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The Influence of the First Thousand Days of Life on Establishing Determinant Behaviors for Dental Caries in Childhood

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ABSTRACT

Objective: To study the influence of the first thousand days of life on establishing determinant behaviors for dental caries in childhood. **Material and Methods:** Longitudinal retrospective study involving 664 children born in 2009 living in a southern Brazilian municipality was carried out. Data was collected through interviews with mothers and through child's health card. Dependent variables were 1) tooth brushing onset after two years of age; 2) absent tooth brushing or once a day; 3) tooth brushing without adult supervision; 4) not having gone to the dentist until the age of 6; and 5) seek for dental services due to toothache at 6 years of age, over the last 30 days. Bivariate and multivariate analyses were performed using Poisson Regression to estimate relative risks (RR) and respective confidence intervals at the 95% accuracy level. **Results:** Mothers with lower schooling at child's birth presented a higher risk of "child's tooth brushing onset only after two years of age", "brushing the teeth once a day only or not brushing" and with "child not having gone to the dentist until the age of 6". Mothers who did not have a job when the child was born were associated with "not having gone to the dentist until the age 6". Children with gastroesophageal reflux who underwent hospitalization for more than 2 days under age 2 were associated with "seeking dental services because of pain at 6 years of age over the last 30 days". **Conclusion:** Higher risks of some determinant behaviors related to dental caries were associated with variables of the period of the first thousand days of life.

Keywords: Infant Behavior; Child Behavior; Oral Health; Cohort Studies.

Introduction

Dental caries is a chronic multifactorial disease with a slow progression in the majority of cases. It is considered the most common disease among Latin American children [1]. It causes suffering and pain [2], impacting children's and families' quality of life [3]. High costs of treatment and existing preventive measures are factors that contribute to be considered this aggravation as a public health problem [2]. Data from the Brazilian National Oral Health Survey [4] showed that Brazilian children at age 5 presented 2.43 teeth attacked by caries in 2010. This figure was 2.80 in 2003, which represented a reduction of only 13.9% of number of decayed, missed or restored deciduous teeth.

Dental caries is determined by hygiene and feeding habits, as well as by the pattern of usage of health services [5]. Considering that dental caries and other chronic diseases have complex etiologies and long periods of time, proper understanding of their development should involve the study of the influence of the first stages of life [6,7]. Thus, longitudinal studies have an appropriate design to investigate life-course events, allowing the exploration of the interaction between biological aspects, social environment and behavioral aspects involved in the development of chronic diseases [8]. Thus, Life Course Theory [6] is a possible pathway to a better understanding on the determination of dental caries. It is based on the accumulation of risks during life, both biological and psychosocial factors at different critical stages of life, especially in childhood. Growth in bad conditions in early childhood and low birth weight are examples of possible influence on health-related behaviors in the future life [9] concerning biological factors. Therefore, if harmful expositions to health are numerous and accumulated during life, the risk of developing chronic diseases increases [6,10].

It can be admitted, therefore, that aspects related to unfavorable environments at birth and in the early stages of childhood are accumulated in the course of life and can reduce the chances of healthy habits and behaviors as well as patterns of use of services that, taken as a whole, can increase the risk of disease in adulthood [9]. In the present study, these aspects were incorporated by socioeconomic status at when the child was born and those related to the first thousand days of life: variables related to pregnancy and related to children up to two years old. So, knowledge about the early stages of life is very important to understand the way an individual's health condition will be in the future [10]. Hence, this study aimed to analyze the influence of the first thousand days of life on selected determinant behaviors for dental caries in 6-year-old children.

Material and Methods

Ethical Clearance

The research project was submitted to and approved by the Ethics Committee on Research with Human Beings of Universidade do Sul de Santa Catarina under the protocol CAAE 38240114.0.0000.5369.

Study Design and Sampling

It was a longitudinal retrospective study involving children enrolled in public and private schools of the municipality of Palhoça/SC, Brazil. The study population consisted of children who were born in 2009 and their families [11]. The minimum sample size was determined using the following parameters: total children population of 1,756; 95% confidence level; unknown prevalence of studied dependent variables (p = 50%); 3% relative error. Thus, the total sample was 664 children and their families. The sample size was calculated in the OpenEpi 3.03a [12].

