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Research Article

Caries Free At 6 Years Of Age In The Province Of Trento - North Italy Trend From 1998 To 2017 And New Critical Areas.

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Abstract

Introduction: The prevalence of dental caries in childhood has seen a significant decrease in the last few decades even if it remains one of the most common chronic childhood diseases. The availability of monitoring systems allows us to know the trend of the disease over time and the aspects to improve. The study reports the temporal trend of the oral health state in children residing in the province of Trento (north east Italy) and evaluated at the age of 6-7 years. The study also analyzes, on the birth cohort of 2011 and assessed in 2017, by family pediatricians, the association of dental caries on deciduous with socio-demographic factors.

Materials and methods: The sources of the data are the annual databases of oral health surveillance. Since the birth cohort of 2006, this source is represented by the forms filled by the family pediatricians on the occasion of the 6-year health assessment. On this basis, the trend of free caries and the trend of oral hygiene procedures followed by children over time were calculated. The factors associated with the risk of decay of deciduous teeth were analyzed with a multiple analysis according to the logistic model. Mother-related variables were retrieved using the Birth Assistance Certificate archive.

Results: There is a progressive increase in the proportion of caries-free children which is statistically significant. The prevalence at 2017 is 77%. The proportion of children with optimal oral hygiene practice increased statistically significantly. The proportion of children who underwent fluoride prophylaxis within the age of 6 has been statistically significantly reduced. The proportion of children with at least one access to the dentist within the age of 6 recorded an increase in an initial period. The accesses for sealing the first molars have also increased over time with a statistically significant trend. Differences remain between Italians and foreigners. The presence of a mother of foreign nationality, a mother aged 24 or younger and not practicing optimal oral hygiene constitute independent risk factors for the risk of decay of deciduous teeth at the age of 6.

Discussion: A revisit of the provincial program for the oral health promotion in childhood would seem necessary, improving the relations with schools and the interventions to the most vulnerable groups such as foreigners. Women of childbearing age and during pregnancy should also receive special care, considering that the mother's lifestyle can have significant impact on the health and behavior of the child. Family pediatrician can play an important role, considering that he comes into contact with the child and his family from birth to puberty. It is necessary however integrate this professional into the network of local health services.

Keywords

Dental caries; Childhood; Health surveillance; Risk factor, Family Pediatrician

Introduction

The prevalence of dental caries in childhood has seen a significant decrease in the last few decades (1,2). This decrease has been possible by health promotion initiatives in school communities and in the general population and by the application of evidence based preventive protocols (3-5). The widespread use of fluoridated toothpastes has also provided a significant contribution, so much so that the presence of sufficient exposure to fluoride would make diet a lower risk factor for developing caries (6,7). Despite this decrease, dental caries remains one of the most common chronic childhood diseases. Worldwide, 60–90% of school children have dental cavities and in the light of changing living conditions and dietary habits, the incidence of dental caries will increase in many of the developing countries (8). Most developed countries have prevalence of dental caries, particularly at the age of 6, well beyond the WHO target for this age and to be reached in 2020 (9). Tooth decay is a multifactorial pathological process, where personal behaviors relating to oral hygiene and nutrition play an important, albeit modifiable, role (6,10). This condition affects a large proportion of the world's child population, regardless of gender and ethnicity, although it tends to occur more frequently in individuals belonging to weaker socio-economic groups in which adherence to correct lifestyles or access to dental services are problematic (6,10,11). This aspect is detectable, albeit with different orders of magnitude, in all developed countries (12-14). The implementation of monitoring systems of the oral health in childhood is therefore important as it represents a necessary tool, on the one hand to monitor the progress of the disease over time and on the other to evaluate the effectiveness of prevention programs which, if well planned and conducted, should help to reduce the impact of social inequalities on health and in particular on oral health (4,5). In the province of Trento (540,000 inhabitants as of 1.1.2019, north east Italy), a global promotion program for oral health in children has been activated since 1998 (15), anticipating the release of the Italian national guidelines that saw the light in 2010 and had a first update in 2013 (16). The program of the province of Trento, although progressively adjusted over time, has provided for a range of actions to be developed from pregnancy up to the age of 14. The subjects involved, as well as the children and their families, were, with an action of awareness and training, the schools and family pediatricians and with organizational interventions, the public dentistry services. In the context of the program, the activation of periodic monitoring of the oral health state, focused on 6 and 12 year old subjects was envisaged. The methods of monitoring and the actors involved in the evaluation of children and in the data collection have changed over time even if the detection criteria have remained substantially constant and refer to the WHO basic methods (17). Since the birth cohort of 2008, the oral health assessment in the province of Trento has been carried out on the basis of the surveillance provided by the family pediatricians. This study reports the temporal trend of the oral health state in children residing in the province of Trento and evaluated at the age of 6-7 years. The study also analyzes, on the birth cohort of 2011 and assessed in 2017, at the age of 6, by family pediatricians, the current prevalence of dental caries on deciduous teeth and the associated socio-demographic factors. The data reported by our study may be also useful in evaluating the results of the provincial program for the promotion of oral health in the age of 0-14, after 20 years from its activation.

