoolers were excluded because they had a disability, and one participant was eliminated because his parent or guardian did not respond to the questionnaire. The analysis of the study was made on 322 preschoolers who had an oral check-up and there were an equal number of parents or guardians surveyed.

Sociodemographic data

The average number of persons per household was 4.5 (range 1 to 12). Ninety-five percent (307/322) of the households reported having potable water. The average age of the father was

32 years (SD=6.87, range 18 to 64), and the average age of the mother was 29 years (SD=6.30, range 18 to 47). Eighty-five percent (274/321) of the parents reported being married. The father's schooling was high school or higher in 71% (229/322); the mother's schooling was higher than high school in 75% (243/322) of the cases. The father's main occupation was that of employee (83%, 267/322) and the mother's was housewife (53%, 171/322). Sixty-seven percent (217/322) of fathers reported earning less than one minimum wage per day, and 33% (105/322) had one minimum wage or more. Parents' perception of the preschooler's current nutritional health was good at 74% (238/322). Ninety-seven percent (312/322) of parents were knowledgeable about tooth decay, however, 33% (105/322) were unaware that different degrees of tooth decay exist.

The age of the preschoolers was on average 4.2 years (SD=0.53, range 3-5). Fifty-four percent of the preschoolers (173/322) were female. Fourteen percent (45/322) had ablactation before five months of age. Seventy-two percent (232/322) started brushing their teeth at two years of age. 83% (268/322) brushed their teeth three times a day, and the majority (84%, 270/322) brushed their teeth after eating. 85% (274/322) brush their teeth under adult supervision. 19% (60/322) of preschoolers consume sweets more than three times a day and 73% (234/322) consume sugary drinks infrequently, 27% do so frequently.

Prevalence of caries

The overall prevalence of caries was 73% (234/322); 81% (140/173) in girls and 63% (94/149) in boys, p<0.01. In total, there were 864 decayed teeth, with a mean of 2.68 (SD= 2.67, range 0 to 12). The total number of filled teeth was 39 with an average of 0.12 (SD= 0.58, range 0 to 6) and there were 9 extracted teeth with an average of 0.028 (SD= 0.22, range 0 to 3). The dmf-d index was 2.8 (SD= 2.7, range 0 to 12).

In the bivariate analysis, there were only three factors potentially associated with caries: preschooler´s gender, mother's schooling, and frequency of consumption of sugar-sweetened beverages. Table 1 shows the results of the estimated strength of association (odds ratio) and the 95% confidence intervals in the bivariate analysis.

In the final model of the multivariate analysis, only the factors of female sex and frequent consumption of sugar-sweetened beverages were associated with caries, with an independent effect (Table 2). The greatest strength of association was with the preschool female sex factor (ora 2.62, 95%ciac 1.41-4.86). A girl had 1.62 times the risk of having caries compared to a boy. A preschooler who consumed sugar-sweetened beverages very frequently had a 72% higher risk of caries compared to a preschooler who consumed them infrequently.

ohi-s di-s in Preschoolers

The ohi-s di-s values were: 6%, good (19/322); 76%, fair (244/322); and 18%, poor (59/322). The mean ohi-s di-s was 1.4 (SD=0.5, range 0.0-3.0). Considering the average ohi-s di-s as the cutoff point, the prevalence of dental biofilm with values from 1.5 to 3.0 was 52% (166/322); 59% (102/173) in girls and 43% (64/149) in boys, p<0.01.

In the bivariate analysis of possible variables associated with poor ohi-s di-s, only the factors of the sex of the preschooler and the high number of people living in the dwelling were significant (Table 3).

Table 1. Bivariate analysis of factors associated with caries in preschoolers aged 3 to 5 years in Acapulco, Mexico, 2019.