Data Collection

Data collection was performed through interviews and children's health cards analysis. Interviews were conducted with mothers or, in her absence, the main child's caregiver at home. Through the direction of schools, letters containing the free and informed consent terms were sent to the parents, with the objectives and the importance of the research, inviting them to participate in the study. To carry out the interviews, a specific instrument was elaborated by the researchers. A workshop composed of six meetings was held involving researchers, Ph.D. and MSc students [11]. The interviews were developed by the team of researchers and Community Health Agents from the municipality of Palhoça/SC. The team was formally trained in 30 hours of activity.

The dependent variables were selected determinant behaviors for dental caries: i- tooth brushing onset after two years of age; ii. absent tooth brushing or once a day; iii- tooth brushing without adult supervision; iv- not having gone to the dentist until the age of 6; v- seek for dental services due to toothache at 6 years of age, over the last 30 days. The independent variables were socioeconomic status at when the child was born and those related to the first thousand days of life: variables related to pregnancy and related to children up to two years old.

Data Analysis

Data were inserted in Excel spreadsheets and then exported to the IBM SPSS® 18.0 software (IBM Corp., Armonk, NY, USA) and then analyzed. Descriptive statistics were performed through distribution and frequency tables. Multivariate analyses were performed to identify independent relationship among the several studied variables. They were also used to identify confounding variables, adjusting the analysis models. These models were composed by variables whose values $p \leq 0.20$ [13] were observed in the bivariate analysis. The bivariate and multivariate analyses were performed using Poisson Regression to estimate relative risks (RR) and respective confidence intervals at the 95% accuracy level.

Results

Regarding oral hygiene, lower mother schooling was independently associated with inadequate habits. Mothers that had finished eight years or fewer of study at child's birth presented 81% higher and independent risk (RR = 1.81; 95% CI = 1.02-3.21; p=0.041) of "child's tooth brushing onset only after two years of age" (Table 1). This variable was also independently associated with the habit of "brushing the teeth once a day only or not brushing" (RR = 2.05; 95% CI = 1.01-4.17; p=0.049) (Table 2). Another oral hygiene habit, "dental brushing without any adult supervision", was not associated with factors related to the first thousand days.

Table 1. Association factors related to the first thousand days of life and the variable "tooth brushing onset after two years of age".

Variables	RR$_c$	CI 95%	p-value	RR$_a$	CI 95%	p-value
Socioeconomic Status						
Mother's Schooling When the Child was Born			0.001			0.041
> 8 Years	1.00			1.00		
≤ 8 Years	2.54	1.61-4.02		1.81	1.02-3.21	
Father's Schooling When the Child was Born			0.007			
> 8 Years	1.00					
≤ 8 Years	1.98	1.20-3.25		*		
Mother's Occupation When the Child was Born			0.075			0.754
With Income	1.00			1.00		

	OR	CI	p	OR	CI	p
Without Income	1.49	0.96-2.33		1.09	0.62-1.92	
Father's Occupation When the Child was Born			0.061			
With Income	1.00					
Without Income	2.10	0.96-4.57				
Steady Partner When the Child was Born						
Yes	1.00			*		
No	1.02	0.44-2.34	0.962			
Related to Pregnancy						
Teenage Pregnancy			0.780			
≥ 20 Years Old	1.00					
10 to 19 Years Old	1.08	0.61-1.89				
Prenatal Consultation			0.236			
Yes	1.00					
No	2.01	0.63-6.36				
Number of Prenatal Consultations			0.276			
≥ 6	1.00					
< 5	1.90	0.59-6.05				
Use of Alcohol While Pregnant			0.003			0.534
No	1.00			1.00		
Yes	2.55	1.38-4.71		1.35	0.52-3.49	
Smoking While Pregnant			0.081			0.747
No	1.00			1.00		
Yes	1.61	0.94-2.75		1.08	0.41-1.86	
Use of Illicit Drugs While Pregnant			0.036			0.127
No	1.00			1.00		
Yes	2.93	1.07-8.01		3.19	0.71-14.21	
Infectious Diseases While Pregnant			0.786			
No	1.00					
Yes	1.06	0.66-1.70				
Gestational Age			0.658			
37 to 41 Weeks	1.00					
< 37 or ≥ 42 Weeks	1.13	0.64-1.98				
Route of Delivery			0.221			
Vaginal	1.00					
Cesarean	1.34	0.83-2.14				
Related to Children up to 2 Years Old						
Child's Gender			0.041			0.060
Female	1.00			1.00		
Male	1.65	1.02-2.69		1.74	0.97-3.09	
Birth Weight			0.386			
≥ 2500g	1.00					
< 2499g	1.86	0.45-7.60				
Apgar 1st Minute			0.466			
≥ 8	1.00					
< 7	0.73	0.31-1.70				
Gastroesophageal Reflux			0.250			
No	1.00					
Yes	1.53	0.74-3.18				
Infectious Diseases			0.064			0.311
No	1.00			1.00		
Yes	2.20	0.95-5.09		1.56	0.65-3.74	
Use of Antibiotics			0.370			
No	1.00					
Yes	1.23	0.77-1.97				
Use of Medication for more than 30 Consecutive Days			0.397			
No	1.00					
Yes	1.26	0.73-2.19				
Hospitalization for More Than 2 Days			0.974			
No	1.00					
Yes	1.01	0.55-1.82				