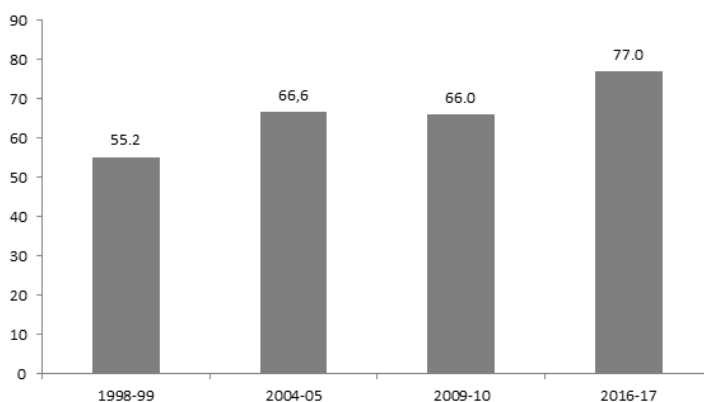


Figure 1 Trento Province. Proportion of children free from caries to deciduous teeth at the age of 6-7. By calendar year

Materials and Methods

Family pediatricians represent a typical figure of the national health system in Italy. It is a figure that works in the community, with a reference of about 1000 children aged between 0-14 years, providing care and prevention services on an outpatient and home basis. About 70 family pediatricians currently operate in the province of Trento. This professional must ensure, in accordance with Italian law, also a surveillance over time of the overall health of the children, also with reference to the provisions of the personal pediatric booklet that is delivered to the family at birth or at a later age, in the case of example in which a child moves to the province of Trento after birth from outside the province. For the monitoring the state of health, health check at filter age are provided from 0 to 14 years, the chronology of which is shown in tab. 1. On the occasion of the health reports of the 12th month, the 6th year and the 13th year, the family pediatrician must also fill in a paper form and send it to the competent health district which will record the data in a specific database. The recorded data are then made available to the Clinical and Evaluative Epidemiology Service for the analysis and the dissemination of the results. At the age of 6 and 13, the evaluation forms provide, starting from the birth cohort of 2006, also the collection of a series of variables aimed at assessing the state of oral health. The variables to be collected are represented in tab. 2 and refer, albeit a concise way, to the WHO basic oral health assessment sheet (17). Based on the data recorded over time, the oral hygiene profile and the trend in the proportion of caries-free children at the age of 6/7 years, in the period 1998-2017, are reported. The significance of the temporal trends has been evaluated according to the Cochran-Armitage criterion. The significance of the differences between the subpopulations compared were analyzed using the Chi-squared test. The factors associated with the presence of deciduous caries have been analyzed by multiple analysis using the logistic regression model in which the explanatory variables were, as for children: gestational age, gender, weight status at the 6-year visit, usual level of oral hygiene and as for the mothers: age range at birth, nationality (Italian vs. other), education level, smoking in pregnancy, residence (urban vs. rural). The variables relating to the mother have been retrieved through a record-linkage with the database of the Birth Assistance Certificate (BAC) related to 2011 birth cohort. The following variables were used as connecting keys between the two archives, the 6-year pediatric card database and the BAC database: date of birth, gender, surname of the child, municipality of residence, number of the pediatric booklet. The latter is reported both in the BAC and in the corresponding personal pediatric booklet. Cases not linked directly were retrieved through a manual link. In Italy, the BAC is a mandatory document that every maternity unit must use to register the birth and monitor pregnancy, birth and newborn health (18). Prevalence estimates and adjusted odds ratios are provided by 95% confidence intervals.