Factors	Categories	Number of preschoolers		OR	CI95% acl	p
		With caries	Without caries			
Parents with knowledge about caries	No	7	3	0.87	0.13 - 5.66	0.88
	Yes	227	85			
Parents with knowledge about caries degrees	Yes	83	22	1.65	0.84 - 3.23	0.14
	Yes	151	66			
Preschooler age	4 to 5 years	201	65	2.16	0.95 - 4.91	0.07
	3 years	33	23			
Preschooler gender	Female	140	33	2.48	1.60 - 3.85	0.0001
	Male	94	55			
Age of the father	18 to 25 years	44	22	0.69	0.29 - 1.65	0.40
	26 to 64 years	190	66			
Age of the mother	18 to 27 years	111	38	1.19	0.70 - 2.02	0.58
	28 to 47 years	123	50			
Number of people in the dwelling	5 to 12 people	101	32	1.33	0.69 - 2.56	0.40
	1 to 4 people	133	56			
Marital status of the father or guardian	Single/widower	34	13	0.99	0.61 - 1.58	0.97
	Married/free union	199	75			
Father´s education	Elementary/ junior high	73	20	1.54	0.73 - 3.27	0.26
	High school or higher	161	68			
Mother´s education	Lower than junior high	7	1	2.68	1.01 - 7.11	0.047
	Junior high or higher	227	87			
Father´s occupation	Unemployed	5	1	1.92	0.61 - 6.05	0.27
	Employee/ Commerce	211	81			
Mother´s occupation	Unemployed	122	49	0.88	0.54 - 1.44	0.61
	Employee/ Commerce	110	39			
Daily income	< minimum wage	162	55	1.35	0.81 - 2.11	0.19
	≥ minimum wage	72	33			
Preschooler´s toothbrushing frequency	0 or once a day	37	17	0.78	0.42 - 1.47	0.44
	2 to 3 times a day	197	71			
Age of onset of toothbrushing	2 to 4 years	177	55	1.86	0.82 - 4.25	0.14
	1 year	57	33			
Moment of toothbrushing	Before eating	37	15	0.91	0.53 - 1.59	0.74
	After eating	197	73			
Sweet consumption	3 to 6 times a day	52	8	2.86	0.89 - 9.17	0.08
	0 to 2 times a day	182	80			
Frequency of consumption of sugar-sweetened beverages	Frequent	69	19	1.52	1.01 - 2.29	0.04
	Infrequent	165	69			
Adult supervision of tooth brushing	No	43	5	3.74	0.97 - 14.3	0.06
	Yes	191	83			
Age of ablactation	0 to 5 months	37	8	1.88	0.95 - 3.70	0.07
	6 to 36 months	197	80			
Preschooler´s nutritional health	Poor, regular	66	18	1.53	0.81 - 2.90	0.19
	Good and Very good	168	70			

ORua = Unadjusted odds ratio. ORa= Adjusted odds ratio. CI95%acl = 95% confidence intervals of the odds ratio adjusted for clustering. X2het = Chi-square of heterogeneity. p = Chi-square of heterogeneity p-value.

Table 2. Final model of the multivariate analysis of factors associated with caries in preschoolers aged 3 to 5 years in Acapulco, Mexico, 2019.

Factor	ORua	ORa	IC95% acl	X^2 het	*p*
Female gender	2.48	2.62	1.41-4.86	0.90	0.34
Frequent consumption of sugar-sweetened beverages	1.52	1.72	1.01-2.92	0.90	0.34

ORua = Unadjusted odds ratio. ORa= Adjusted odds ratio. CI95%acl = 95% confidence intervals of the odds ratio adjusted for clustering. X2het = Chi-square of heterogeneity. p = Chi-square of heterogeneity p-value.

The two variables maintained an independent effect in the multivariate analysis (Table 4). The greatest strength of association was presented with the preschool female sex factor (ORa 1.92, CI 95%ac 1.16 - 3.17). A girl had a 92% higher risk of having poor OHI-S DI-S compared to a boy. A preschooler living with five or more people had a 41% higher risk of having poor OHI-S DI-S compared to a preschooler living with fewer people.

DISCUSSION

The prevalence of caries was higher in girls than in boys. Also, the presence of dental biofilm was higher in girls. The DMF-d index was moderate. The factors associated with an independent effect on caries were the female sex and the high frequency of consumption of sugar-sweetened beverages. The factors that had an independent association with OHI-S DI-S were the female sex and the number of people over five in the dwelling. The purpose of the study was to generate information that would allow us to know the problem of caries and dental biofilm and to identify associated factors. The results of this research confirm the need to intensify some specific actions for caries prevention and dental plaque in the preschool population.