			0.988			
Hospitalization During the First 29 Days of Life						
Yes	1.01	0.40-2.50				
No	1.00					
Nursery Frequency			0.529			
No	1,00					
Yes	1,16	0.72-1.86				

RR$_c$= Crude Relative Risk; RR$_a$= Adjusted Relative Risk; CI 95% = Confidence interval 95%; *The variable "Mother's schooling when the child was born" showed some collinearity with the variable "Father's schooling when the child was born" (p=0.001) along with "Father's occupation when the child was born" (p=0.032). "Mother's schooling when the child was born" was maintained and the others were removed.

Table 2. Association factors related to the first thousand days of life and the variable "absent tooth brushing or once a day".

Variables	RR$_c$	CI 95%	p-value	RR$_a$	CI 95%	p-value
Socioeconomic Status						
Mother's Schooling When the Child was Born			0.008			0.049
>8 Years	1.00			1.00		
≤ 8 Years	2.02	1.19-3.41		2.05	1.01-4.17	
Father's Schooling When the Child was Born			0.013			
>8 Years	1.00					
≤ 8 Years	2.09	1.17-3.75		*		
Mother's Occupation When the Child was Born			0.234			
With Income	1.00					
Without Income	1.35	0.82-2.23				
Father's Occupation When the Child was Born			0.437			
With Income	1.00					
Without Income	1.49	0.54-4.12				
Steady Partner When the Child was Born			0.150			0.550
Yes	1.00			1.00		
No	1.72	0.82-3.61		1.39	0.47-4.13	
Related to Pregnancy						
Teenage Pregnancy			0.220			
≥ 20 Years Old	1.00					
10 to 19 Years Old	1.55	0.76-3.14				
Prenatal Consultation			0.843			
Yes	1.00					
No	1.22	0.16-8.80				
Number of Prenatal Consultations			0.095			
≥ 6	1.00					
< 5	1.89	0.89-4.00		*		
Use of Alcohol While Pregnant			0.052			0.298
No	1.00			1.00		
Yes	2.08	0.99-4.37		1.76	0.60-1.13	
Smoking While Pregnant			0.550			
No	1.00					
Yes	1.22	0.63-2.33				
Use of Illicit Drugs While Pregnant			0.926			
No	1.00					
Yes	1.09	0.15-7.91				
Infectious Diseases While Pregnant			0.382			
No	1.00					
Yes	1.26	0.74-2.12				
Gestational Age			0.436			
37 to 41 Weeks	1.00					
< 37 or ≥ 42 Weeks	1.26	0.70-2.27				
Route of Delivery			0.038			0.042
Vaginal	1.00			1.00		
Cesarean	0.89	0.70-0.97		0.42	0.18-0.97	
Related to Children up to 2 Years Old						
Child's Gender			0.147			

	RR_c	CI 95%	p-value	RR_a	CI 95%	p-value
Female	1.00					
Male	1.50	0.86-2.62		*		
Birth Weight			0.161			
≥ 2500 g	1.00					
< 2499 g	1.93	0.76-4.87				
Apgar 1st Minute			0.484			
≥ 8	1.00					
< 7	1.66	0.40-6.87				
Gastroesophageal Reflux			0.364			
No	1.00					
Yes	1.33	0.71-2.50				
Infectious Diseases			0.036			0.165
No	1.00			1.00		
Yes	3.47	1.08-11.12		2.77	0.66-11.6	
Use of Antibiotics			0.551			
No	1.00					
Yes	1.17	0.69-1.98				
Use of Medication for More than 30 Consecutive Days			0.889			
No	1.00					
Yes	1.04	0.54-2.00				
Hospitalization for More than 2 Days			0.117			0.968
No	1.00			1.00		
Yes	1.58	0.89-2.83		1.01	0.41-2.52	
Hospitalization During the First 29 Days of Life			0.177			
Yes	3.91	0.54-28.32				
No	1.00					
Nursery Frequency			0.799			
No	1.00					
Yes	1.07	0.62-1.82				

