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Oral health follow-up studies in the 1993 Pelotas (Brazil) birth cohort study: methodology and principal results

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Abstract

The aim of this study was to describe oral health follow-up studies nested in a birth cohort. A population-based birth cohort was launched in 1993 in Pelotas, Rio Grande do Sul State, Brazil. Two oral health follow-up studies were conducted at six (n = 359) and 12 (n = 339) years of age. A high response rate was observed at 12 years of age; 94.4% of the children examined at six years of age were restudied in 2005. The mean DMF-T index at age 12 was 1.2 (SD = 1.6) for the entire sample, ranging from 0.6 (SD = 1.1) for children that were caries-free at age six, 1.3 (SD = 1.5) for those with 1-3 carious teeth at six years, and 1.8 (SD = 1.8) for those with 4-19 carious teeth at six years ($p < 0.01$). The number of individuals with severe malocclusions at 12 years was proportional to the number of malocclusions at six years. Oral health problems in early adolescence were more prevalent in individuals with dental problems at six years of age.

Keywords

Oral Health; Cohort Studies; Child; Adolescent

Introduction

Birth cohort studies have contributed significantly to our understanding of the effect of early social and biological factors on health conditions in adulthood, including hypertension, cardiovascular diseases, diabetes, neoplasms, and other conditions [1,2,3]. Population-based birth cohorts are rare in developing countries. An outstanding exception is the series of three Brazilian birth cohort studies in Pelotas, Rio Grande do Sul State, beginning in 1982, 1993, and 2004, respectively, and still under way [4,5,6,7]. Studies with this design are especially useful, since they help expand our understanding of the determinants of health problems.

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Contributors M. A. Peres participated in the design, planning, and supervision of the fieldwork, data analysis, and writing of the manuscript. A. J. Barros contributed to the data interpretation and the writing and critical revision of the manuscript. K. G. Peres collaborated in the design, planning, and supervision of the fieldwork, critical analysis, and writing of the manuscript. C. L. Araújo, A. M. B. Menezes, P. C. Hallal, and C. G. Victora collaborated in the critical revision and writing of the manuscript.

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Population-based birth cohort studies focusing on oral health problems and the related exposures are also scarce. The existing examples include the birth cohort launched in Dunedin, New Zealand, in 1972. In this study, individuals were studied from birth to 32 years of age for their various oral health trajectories, including plaque dental caries, gingival bleeding, and periodontal diseases [8,9].

In the Pelotas birth cohorts, oral health follow-up studies were conducted in the 1982 cohort when the individuals were 15 and 24 years old, and in the 1993 cohort at 6 and 12 years of age [10,11,12,13,14,15]. We have no knowledge of other birth cohorts involving oral health issues and performed outside the developed countries.

The main objectives of the current study were to present the methodology of the follow-up studies at 6 and 12 years and to test the association between dental caries and malocclusions at 6 and 12 years of age, respectively, in the 1993 birth cohort in Pelotas.

Methods

The study was held in the city of Pelotas, located in the southern region of Rio Grande do Sul State, near the border with Uruguay. The population of Pelotas in 2000 was 323,158, 93% living in the urban area (*Censo Demográfico de 2000*. Instituto Brasileiro de Geografia e Estatística, http://www.ibge.gov.br). The main economic activities are agriculture, livestock farming, and commerce, besides an important university campus. Despite being a regional hub, the city is experiencing a process of impoverishment, with a relative drop in its per capita gross domestic product (GDP) compared to the State of Rio Grande do Sul and Brazil as a whole [4].

In 1993, the second of three birth cohorts was launched in Pelotas, the main aim of which was to study perinatal and child health [5]. In 1999, when the children reached six years of age, the first oral health study was performed, and followed by the second study when the children reached 12 years of age. Methodological details of the cohort study have been published elsewhere [5,7].

The oral health study in the 1993 cohort at six years of age

In 1999, when the children in the cohort reached six years of age, an oral health study was performed whose main objective was to investigate early-life social, biological, and behavioral effects in the children on the occurrence and severity of dental caries and malocclusions, in addition to estimating the prevalence and severity of these conditions.