Developed countries have reported lower caries prevalence figures of 15% to 47%[15,18]. This may reflect better access to health services, better educational level, and higher parental income[18]. Social development contributes to a good level of preschoolers' health, mainly at the oral and dental levels. Some researchers in developing countries have reported caries prevalences between 60% and 70% in preschoolers close to the ones we report[21]. Other authors in Mexico have reported high percentages (90%) of infants with caries[5,12], although these studies

Table 3. Bivariate analysis of factors associated with poor OHI-S DI-S in preschoolers aged 3-5 years in Acapulco, Mexico, 2019

Factors	Categories	Number of preschoolers				p
		With deficient OHI-S DI-S	With adequate OHI-S DI-S	OR	IC95% acl	
Parents with knowledge about caries	Without knowledge	7	3	2.25	0.69 - 7.26	0.17
	With knowledge	159	153			
Parents with knowledge about caries degrees	Without knowledge	59	46	1.32	0.93 - 1.88	0.12
	With knowledge	107	110			
Preschooler age	4 to 5 years	143	123	1.67	0.96 – 2.89	0.07
	3 years	23	33			

Table 3. Continued

Factors	Categories	Number of preschoolers				p
		With deficient OHI-S DI-S	With adequate OHI-S DI-S	OR	IC95% acl	
Preschooler gender	Female	102	71	1.91	1.17 - 3.12	0.01
	Male	64	85			
Age of the father	18 to 25 years	34	32	1.00	0.48 - 2.08	0.99
	26 to 64 years	132	124			
Age of the mother	18 to 25 years	67	54	1.28	0.96 – 1.71	0.09
	26 to 47 years	99	102			
Number of people in the dwelling	5 to 12 people	75	58	1.39	1.11 – 1.75	0.01
	1 to 4 people	91	98			
Marital status of the father or guardian	Single/widower	23	24	0.89	0.43 - 1.85	0.75
	Married/free union	142	132			
Father´s education	Elementary/ junior high	44	49	0.79	0.49 - 1.27	0.33
	High school or higher	122	107			
Mother´s education	Lower than junior high	5	3	1.58	0.94 - 2.67	0.09
	Junior high or higher	161	153			
Father´s occupation	Unemployed	2	4	0.47	0.14 - 1.56	0.21
	Employee/ Commerce	151	141			
Mother´s occupation	Unemployed	78	93	0.60	0.40 - 0.89	0.01
	Employee/ Commerce	87	62			
Daily income	< minimum wage	112	105	1.01	0.70 - 1.46	0.96
	≥ minimum wage	54	51			
Preschooler´s toothbrushing frequency	0 or once a day	148	133	1.42	0.75 - 2.68	0.28
	2 to 3 times a day	18	23			
Age of onset of toothbrushing	2 to 4 years	41	26	1.64	0.97 - 2.78	0.07
	1 year	125	130			
Moment of toothbrushing	Before eating	21	31	0.58	0.32 - 1.08	0.09
	After eating	145	125			
Sweet consumption	3 to 6 times a day	29	31	0.85	0.58 – 1.25	0.41
	0 to 2 times a day	137	125			
Frequency of consumption of sugar-sweetened beverages	Frequent	164	152	2.16	0.51 – 9.08	0.29
	Infrequent	2	4			
Adult supervision of tooth brushing	No	28	20	1.38	0.65 – 2.91	0.40
	Yes	138	136			
Age of ablactation	0 to 5 months	23	22	0.98	0.80 - 1.20	0.85
	6 to 36 months	143	134			
Preschooler´s nutritional health	Poor, regular	35	49	0.58	0.33 - 1.02	0.14
	Good and Very good	131	107			

OR= odds ratio. CI 95% acl= Cluster-adjusted 95% confidence intervals. p= cluster-adjusted p-value. p= cluster-adjusted p-value.