RR_c= Crude Relative Risk; RR_a= Adjusted Relative Risk; CI 95% = Confidence interval 95%; *The variable "Mother's schooling when the child was born" showed some collinearity with the variable "father's schooling when the child was born" (p=0.001) along with "number of prenatal exams" (p=0.031) and birth weight" (p=0.046); "Mother's schooling when the child was born" was maintained and the others were removed.

Regarding access to dental services, lower mother schooling was also independently associated with "child not having gone to the dentist until the age of 6" (RR = 1.69; 95% CI = 1.05- 2.72; p=0.028) and with mother's occupation when the child was born. Children whose mothers had no income (who did not have a job) presented a relative risk of 1.75 (95% CI = 1.08-2.82; p=0.021) of "not having gone to the dentist until the age 6" (Table 3).

Table 3. Association factors related to the first thousand days of life and the variable "not having gone to the dentist until the age of 6".

Variables	RR_c	CI 95%	p-value	RR_a	CI 95%	p-value
Socioeconomic Status						
Mother's Schooling When the Child was Born			< 0.001			0.028
> 8 Years	1.00			1.00		
≤ 8 Years	2.19	1.57-3.06		1.69	1.05-2.72	
Father's Schooling When the Child was Born			0.283			
>8 Years	1.00					
≤ 8 Years	1.22	0.84-1.77				
Mother's Occupation When the Child was Born			0.005			0.021
With Income	1.00			1.00		
Without Income	1.61	1.15-2.25		1.75	1.08-2.82	
Father's Occupation When the Child was Born			0.735			
With Income	1.00					
Without Income	1.14	0.53-2.43				
Steady Partner When the Child was Born			0.040			0.339
Yes	1.00			1.00		

	RRc	CI 95%	p	RRa	CI 95%	p
No	1.67	1.02-2.74		1.47	0.66-3.27	
Related to Pregnancy						
Teenage Pregnancy			0.297			
≥ 20 Years Old	1.00					
10 to 19 Years Old	1.22	0.83-1.78				
Prenatal Consultation			0.454			
Yes	1.00					
No	1.46	0.54-3.94				
Number of Prenatal Consultations			0.600			
≥ 6	1.00					
< 5	1.19	0.60-2.35				
Use of Alcohol While Pregnant			0.005			0.204
No	1.00			1.00		
Yes	2.04	1.24-3.34		1.57	0.78-3.17	
Smoking While Pregnant			0.096			0.230
No	1.00			1.00		
Yes	1.41	0.94-2.11		1.41	0.80-2.50	
Use of Illicit Drugs While Pregnant			0.128			0.786
No	1.00			1.00		
Yes	1.99	0.82-4.87		1.32	0.17-9.89	
Infectious Diseases While Pregnant			0.147			0.644
No	1.00			1.00		
Yes	1.28	0.91-1.79		1.11	0.69-1.78	
Gestational Age			0.761			
37 to 41 Weeks	1.00					
< 37 or ≥ 42 Weeks	1.07	0.68-1.67				
Route of Delivery			0.707			
Vaginal	1.00					
Cesarean	1.07	0.74-1.54				
Related to Children up to 2 Years Old						
Child's Gender			0.905			
Female	1.00					
Male	1.02	0.71-1.46				
Birth Weight			0.494			
≥ 2500 g	1.00					
< 2499 g	1.28	0.62-2.63				
Apgar 1st Minute			0.010			0.059
≥ 8	1.00			1.00		
< 7	0.48	0.28-0.83		0.54	0.29-1.02	
Gastroesophageal Reflux			0.750			
No	1.00					
Yes	1.08	0.67-1.73				
Infectious Diseases			0.316			
No	1.00					
Yes	1.29	0.77-2.16				
Use of Antibiotics			0.127			0.422
No	1.00			1.00		
Yes	1.29	0.92-1.80		1.21	0.75-1.94	
Use of Medication for More than 30 Consecutive Days			0.270			
No	1.00					
Yes	1.25	0.83-1.88				
Hospitalization for More than 2 Days			0.350			
No	1.00					
Yes	1.21	0.80-1.83				
Hospitalization During the First 29 Days of Life			0.590			
No	1.00					
Yes	1.23	0.57-2.64				
Nursery Frequency			0.442			
No	1.00					
Yes	1.15	0.80-1.65				

RRc= Crude Relative Risk; RRa= Adjusted Relative Risk; CI 95% = Confidence Interval 95%.