Based on the total sample of 5,249 live births in Pelotas, a 20% sample was obtained in 1993 for follow-up, including all the low birth weight infants. In 1998, 1,273 children from the sample were located. From this sample, a subsample of 400 children was obtained for the oral health study. The calculation assumed 65% caries prevalence for children not exposed to risk factors, 5% significance level, and test power of 80%, totaling 302 children. This sample was sufficient to detect a relative risk of 1.3. In addition, the association was investigated between malocclusions at six years of age and breastfeeding duration. Non-exposure to breastfeeding was defined as children that nursed for less than nine months. Assuming the detection of a relative risk of at least 1.9 for anterior open bite and 2.5 for posterior crossbite, with respective prevalence rates of 54% and 20% in children that nursed for less than nine months (unexposed to breastfeeding), we obtained a sample of 342 with 80% power and 5% type I error, totaling 400 children, after adding 10% at the end to compensate for refusals and losses. Children were selected for the oral health study by simple random sampling.

Since all the low birth weight children were included, totaling 28.7% of the sample of 1,273 children, all the analyses were weighted so as to represent the true proportion of low birth weight children (9.7%). In addition to the oral examination, the child's parent or guardian answered a questionnaire on habits, behaviors (use and frequency of tooth-brushing and flossing), toothache, and use of dental services. The questionnaire and oral examination were completed in the children's homes. The fieldwork was preceded by training and calibration of the three team examiners, pre-testing the questionnaire, and a pilot study in 40 households (10% of the sample). Inter-examiner diagnostic reproducibility was measured by the kappa statistic, observing 0.65 as the lowest value for the tooth-by-tooth diagnosis of the dental crown status, and the majority of the values equal to 1.0.

The field team consisted of three pairs, each including an examiner (dentist) and an interviewer. Visits were preceded by telephone contacts from the study's secretary. The majority of the addresses and telephones of the children's parents or guardians were up-to-date, since one of the cohort's follow-up visits had occurred in 1997. The exams were performed with dental instrument kits (World Health Organization CPI probe, number 5 plane mouth mirror, gauze, and wooden spatulas) packaged in craft paper, autoclaved, and stored in metal boxes for transport to the homes. The examiners used disposable masks and gloves for each of the exams, and all the material was opened in the house in the presence of the children and their parents/guardians.

Clinical examination included diagnosis of soft tissue lesions, dental crown conditions (caries), and analysis of occlusion. The examination began with the upper right quadrant, followed by the upper left quadrant, lower left quadrant, and finally the lower right quadrant. The children were examined under natural light, sitting in a chair with the examiner in front. When necessary, the child's mandible was placed in the centric position by the examiner for occlusal analysis.

The study calculated the index that measures caries on the deciduous dentition, the dmft index (counting decayed, missing, and filled deciduous teeth), based on WHO diagnostic criteria [16]. Occlusal problems were recorded based on the Foster & Hamilton classification [17]. This classification allows identifying the presence of anterior open bite, unilateral or bilateral posterior crossbite, and inter-canine relationship and occlusion. The stage of eruption of the first permanent molars (not erupted, initial eruption, distal fossa covered by the mucous membrane, occlusal face released, and in occlusion) and the presence of soft tissue lesions (fundamental lesions) were also diagnosed.

Children were defined as losses when it was impossible to contact the family or conduct the interview after four attempts, including at least one in the evening and one on weekends. Of the total of 400 children in the sample, 359 (89.8%) were studied. The losses resulted from the family's moving to another municipality (38) and three refusals.

The oral health follow-up study at 12 years of age

The 359 children that participated in the study in 1999 were searched for in 2005 to conduct new exams and interviews. Twelve years is considered an index age used internationally for assessing oral health conditions in childhood and early adolescence [16]. After locating the children and obtaining authorization for participation the study, the home visits were made.

A questionnaire was used containing questions on the use of dental services, history of toothache, and habits and behaviors related to oral hygiene.

The clinical examination began with the diagnosis of fluorosis following by identification of dental traumas and associated treatment needs, examination of the dental crown (caries),

gingival bleeding, and finally dentofacial anomalies. The examination began with the upper right quadrant and ended with the lower right quadrant and was performed in the child's home, in the room with the best light. Headlights were used to improve the field of view. Each examiner wore the proper gear and used all the dental instruments properly sterilized (number 5 plane mirror and WHO model CPI probe).