Results

The average annual number of children evaluated at the age of 6-7 in the period 1998-2017 is 3,900. The time course (fig. 1) shows a progressive increase in the proportion of caries-free children which is statistically significant (p trend 0.001). Considering various aspects that make up the oral hygiene profile, we obtain for the corresponding years, the values shown in tab.3. The proportion of children who underwent fluoride prophylaxis within the age of 6 has been statistically significantly reduced ($p < 0.001$), also due to the discontinuation by schools and local health services of the active supply of fluorine. The proportion of children with optimal oral hygiene practice increased statistically

Age	Health Check	Filling in the form
1st month	•	
3rd month	•	
6th month	•	
12th month	•	•
24th month	•	
3rd year	•	
6th year	•	•
9th year	•	
13th year	•	•

Table 1 Province of Trento, Chronology of health checks provided by family pediatricians for the periodic assessment of child health status.

significantly ($p < 0.001$). The proportion of children with at least one access to the dentist within the age of 6 recorded an increase in an initial period after which, especially since 2010, it recorded a reduction, partly explained by the economic and financial crisis making more difficult for families the access dental care. The accesses for sealing the first molars have also increased over time with a statistically significant trend ($p < 0.0001$). The number of the 2011 birth cohort evaluated by family pediatricians in 2017 consists of 3,505 subjects (1,787 males and 1,718 females) representing approximately 65% of the total resident population of the same age in the province of Trento. 29% of children has been evaluated before their 6th year birthday, on average 32 days before, 1% has been evaluated exactly on their 6th year birthday, 70% after their 6th year birthday, on average 40 days later. 7.3% were born preterm and/or of low weight, 23.7% are overweight (20.7% male, 26.8% female), 7.4% obese (7.3% male, 7.5% female). The oral health procedures ascertained in the subjects of this cohort, according to the gender and the citizenship of the mother, are represented in tables 4 and 5. The multiple analysis aimed to verify the level of association of a series of variables with the risk of caries in deciduous teeth was performed on 2,872 subjects with valid data. Compared to the initial number of 3,505 cases, for 332 subjects there were no data relating to the birth and/or the mother since they were born outside the province of Trento for which a BAC was not available, a further 301 subjects were excluded from the dataset due to data missing. The presence of a mother of foreign nationality, a mother aged 24 or younger and not practicing optimal oral hygiene constitute independent risk factors for the risk of decay of deciduous teeth at the age of 6. We do not find differences in relation to the gender of the children, the state of birth at term or preterm and the weight status. Smoking in pregnancy may play an effect even if it is not statistically significant. There is no clear association with the mother's educational qualification or urban / rural place of residence (tab.6).