Table 4 shows statistically independent and significant associations of two variables with "seek for dental services because of pain at 6 years of age over the last 30 days". Children with gastroesophageal reflux under the age 2 showed a relative risk of 2.00 (95% CI = 1.01-3.98; p=0.046), and children who were undergone hospitalization for more than 2 days under age 2 presented a relative risk of 1.98 (95% CI = 1.03-3.96; p=0.044).

Table 4. Association factors related to the first thousand days of life and the variable "seek for dental services due to toothache at age 6, over the last 30 days".

Variables	RR$_c$	CI 95%	p-value	RR$_a$	CI 95%	p-value
Socioeconomic Status						
Mother's Schooling When the Child was Born			0.068			
> 8 Years	1.00					
≤ 8 Years	1.36	0.97-1.90		*		
Father's Schooling When the Child was Born			0.306			
> 8 Years	1.00					
≤ 8 Years	1.17	0.86-1.58				
Mother's Occupation When the Child was Born			0.024			0.051
With Income	1.00			1.00		
Without Income	1.37	1.04-1.80		1.41	0.98-2.01	
Father's Occupation When the Child was Born			0.335			
With Income	1.00					
Without Income	1.44	0.68-3.07				
Steady Partner When the Child was Born			0.357			
Yes	1.00					
No	1.34	0.71-2.54				
Related to Pregnancy						
Teenage Pregnancy			0.930			
≥ 20 Years Old	1.00					
10 to 19 Years Old	1.01	0.72-1.43				
Prenatal Consultation			0.281			
Yes	1.00					
No	1.56	0.69-3.51				
Number of Prenatal Consultations			0.260			
≥ 6	1.00					
< 5	1.41	0.77-2.60				
Use of Alcohol While Pregnant			0.441			
No	1.00					
Yes	1.32	0.65-2.67				
Smoking While Pregnant			0.317			
No	1.00					
Yes	1.24	0.81-1.89				
Use of Illicit Drugs While Pregnant			0.802			
No	1.00					
Yes	1.15	0.37-3.61				
Infectious Diseases While Pregnant			0.224			
No	1.00					
Yes	1.19	0.89-1.59				
Gestational Age			0.096			0.202
37 to 41 Weeks	1.00			1.00		
< 37 or ≥ 42 Weeks	1.43	0.93-2.20		1.34	0.85-2.11	
Route of Delivery			0.973			
Vaginal	1.00					
Cesarean	1.00	0.73-1.38				
Related to Children up to 2 Years Old						
Child's Gender			0.818			
Female	1.00					
Male	1.03	0.75-1.42				
Birth Weight			0.363			

	RR$_b$	CI 95%	p	RR$_a$	CI 95%	p
≥ 2500 g	1.00					
< 2499 g	1.51	0.62-3.68				
Apgar 1st Minute			0.439			
≥ 8	1.00					
< 7	0.77	0.40-1.47				
Gastroesophageal Reflux			0.098			0.046
No	1.00			1.00		
Yes	1.33	0.94-1.88		2.00	1.01-3.98	
Infectious Diseases			0.089			0.462
No	1.00			1.00		
Yes	1.33	0.95-1.86		1.17	0.76-1.82	
Use of Antibiotics			0.533			
No	1.00					
Yes	1.09	0.82-1.45				
Use of Medication for More than 30 Consecutive Days			0.883			
No	1.00					
Yes	1.02	0.71-1.48				
Hospitalization for More than 2 Days			0.041			0.044
No	1.00			1.00		
Yes	1.60	1.02-2.50		1.98	1.03-3.96	
Hospitalization During the First 29 Days of Life			0.455			
No	1.00					
Sim	1.29	0.65-2.53				
Nursery Frequency			0.105			
No	1.00					
Yes	1.27	0.95-1.71		*		

RR$_b$= Total Relative Risk; RR$_a$= Relative Risk; CI 95% = Confidence Interval 95%; *The variable "Mother's occupation when the child was born" showed some collinearity with the variable "mother's schooling when the child was born" (p=0.001) along with "nursery frequency" (p=0.001); "Mother's schooling when the child was born" was maintained and the others were removed.