All the clinical information on malocclusions was collected using the Dental Aesthetic Index (DAI) criteria, which assesses the following occlusal conditions: number of lost incisors, canines, and premolars, incisal crowding, incisal spacing, diastema, anterior maxillary and mandibular irregularities, mandibular protrusion, anterior open bite, molar relationship, and overjet. To calculate the index, each condition receives a weighting factor, the conditions are added, and a constant is added at the end [16]. After the calculation, the index is categorized as follows: normal occlusion (≤ 25), malocclusion with need for elective treatment (26-30), severe malocclusion with treatment highly desirable (31-35), and highly severe or incapacitating malocclusion (≥ 36). The examination also assessed caries, fluorosis, trauma, and gingival bleeding. Diagnosis of dental caries followed WHO criteria 16. The study calculated caries prevalence (proportion of individuals with DMF-T ≥ 1), mean DMF-T index (number of decayed, missing, and filled teeth), its components (decayed, missing, and filled), the proportion of disease-free individuals (DMF-T = 0), and the care index (relationship between filled component teeth and DMF-T index). The care index indirectly expresses the degree of utilization of dental services in population groups [18].

To detect gingival bleeding, all the teeth were probed in six sites (three on the buccal face and three on the lingual or palatal face of each tooth) with the above-mentioned periodontal probe, waiting ten seconds after probing to verify the presence or absence of bleeding. The study calculated the prevalence of bleeding (bleeding present in at least one tooth), mean number of teeth with bleeding per individual, and the proportion of teeth with bleeding among those present.

Prevalence of fluorosis was estimated using the Dean index, which classifies fluorosis as very mild, mild, moderate, and severe [16]. Cracked/fractured teeth were identified according to the adapted O'Brien criterion [19]. The index uses the dental examination of the eight incisors and is categorized into absence of dental trauma, dental enamel fracture, enamel and dentin fracture, fracture with signs of pulp involvement, tooth with no fracture but with signs of pulp involvement resulting from trauma, avulsed tooth due to trauma, other type of damage, and not assessed. The study also assessed the need for dental treatment due to trauma. Toothache reported in the previous month was also recorded, and the intensity was measured with a scale ranging from 1 to 10.

A specific instrument was applied to measure the impact of oral conditions on quality of life, the *Oral Impacts on Daily Performance* (OIDP) proposed by Adulyanon & Sheiham [20], validated in Brazil [21]. OIDP is based on the dimensions of pain, discomfort, limitation of function, and dissatisfaction with appearance that can lead to social, psychological, and physical incapacity. This indicator can vary from 0 to 9, categorized as OIDP = 0 or ≥ 1.0.

The fieldwork was preceded by a pretest with all the instruments and a pilot study with 40 children (10% of the sample) of the same age and not belonging to the sample. Calibration of the examiners was based on another 40 children 11-13 years of age enrolled in public and private schools according to a previously described methodology [22]. Diagnostic reproducibility was measured with the kappa statistic (categorical variables) and the intra-class correlation coefficient (continuous and discrete variables), showing good inter-examiner reproducibility after two weeks of intensive training (the lowest value was 0.60 for

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gingival bleeding, although most of the values were 1.0). An instruction manual for the field researchers was prepared and used during the training and throughout the data collection.

Four teams were formed, each consisting of an examiner and an interviewer, undergraduate students in the last year at the School of Dentistry, Federal University in Pelotas (UFPel), specifically selected for the study. The field supervisor was a dentist (and doctoral student). The team spent 30-40 minutes at each household. Quality control was done by the field supervisor in 10% of the sample, by telephone, by applying a short version of the questionnaire.

The fieldwork took eight weeks, from April to June 2005. Table 1 shows the oral health information collected at 6 and 12 years of age.

Data keying-in and analysis

A databank was created using Epi Info 6.04 (Centers for Disease Control and Prevention, Atlanta, USA), and all the information was recorded independently by two processors. The two digital records were compared and the errors were corrected. Later, the study supervisor and coordinators, together with the processors, verified the databank's consistency.