Oral Health			
A Dental visit before the age of 6	[yes] [no]	[] for prevention	[] for treatment
Malocclusions	[yes] [no]	Orthodontic treatment	[yes] [no]
Deciduous caries	[yes] [no]	Teeth brushing twice a day	[yes] [no]
Permanent caries	[yes] [no]	Permanent teeth sealings	[yes] [no]
Fluoride prophylaxis	[yes] [no]	Fluoride prophylaxis for years _____	

Table 2 Province of Trento. Variables on oral health collected by family pediatricians at the 6 years health check

Time period	% children who underwent systemic fluoride prophylaxis within 6 years	% children with optimal level of oral hygiene (brushing teeth twice / day)	% children with at least one dental visit before the age of 6	% children with sealing of the first molars
1998-99	63.0	36.4	48.0	10.0
2004-05	51.0	32.0	68.0	20.0
2009-10	35.8	52.8	59.0	30.0
2016-17	27.0	77.5	53.2	55.0

Table 3 Province of Trento. Oral Health Procedures in children 6/7years. Period 1988-2017

Oral health procedure	Males	Females
% children with at least one dental visit before the age of 6	53.4 (51.1-55.7)	52.9 (50.6-55.2)
% children who underwent systemic fluoride prophylaxis within 6 years	26.0 (23.9-28.1)	28.5 (26.5-30.5)
% children with optimal level of oral hygiene (brushing teeth twice/day)	77.0 (75.2-78.8)	78.0 (76.5-79.5)
% children with sealing of the first molars	54.0 (51.8-56.2)	56.2 (54.1-58.3)
Proportion of caries free to deciduous teeth at the age of 6-7	76.5 (75.1-77.9)	77.5 (76.1-78.9)

Table 4 Province of Trento. Oral health procedures and oral health in the 2011 birth cohort. Proportion and 95% CI by gender.

Oral health procedure	Italians	Foreigners
% children with at least one dental visit before the age of 6	60.0 (59.1-60.9)	48.4 (43.0-53.0)
% children who underwent systemic fluoride prophylaxis within 6 years	28.7 (27.7-29.7)	21.0 (16.2-26.4)
% children with optimal level of oral hygiene (brushing teeth twice/day)	77.0 (76.2-77.8)	78.0 (73.5-81.6)
% children with sealing of the first molars	60.2 (59.1-61.1)	43.1 (38.1-48.3)
Proportion of caries free to deciduous teeth at the age of 6-7	78.3 (77.5-79.1)	69.0 (64.4-73.6)

Table 5 Province of Trento. Oral health procedures and oral health in the 2011 birth cohort. Proportion by citizenship of mothers and 95% CI.

Parameters	Odds Ratio	95% C.I.		P-Value
Females vs. Males	1.03	0.86	1.23	0.69
Preterm births vs. term born	0.89	0.62	1.26	0.51
overweight / obese vs. normal weight	0.97	0.80	1.18	0.79
Oral hygiene <2 times / day vs. at least 2 times / day	1.84	1.48	2.29	0.00
Maternal age <= 24 y vs. 30-34 y	1.43	1.03	1.97	0.03
Maternal age 25-29 y vs. 30-34 y	1.09	0.85	1.40	0.47
Maternal age 35+ y vs. 30-34 y	1.02	0.83	1.26	0.81
Smoking in pregnancy versus non-smoking in pregnancy	1.19	0.82	1.74	0.34
Foreign mothers vs. Italian mothers	1.69	1.23	2.31	0.00
Rural vs. urban residence	1.16	0.95	1.42	0.33
High school towards graduation	1.08	0.81	1.41	0.28
Middle school or lower vs. Graduation	1.19	0.95	1.54	0.12

Table 6 Factors associated with deciduous teeth caries at 6/7 years. Adjusted Odds ratios [95%CI].