Discussion

Among the different possibilities of using socioeconomic indicators, it is noticed that the level of maternal schooling is considered one of the best indicators of the child's health, especially in underdeveloped countries. Furthermore, as mothers are the main children's caregivers, their understanding about oral hygiene practices and habits is crucially relevant when aiming for good oral health for their children [14].

Mother's schooling equal or fewer than eight years resulted in a greater risk of establishing inadequate child's oral hygiene habits (dental brushing onset after two years of age and absent or only once a day brushing). An analysis directed to the social conditions of the individual is primordial to identify determining factors for the occurrence of diseases [14]. In a study conducted in Brazil, the variable "maternal schooling" was also significantly associated with caries experience [15], corroborating the results of the present study. It was also found that children of mothers who did not study had a higher incidence of caries than those with a higher average education. Thus, as provided by the literature, maternal education is one of the variables capable of influencing the levels of dental caries [16]. Mothers with lower educational attainment have a lower income, less access to dental service, less knowledge about oral health practices, and therefore are less well informed about curative and preventive measures of dental caries control, which ultimately influences the pattern of dental caries during childhood [17].

In this study, another socioeconomic variable related to the first thousand days associated with determinant behaviors for dental caries was the mother's occupation. It was observed that children whose mothers had no formal income (who did not have a job) presented a higher risk of not having gone to the dentist until the age 6. Peres et al. [18] observed that children whose parents were unemployed when they

were born presented a 7.7 higher chance of having caries and dental pain. Other studies [19,20] have pointed out that parents with better education and income have better conditions and higher access to dental services.

In the present study, in the group of variables related to pregnancy, the only one associated with determinant behaviors for dental caries was the route of delivery. It is known that during the pregnancy, the mother undergoes different physiological transformations in all the organic systems since several hormones and psychological factors are involved [20]. In this research, the cesarean delivery method was associated with inadequate oral hygiene habits. There are no studies reporting this relationship, but there are other associations related to the route of delivery. For example, a case-control study in Sweden demonstrated a significantly higher prevalence of certain strains, such as *Streptococcus salivarius*, *Lactobacillus curvata*, *Lactobacillus salivarius*, and *Lactobacillus casei* in children who were born by vaginal delivery compared to those born by cesarean section [21]. On the other hand, Thakur et al. [22] concluded that there was no association between vaginal or cesarean delivery with a significantly higher prevalence of certain strains. They also affirmed that the socioeconomic status and the food that mothers had tried during pregnancy showed a possible initial acquisition of *Streptococcus mutans* in children's oral cavity [22].

In the group of variables related to children's health up to two years old, a significant association of the variable "hospitalization for more than two days" with "seeking for dental services due to pain" was observed. It can be explained by the marked use of medications and the difficulties of oral hygiene in children with some kind of health problems who needed hospitalization up to the age 2. In these cases, parents could be more concerned with the child's general health than oral health, so when dental care is required, a painful dental symptomatology has already been created. A study evaluated the oral health of children who were hospitalized from 2 to 12 years old in a hospital in Imperatriz, Brazil [23]. The authors observed that 65.2% of children with three days of hospitalization had poor oral hygiene. Regarding nocturnal oral hygiene, 76.2% of them reported that it was never done. Some factors may be related to unsatisfactory oral hygiene in hospitalized children: the age group (the youngest do not have enough motor coordination to perform adequate brushing), the condition they are in (lack of physical disposition due to the weakness), the lack of knowledge of the hospital staff about oral hygiene practices and, finally, the lack of motivation of parents and children on the benefits of oral hygiene [23].