The response rates for each of the studies were calculated and compared for some socio-demographic characteristics of the target population, using the chi-square and t-test. The prevalence rates were calculated for exposures to habits, behaviors (tooth-brushing and flossing) and use of dental services. Comparisons were made between prevalence of dental caries and malocclusions at 6 and 12 years. The dmf-t index at six years was categorized according to distribution tertiles (0, 1-3, and 4-19) and compared to the distribution of the DMF-T index at 12 years of age using the Mann-Whitney test. Malocclusions identified at six years were divided into four categories (absent, one, two, or three malocclusions), and the association between this variable and DAI at 12 years of age was assessed using chi-square. The principal exposures and outcomes were compared according to family income quartiles at birth using the Kruskall Wallis test for comparison of continuous or discrete variables with two or more categories, Mann-Whitney U test for comparison of continuous or discrete variables with two categories, and chi-square test for comparison of proportions.

Ethical issues

The studies were approved by the Institutional Review Board for Research in Human Beings at UFPel. Free and informed consent was obtained from the parents or guardians. Children with dental problems were referred to the UFPel School of Dentistry, where treatment was guaranteed at the clinic of the Graduate Studies Program in Dentistry.

Results

A high response rate was observed between 6 and 12 years of age: 339 (94.4%) of the children studied in 1999 were located and restudied in 2005. In addition, the percentage of children located and restudied was not associated with gender or family income.

Table 2 shows the distribution of habits, behaviors (use and frequency of brushing and flossing), and use of dental services in the study population at 12 years of age according to family income quartiles at birth. Some 75% of the children were satisfied with their dental status, with no variation according to family income. The majority of the children reported brushing their teeth, and nearly all (more than 95%) used toothpaste. Meanwhile, about one in four children brushed their teeth less than twice a day on average. Finally, flossing was reported by fewer than 10% of sample. Children from poorer families brushed less and used less toothpaste ($p = 0.01$) and flossing ($p < 0.01$). Nearly half of the children had visited the

dentist in the previous year (n = 158; 46.5%), 43% of whom in the Unified National Health System (SUS). Children from lower-income families had used dental services less in the previous year, but had used dental services more in the SUS ($p < 0.01$). The proportion of children that were using or had used orthodontic appliances varied greatly, from 4.3% in children from families in the lowest income quartile to 65.2% in those from families in the highest quartile. About one-third and one-fourth of the children, respectively, reported having used fluoride rinses or fluoride gel at some time in school. Although the coverage of treated (and thus fluoridated) water was 83% of the sample in 1993, one in four children from the lowest-income families lacked access to fluoridated water.

Table 3 shows the main oral health outcomes studied at 12 years of age. Slightly more than half the study population had at least one decayed tooth. The mean DMF-T index was 1.2, and the care index was only 27.3%, showing low use of dental services. Gingival bleeding (an indicator of gingivitis and inadequate brushing) was present in 88% of the children at 12 years. Fluorosis was found in 15.2% of the children, mainly mild cases. Dental fractures, mainly enamel fractures, affected 15.2% of the study population, while 12% reported toothache in the previous month. Malocclusions were frequent, and 40.2% of the children presented some need for orthodontic treatment. Children from low-income families had more decayed teeth ($p < 0.01$) and gingival bleeding ($p = 0.02$). Meanwhile, children from higher-income families had more restored teeth and thus better restorative indices ($p < 0.01$). More than half of the participants reported at least one kind of impact on daily life resulting from oral conditions, with significant differences according to family income.

Figure 1 shows the DMF-T index distribution at 12 years according to the distribution of the dmf-t index at six years. The group of caries-free children at 12 years varied from 69.4% among children who were caries-free at six years of age to 29.1% in the group with dmf-t from 4 to 19, or the worst tertile, at six years. Mean DMF-T at 12 years was 0.57, 1.27, and 1.80 for the groups with no caries, with one to three carious teeth, and with 4-19 carious teeth at six years, respectively ($p < 0.01$).

Figure 2 shows the relationship between malocclusions in the primary and permanent dentitions. There was a tendency towards more individuals with very severe malocclusions at 12 years (DAI > 36) in proportion to malocclusions at six years, but the difference was not statistically significant (p linear trend = 0.171). There was a lack of statistical power to assess the association between malocclusions in the primary and permanent dentitions (power = 0.69), although the size of the differences is clinically important.