Discussion

The health surveillance activity in childhood supported by family pediatricians fulfills an important task, even though it is not very developed in Italy considering that the data collected at the 12th month, 6th and 13th year health checks are valued, as well as the province of Trento, only in the Emilia Romagna Region. This makes difficult to compare our results with those of other Italian regions or other European countries. Another limitation of the study is represented by the fact that access to the planned health assessment is not mandatory but associated with the availability and sensitivity of the family. This can lead to differentiated access, linked to the social stratification of families. In the 2011 birth cohort, for example, the proportion of foreigners evaluated was 7%, a much lower value than the proportion of those born with a foreign mother, equal to 22%. This selection bias can cause a possible information bias with a potentially negative impact on prevalence estimates. It should also be kept in mind that health surveillance carried out through family pediatricians, while important in itself, does not lend itself directly to carrying out evaluative or planned studies. With these limitations in mind, we believe that the study still provides information that may be deemed useful. A reduction in the prevalence of dental caries in childhood, in particular in 6-year-old subjects, is confirmed also in the province of Trento, as in other national and international realities. The proportion of caries free of deciduous teeth in the province of Trento, relating to 2017, substantially coincides with what is reported by local or multicentric Italian surveys in recent years, albeit relating to children evaluated at different years, especially at 4 years of age, a reference considered today more suitable, together with that relating to 12 years (19-23). Overall, we are still far from the caries free target indicated by the WHO for the age of 6 by 2020 which is 90% [9]. Over time, there has been an increase in the proportion of children who perform optimal oral hygiene, without significant differences in relation to gender or citizenship. This is contrasted by a reduction in the practice of fluoride prophylaxis, whose efficacy in promoting oral health is well

documented whether it is delivered in a systemic or not [24,25]. This reduction can be explained by the absence, from 2011, of the active offer by schools and local health services of fluoride tablets and which has not been replaced by family practice. The practice of systemic fluoride prophylaxis up to the age of 6 would also be justified by the lack of fluoride in the drinking water of the province of Trento. The average concentration of fluoride in drinking water is, on the whole of the province of Trento, less than 0.03 ppm /l. The maintenance of systemic fluoride prophylaxis could be useful to reduce possible inequalities, linked for example to citizenship. In fact, the practice in the 2011 cohort was reduced more in foreigners than in Italians. Access to dental services, despite having been negatively affected by the economic and financial crisis of 2009-2010, presents satisfactory aspect overall, even if it confirms the differences between Italian and foreign citizen. The diversity of access to prevention and treatment services in relation to the different ethnic group is widely reported in the literature [11-13, 26,27]. Multiple analysis highlights the importance, as a risk factor, of being a foreign citizen, as well as the role of poor oral hygiene [5,6,10]. An effect linked to the mother emerges, not so much associated to the education level, even if the risk increases as the education level of the mother decreases, but above all to the age. In fact, being a young mother is associated with a greater risk of decay in the deciduous teeth of their children at the age of 6. It could be argued that this can be ensured to a deficiency in parenting skills in younger women. Alternatively, this could be associated with a drop in interest about the oral health issue which has occurred in schools and in the general population of the Trento province in the last decade. This has affected the entire territory of our province, considering that there are no differences in relation to the various territorial areas. There is a small effect linked to smoking in pregnancy even if it does not appear statistically significant. This aspect could be better evaluated considering the exposure to environmental smoke in the first years of the child's life [28,29]. Our data do not confirm the associations with the gestational age and birth weight of the child, nor with the BMI calculated at the 6-year assessment [30-34]. Possible selection biases related to the 6-year series may be involved. A revisit of the provincial program for the oral health promotion in childhood would seem necessary, improving the relations with schools and the interventions to the most vulnerable groups such as foreigners [35,36]. Women of childbearing age and during pregnancy should receive special care, considering that the mother's lifestyle can have significant impact on the health and behavior of the child. On the other hand dental care during pregnancy is safe and recommended and can reduce maternal *Streptococcus mutans* levels [37-39]. Family pediatrician can play, in the context of an oral health promotion program, an important role, considering that he comes into contact with the child and his family from birth to puberty [40]. This professional can act as an informative and educational multiplier, can identify in advance the subjects at greatest risk of caries, also facilitate taking charge by community dental service [41]. It is necessary however integrate this professional into the network of local health services improving, his knowledge and skills with respect to oral health. All of this can help to mitigate the impact of social inequalities on health and in particular on oral health in childhood [42]. Promoting oral health in childhood means laying the foundations for maintaining oral health in adulthood [43,44] with the benefit of reducing the costs of dental care by families and by health services and improving quality of life too [45].

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