Gastroesophageal reflux, another variable related to under two-year-old children's health, also showed association with the same variable "seek for dental services due to pain". The relationship between this variable and several modifications in the oral cavity is found in the literature. Oral manifestations include dental erosion, salivary alterations, halitosis, xerostomia, cancer sores, burning or itching of the oral mucosa, sour or bitter taste in the mouth, gingival alterations, lingual and dental sensitivity. In the first year of life, in addition to recurrent regurgitation and/or vomiting, gastroesophageal reflux manifestations include irritability, constant crying and refusal of food [24]. To date, there is little information available on the experience of caries disease in children with gastroesophageal reflux. Although there is no direct relationship between caries and erosive erosion [25], the association of caries disease with gastroesophageal reflux disease has been suggested [26,27]. In a study by Ersin et al. [28] the salivary flow, buffer capacity and amount of *Streptococos mutans*, *Lactobacilli* and colonization yeasts of children with gastroesophageal reflux disease were investigated. The authors concluded that these children had an increased risk of developing caries disease compared to healthy ones. Similarly, Tenório et al. [29] stated that low oral pH in children with gastroesophageal reflux causes enamel dissolution and transport of calcium and phosphate to the oral environment, which fosters the bacteria survival.

The results of the present study should be viewed with caution. An important limitation is related to the collection of information that occurred six years ago. However, it is believed that the main information related to pregnancy is fully remembered by the woman, in addition to the fact that all information present in the child's health card was used. Another limitation is the non-inclusion of feeding habits, which should be investigated in future studies.

Conclusion

Higher risk of some determinant behaviors related to dental caries can be associated to variables of the period of the first thousand days of life. Tooth brushing onset after two years of age was independently associated with lower mother's schooling when the child was born. Absent tooth brushing or once a day was independently associated with lower mother's schooling when the child was born and with vaginal route of delivery. Not having gone to the dentist until the age of 6 was independently associated with lower mother's schooling when the child was born and with mother's occupation without income when the child was born. Seek for dental services due to toothache at age 6, over the last 30 days was independently associated with occurrence of gastroesophageal reflux and hospitalization for more than 2 days.

Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

References

[1] GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016; 388(10053):1659-1724. https://doi.org/10.1016/S0140-6736(16)31679-8

[2] Filho MDS, Carvalho GDF, Carvalho MC, Martins MC. Consumption of sugar-rich foods and dental caries in preschool children. Arq Odontol 2010; 46(3):152-9.

[3] Buldur B, Güvendi ON. Conceptual modelling of the factors affecting oral health-related quality of life in children: A path analysis. Int J Paediatr Dent 2020; 30(2):181-92. https://doi.org/10.1111/ipd.12583

[4] Brasil. Ministério da Saúde. Coordenação Geral de Saúde Bucal. Banco de dados da Pesquisa Nacional de Saúde Bucal – Projeto SB. Brasília: Ministério da Saúde; 2010. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/pesquisa_nacional_saude_bucal.pdf [Accessed on November 10, 2019]. [In Portuguese].

[5] Buldur B. Pathways between parental and individual determinants of dental caries and dental visit behaviours among children: Validation of a new conceptual model. Community Dent Oral Epidemiol 2020; 48(4):280-7. https://doi.org/10.1111/cdoe.12530

[6] Kuh D, Ben-Shlomo Y, Lynch J, Hallqvist J, Power C. Life course epidemiology. J Epidemiol Community Health 2003; 57(10):778-83. https://doi.org/10.1136/jech.57.10.778

[7] Modin B, Fritzell J. The long arm of the family: are parental and grandparental earnings related to young men's body mass index and cognitive ability? Int J Epidemiol 2009; 38(3):733-44. https://doi.org/10.1093/ije/dyp001

[8] Demarco FF, Peres KG, Peres MA. Life course epidemiology and its implication for oral health. Braz Oral Res 2014; 28(1):1-2. https://doi.org/10.1590/S1806-83242014.50000006

[9] Nicolau B, Marcenes W, Bartley M, Sheiham A. A life course approach to assessing causes of dental caries experience: the relationship between biological, behavioural, socio-economic and psychological conditions and caries in adolescents. Caries Res 2003; 37(5):319-26. https://doi.org/10.1159/000072162

[10] Kuh D, Ben-Shlomo Y. Introduction: A life course approach to the aetiology of adult chronic disease. In: Kuh D, Ben-Shlomo Y, editors. The life course approach to chronic disease epidemiology. Oxford: Oxford University Press; 1997. p. 3-14.

[11] Traebert J, Lunardelli SE, Martins LGT, Santos K, Nunes RD, Lunardelli AN, et al. Methodological description and preliminary results of a cohort study on the influence of the first 1,000 days of life on the children's future health. An Acad Bras Cienc 2018; 90(3):3105-14. https://doi.org/10.1590/0001-3765201820170937

[12] Dean AG, Sullivan K, Soe M. OpenEpi: Open Source Epidemiologic Statistics for Public Health. 2014. Available from: http://www.OpenEpi.com. [Accessed on August 20, 2015].