Discussion

The study showed a high follow-up rate over a six-year period (94.5%) and high reproducibility, with validated, internationally-used data collection instruments, contributing to the study's internal validity. Although the sample size was sufficient to test hypotheses related to phenomena that occurred in childhood, it may not have been sufficient to test hypotheses in adolescence and adulthood. Dental caries should have been assessed using the teeth's surfaces (DMF-S), which is more sensitive for detecting changes in longitudinal studies, rather than taking the entire tooth as the analytical element (DMF-T). These are the study's two main limitations, caused mainly by budget constraints.

Different exposures and outcomes were studied over the course of childhood. Family income at birth was chosen to characterize childhood socioeconomic conditions [23]. There were important differences in the proportions of decayed teeth and gingival bleeding according to family income levels. Children from lower-income families showed a higher prevalence of decayed teeth and gingival bleeding at 12 years of age.

The prevalence and severity of caries in the study (51.8%, mean DMF-T 1.2) were lower than for both the country as a whole (68.9%; mean DMF-T 2.8) and the Southern Region (63.3%; mean DMF-T 2.31) [24]. However, children with lower family income at birth, on average, showed more decayed teeth and fewer filled teeth than those from higher income families, probably revealing inequality in access to (and use of) dental services. The effect of brushing on dental caries prevention increases in proportion to the increase in fluoride concentration, frequency of brushing, and high rates of previous caries [25].

In this Brazilian study, caries in the primary dentition was strongly associated with caries in permanent dentition, thus corroborating international findings [26]. Three hypotheses can explain these findings. The first suggests that dental caries in the deciduous dentition may be a marker for persistent social, dietary, and behavioral patterns that determine the caries pattern at 12 years of age. According to the second, caries in the deciduous dentition per se is a risk factor for caries in the permanent dentition. That is, caries in the deciduous dentition creates a microbiological environment which, if maintained in the mixed and permanent dentition, results in increased caries risk in the future. The third hypothesis is the combination of the first two. The assumption of one or the other hypotheses or the combination has implications for the adequate planning of services and preventive interventions. Currently, often for reasons of operational ease, schools are chosen as the prime site for preventive and educational activities in oral health. Assuming the second hypothesis, at six years of age the exposures and conditions that predict future problems are already present, as observed in previous analyses of this cohort [12,13,14]. Whatever the correct hypothesis, it is necessary to acknowledge that the risk factors begin at very early ages, and thus the earlier the preventive interventions, the better the results, both in changing behavior patterns and decreasing caries rates in the deciduous dentition. Interventions targeted to nutritional and dietary orientation in the first year of life have proven effective in reducing dental caries in children immediately after the intervention (first year of life), and maintaining the effect years later (four years of age) [27,28].

Meanwhile, there are still doubts as to whether the same association holds for malocclusions. Numerous studies suggest that malocclusions in the deciduous dentition are associated with occlusal problems in the permanent dentition; however, no longitudinal studies were found in the literature, even in the only population-based cohort study that investigated different oral health problems [8,9]. Children with the combined presence of open bite, crossbite, and inadequate inter-canine relationship at six years showed a higher prevalence of more severe malocclusions at 12 years (27.3%) as compared to those with up to two malocclusions at six years (9.6%). The assessment of occlusal problems during the continuing follow-up of the 1993 Pelotas birth cohort, plus the possibility of investigating the cohort launched in 2004, with a larger sample and thus greater statistical power, will help further clarify this issue.

The association between caries and malocclusions in the deciduous and permanent dentitions is especially relevant for developing oral health policies targeting children. Problems identified at six years of age are caused by early exposures, beginning at birth, as evidenced by previous studies [12,13,14]. For example, caries occurrence was associated with unfavorable socioeconomic conditions at birth, stunting (height-for-age deficit) at 12 months, delayed school enrollment, brushing less than twice a day, and excessive sugar intake [13,14]. Malocclusions at six years were associated with short duration of breastfeeding and prolonged pacifier use, in addition to the occurrence of dental caries [12].

One can conclude that better family socioeconomic conditions at the time of the child's birth were associated with better indicators related to gingival bleeding, treatment of dental caries, use of dental services, and oral hygiene habits at 12 years of age. Caries in the deciduous

dentition showed a strong positive association with caries in the permanent dentition. Oral health studies nested in birth cohorts help improve our understanding of lifetime oral health problems and their determinants.