Table 4. Final model of the multivariate analysis of factors associated with poor OHI-S DI-S in preschoolers aged 3 to 5 years in Acapulco, Mexico, 2019

Factor	ORua	ORa	IC95% acl	X^2 het	*p*
Female gender	1.91	1.92	1.16-3.17	0.10	0.75
Five or more people in the dwelling	1.39	1.41	1.18-1.68	0.10	0.75

ORua = Unadjusted odds ratio. ORa= Adjusted odds ratio. CI95%acl = 95% confidence intervals of the adjusted odds ratio by cluster. X2het = Chi-square of heterogeneity. p = Chi-square of heterogeneity p-value.

were performed in infants, from zero to 12 years of age, users of a pediatric dentistry clinic. It is possible that the patients attended because of a dental problem and since it is a specialized service, there was a higher proportion of affected children[10].

We found that the female sex factor was associated with caries. This is discordant with what is reported in world literature. Other studies have found that the male gender is the most affected[4,14]. In one study, female sex was associated with caries in the permanent dentition[30]. The reviewed literature did not offer a possible biological or physiological explanation between girls and boys of this age related to caries. It could be a social-cultural cause, since in general, the population of Acapulco has greater care and preferences for the male gender. Another study, also in Mexico, found the opposite[31]. Another author who similarly found a higher occurrence of caries in girls stated that it may be due to the earlier appearance of teeth and the access that girls may have to food preparation, since in some cultures cooking is closely linked to the female gender[32]. In one study, a higher prevalence of dental problems was found in girls, and the author reported that nuclear families act as a protective factor against caries[30].

In our study, frequent consumption of sugar-sweetened beverages was associated with caries; this association has also been reported in another study[22]. The cariogenic nature of sugars in the oral cavity has been demonstrated, particularly if there is no oral hygiene after consumption[13,14]. The presence of caries at an early age possibly reflects the cultural habit of the population that introduces sugary drinks into the diet of preschoolers at an early age[33].

The average OHI-S DI-S was 1.4; another author reported an index of 1.2 in children of the same age[24], a figure close to our result. The study was in preschoolers with similar socioeconomic characteristics, and the small difference may be because it measured only male preschoolers.

In our study, the female gender was associated with a more deficient OHI-S DI-S; in other studies, this association has not been reported[24,34]. In the data analysis of our research, we found that girls with single or cohabiting mothers had a higher percentage of poor OHI-S DI-S than daughters of mothers who reported being married; the size of the study sample prevented a more in-depth analysis. This marital status may indicate a greater need for work and consequently less money available for hygiene supplies and less time available for oral care of their girls. However, we found that parental supervision of toothbrushing was equal between girls and boys, while the frequency of brushing was lower in girls. The combination of proper oral hygiene techniques and high frequency of toothbrushing reduces dental biofilm rates[35].

The habitation of five or more people in the dwelling was associated with poor OHI-S DI-S in preschoolers. One study found this association with older age of schoolchildren, higher number of children in the dwelling, and lower schooling of mothers[24]. The association may be due to the economic constraints of the families; it is common that the greater the number of family members, the worse the oral health condition.

This study, due to its cross-sectional design, has limitations regarding the temporality of caries causation. It is reasonable to assume that caries occurred after exposure to the consumption of sugar-sweetened beverages. Another limitation was the missing data; 16% of preschoolers were absent; it is possible that their socioeconomic conditions are more precarious than those of the study participants. In this sense, the results could be overestimated. The results of the present study are representative of preschool units in the upper zone of the municipality of Acapulco; however, they could be generalized to other preschool units in other municipalities of the State of Guerrero or the country with similar characteristics.

CONCLUSION

The prevalence of caries was high, and the oral hygiene index was regular. The factors associated with caries were female sex and frequent consumption of sugar-sweetened beverages. The latter could be modified at a low cost through preventive programs implemented by health authorities. The factors gender of the preschooler and the number of people living in the home were the variables associated with the poor oral hygiene index. Although the latter factors are conditioning, they set a guideline for paying more attention to oral health in these population groups.

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