[13] Hosmer D, Lemeshow S. Applied Logistic Regression. 3rd ed. Hoboken: Wiley Interscience; 2000.

[14] Tagliaferro EP, Ambrosano GM, Meneghim Mde C, Pereira AC. Risk indicators and risk predictors of dental caries in schoolchildren. J Appl Oral Sci 2008; 16(6):408-13. https://doi.org/10.1590/s1678-77572008000600010

[15] Costa MM, Souto ICC, Barroso KMA, Paredes SO. Factors associated with the experience of dental caries in public schools at a small city in the Northeast of Brazil. Rev Bras Pesq Saúde 2017; 19(3):32-40.

[16] Moreira PVL, Rosenblatt A, Passos IA. Prevalence of cavities among adolescents in public and private schools in João Pessoa, Paraíba State, Brazi. Ciênc Saúde Coletiva 2007; 12(5):1229-36. https://doi.org/10.1590/S1413-81232007000500020

[17] Hashizume LM, Shinada K, Kawaguchi Y. Factors associated with prevalence of dental caries in Brazilian schoolchildren residing in Japan. J Oral Sci 2011; 53(3):307-12. https://doi.org/10.2334/josnusd.53.307

[18] Peres MA, de Oliveira Latorre M, Sheiham A, Peres KG, Barros FC, Hernandez PG, et al. Social and biological early life influences on severity of dental caries in children aged 6 years. Community Dent Oral Epidemiol 2005; 33(1):53-63. https://doi.org/10.1111/j.1600-0528.2004.00197.x

[19] Piovesan C, Mendes FM, Antunes JL, Ardenghi TM. Inequalities in the distribution of dental caries among 12-year-old Brazilian school children. Braz Oral Res 2011; 25(1):69-75. https://doi.org/10.1590/S1806-83242011000100012

[20] Reis DM, Pitta DR, Ferreira HMB, Jesus MCPd, Moraes MELd, Soares MG. Health education as a strategy for the promotion of oral health in the pregnancy period. Ciênc Saúde Coletiva 2010; 15(1):269-76. https://doi.org/10.1590/S1413-81232010000100032

[21] Barfod M, Magnusson K, Lexner MO, Blomqvist S, Dahlén G, Twetman S. Oral microflora in infants delivered vaginally and by caesarean section. Inter J Paediatr Dent 2011; 21(6):401-6. https://doi.org/10.1111/j.1365-263X.2011.01136.x

[22] Thakur R, Singh G, Chaudahary S, Manuja N. Effect of mode of delivery and feending practices on acquisition of oral Streptococcus mutans in infants. Inter J Paediatr Dent 2011; 22(3):197-202. https://doi.org/10.1111/j.1365-263X.2011.01176.x.

[23] Lima MCPS, Lobo INR, Leite KVM, Muniz GRL, Henrique, Steinhauser C, et al. Oral health status of children admitted to the Children's Municipal Hospital of Imperatriz – Maranhão. Rev Bras Odontol 2016; 73(1):24-9.

[24] Guimarães KSFM, Moreira MR, Santin GC. Oral manifestations of gastroesophageal reflux disease in children. Rev Uningá 2018; 55(2):14.

[25] Corrêa MC, Lerco MM, Cunha MDEL, Henry MA. Salivary parameters and teeth erosions in patients with gastroesophageal reflux disease. Arq Gastroenterol 2012; 49(3):214-18. https://doi.org/10.1590/S0004-28032012000300009

[26] Alfaro EV, Aps JKM, Martens LC. Oral implications in children with gastroesophageal reflux disease. Curr Opin Pediatr 2008; 20(5):576-83. https://doi.org/10.1097/MOP.0b013e32830dd7df

[27] Corica A, Caprioglio A. Meta-analysis of the prevalence of tooth wear in primary dentition. Eur J Paediatr Dent 2014; 15(4):385-88.

[28] Ersin NK, Önçag O, Tümgör G, Aydoğdu S, Hilmioğlu S. Oral and dental manifestations of gastroesophageal reflux disease in children: a preliminary study. Pediatr Dent 2006; 28(3):279-84.

[29] Tenório MDH, Cota AL, Tenório DMH. Importance of the anatomy of deciduous teeth for the clinical procedures. Odontol Clin Cientif 2009; 8(1):21-8.