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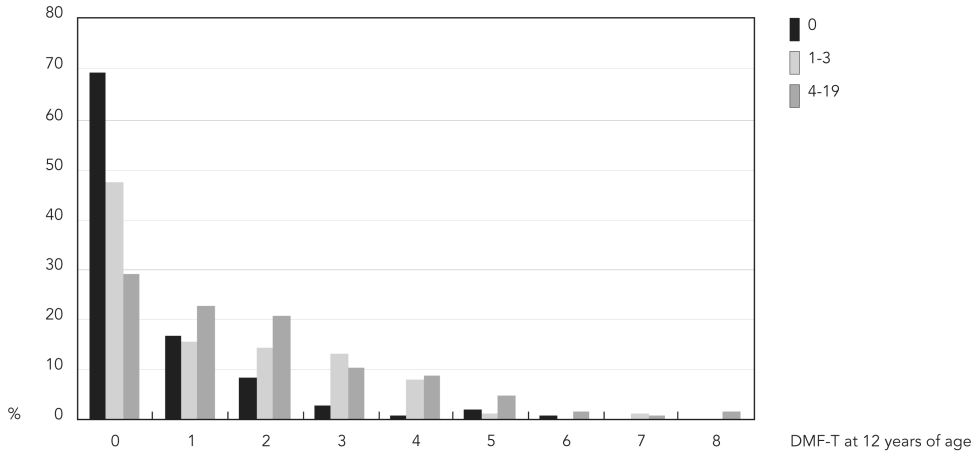

Figure 1.
Relationship between caries in the primary dentition at six years of age (dmf-t) and caries in the permanent dentition (DMF-T) at 12 years of age (n = 339). 1993 Pelotas (Brazil) birth cohort study.

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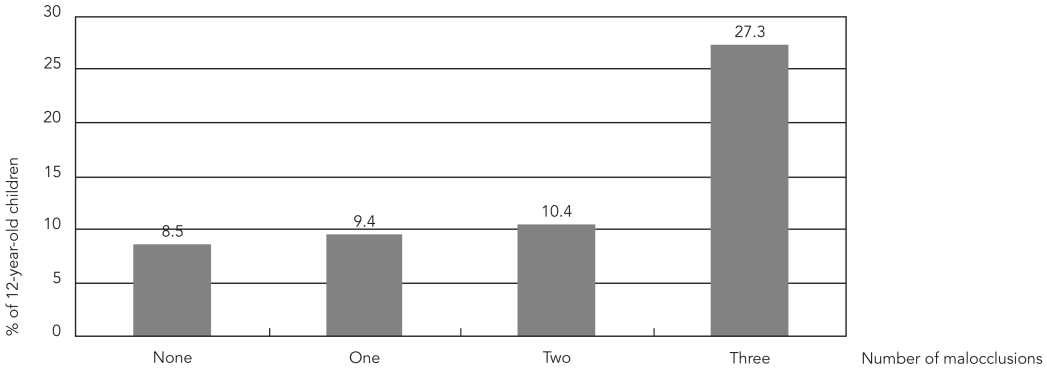

Figure 2.
Relationship between the number of malocclusions at 6 years of age and the proportion of children at 12 years of age (n = 339) with extremely severe malocclusions (Dental Aesthetic Index – DAI ≥ 36). 1993 Pelotas (Brazil) birth cohort study.

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Table 1

Information collected in oral health follow-up studies at 6 and 12 years of age. 1993 Pelotas (Brazil) birth cohort study.

Information		Age (years)	
		6	12
Oral health education	Preschool oral health educational activities	X	
Dental care	Use of dental services	X	X
	Main reason for use of services	X	X
	Type of service used	X	X
	Fear of dentist	X	X
	Use of orthodontic appliance		X
Habits and behaviors	Breastfeeding	X	
	Use of baby bottle	X	
	Use of sugar in beverage	X	
	Favorite beverage	X	
	Candy/Sweets	X	
	Pacifier	X	
	Thumb/Finger-sucking	X	
	Other sucking habits	X	
	Mouth breathing	X	
Hygiene and use of fluoride	Tooth-brushing (beginning, frequency)	X	X
	Flossing (use, frequency)	X	X
	Adults' help with oral hygiene	X	
	Amount of dentifrice used	X	
	Brand name of dentifrice	X	
	Swallowing dentifrice	X	
	Prenatal fluoride supplement	X	
	Source of drinking water	X	
	Use of fluoride gel at school	X	
	Fluoride gel in dentist's office	X	
	Fluoride rinse at school	X	
Self-assessed oral health	Self-assessment of dentition	X	X
	Impact of oral health conditions on daily life (using OIDP)		X
Outcome	Toothache	X	X
	Oral cavity lesions	X	
	Insertion of lingual and labial frenum	X	
	Occlusion	X	X
	Lip seal	X	X
	Diagnosis of dental crowns (caries)	X	X
	Stage of eruption of permanent 1st molar	X	
	Gingival bleeding	X	
	Dental fluorosis	X	
	Tooth trauma	X	
	Need for treatment of tooth trauma		X

OIDP: *Oral Impacts on Daily Performances*.

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Table 2

Report of habits and behaviors related to oral health and use of dental services in the sample studied at 12 years of age (n = 339) according to family income (in times the minimum wage) at birth. 1993 Pelotas (Brazil) birth cohort study.

Reported behavior	Family income quartile at birth				Total	p-value *
	1st	2nd	3rd	4th		
Satisfaction with teeth	76.7	74.1	77.8	69.5	74.6	0.65
Brushes teeth	96.5	94.1	98.8	100.0	97.3	0.06
Use of toothpaste	94.2	95.3	98.3	100.0	97.0	0.01
Brushes teeth ≥ twice a day	72.1	69.4	84.0	84.1	77.2	0.01
Flosses	2.3	5.9	9.9	13.4	7.8	< 0.01
Visited dentist in the previous year	32.6	37.6	45.7	69.5	46.1	< 0.01
Last visit in the Unified National Health System **	67.9	61.8	42.1	21.1	43.3	< 0.01
Current or past use of orthodontic appliance	4.3	13.0	17.4	65.2	6.9	< 0.01
Fluoride rinse at school	30.2	35.3	38.3	39.0	35.6	0.21
Fluoride gel at school	17.4	30.6	17.3	28.0	23.4	0.36

* Linear trend p-value;

** Only includes children that visited the dentist in the previous year.

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Table 3

Oral health outcomes at 12 years of age (n = 339) according to family income quartiles (in times the minimum wage) at birth; means (medians) and prevalence rates. 1993 Pelotas (Brazil) birth cohort study.

	Family income quartile at birth				Total	p-value *
	1st	2nd	3rd	4th		
Outcome (mean and median)						
Teeth present	25.4 (26.0)	25.4 (26.0)	25.5 (25.0)	25.6 (26.0)	25.5 (26.0)	0.77
Decayed	0.9 (0.0)	1.2 (1.0)	0.7 (0.0)	0.7 (0.0)	0.9 (0.0)	0.03
Missing	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.88
Filled	0.2 (0.0)	0.2 (0.0)	0.5 (0.0)	0.5 (0.0)	0.3 (0.0)	< 0.01
DMF-T	1.1 (1.0)	1.4 (1.0)	1.2 (1.0)	1.2 (1.0)	1.2 (1.0)	0.69
Bleeding (% teeth)	28.5 (25.0)	25.9 (18.5)	23.5 (18.5)	18.6 (14.3)	24.2 (18.5)	0.02
Dental aesthetic index	24.5 (23.0)	24.9 (23.0)	25.6 (24.0)	24.7 (22.5)	24.9 (23.0)	0.56
Care index (%)	19.1 (0.0)	12.2 (0.0)	38.2 (0.0)	42.3 (29.2)	27.3 (0.0)	< 0.01
Outcomes (prevalence)						
Caries (DMF-T ≥ 1)	51.2	56.5	50.6	48.8	51.8	0.60
Bleeding	88.4	89.4	87.7	86.6	88.0	0.66
Fluorosis	14.0	20.0	12.5	13.9	15.2	0.68
Toothache (12 months)	14.0	11.8	13.6	8.5	12.0	0.36
Malocclusion	40.7	40.0	42.0	37.8	40.2	0.81
Fractured tooth	12.3	15.0	18.8	15.1	15.4	0.50
OIDP ≥ 1	54.7	60.0	61.7	56.1	58.1	0.79

OIDP: *Oral Impacts on Daily Performances*.

* Linear trend p-value.