

Changes in Caries Prevalence and Oral Hygiene Skills Among Preschool-Aged Children in Lithuania Between 2000 and 2010

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Key words: dental caries; prevalence, intensity; dmf index; oral hygiene.

Summary. The aim of the study was to evaluate the factors associated with the prevalence and severity of dental caries as well oral hygiene habits among 4- to 6-year-old children in Kaunas (Lithuania) in 2000 and 2010.

Material and Methods. A repeated cross-sectional study was carried out to reveal the changes in dental caries prevalence in 2000 and 2010. The study population comprised 4- to 6-year-old children living in Kaunas city and attending kindergartens. The study consisted of two parts: questionnaires on oral health behavior and clinical examination of children's teeth by the World Health Organization methodology.

Results. A total of 941 4–6-year-old children were examined in 2000 and 2010. The prevalence of dental caries increased from 85.4% in 2000 to 88.4% in 2010; however, the difference was not significant ($P=0.28$). A significant increase in the dmf-t index, describing the severity of dental caries, was observed (from 7.42 in 2000 to 12.03 in 2010, $P<0.001$). The percentage of 4- to 5-year-old girls and 5-year-old boys brushing their teeth regularly decreased in 2010. During the period of the study, a significant change in the accumulation of plaque on children's tooth surfaces was documented ($P=0.001$).

Conclusions. Comparing 2000 and 2010, no significant difference in the prevalence of dental caries among 4- to 6-year-old children in Kaunas was observed; however, the severity of dental caries differed significantly. A significant decrease in regular toothbrushing skills was documented for 4- and 5-year-old girls and 5-year-old boys. The Silness-Loe oral hygiene index was assessed as satisfactory.

Introduction

Dental caries per se can be described as a demineralization process, which is followed by cavitations. The disease seems to be more aggressive in the primary dentition. This could be caused by a number of factors: a thinner layer of enamel, a high-sugar diet, and/or an inability of children to brush their teeth properly (1).

Dental caries affects both the primary and the permanent dentition. For the reason that the disease is chronic and cumulative, it increases with the age of the population. Dental caries in the primary dentition is a strong predictor of caries in the permanent dentition and an indicator of future oral health (2). The prevalence of caries in the primary dentition differs regarding populations and time. Dental caries is widely prevalent among children of different age groups in Lithuania. In 2002, a study by Slabšinskienė et al. reported that the prevalence of caries among 3-year-old children was 50.6%, and

the prevalence of early childhood caries was 6.5% (3). Older children have a higher prevalence of caries, which affects not only deciduous, but permanent teeth as well. The first permanent molars are damaged most frequently (4). The forms of complicated dental caries are frequent, and their treatment is complex and expensive (5).

Differences in the prevalence of caries in the primary and the permanent dentition can be caused by the factor of age. However, the time and the population also matter, and they both are influenced by the factor of age. Changes in the prevalence of caries can be attributed to social determinants, which affect birth cohorts at one particular moment or last for a period of time (1).

To examine the needs of oral health and to recognize risk groups, epidemiological studies on oral health are being carried out (6). Comprehensive data on children's oral health and its development served as a basis for two oral health improvement programs in 2000–2003: toothbrushing skills training and fluoride gel applications. Both programs were effective, but due to financial reasons, these programs were discontinued in 2003 (7). In Lithuania, Kaunas re-

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gion is one of the regions best supplied with dental care, having 18.9 dentists per 10 000 inhabitants (average in country, 8.2 per 10 000) (8). Since 2003, the activities for dental caries prevention among preschool-aged children in Kaunas region have not been implemented, and the situation remains unknown.

The aim of the study was to evaluate the prevalence and severity of dental caries as well as the development of oral hygiene among 4- to 6-year-old children in Kaunas in 2000 and 2010. The study also aimed at determining the impact of age and gender on the development of dental caries and oral hygiene behavior both in 2000 and 2010.

Material and Methods

Study Design and Population. A repeated cross-sectional study was carried out to compare the prevalence and severity of dental caries in 2000 and 2010. The study enrolled 4- to 6-year-old children living in Kaunas (Lithuania) and attending kindergartens. The kindergartens were selected from the alphabetical list of educational institutions in Kaunas. The first and the last one were chosen from the list. The response rate in the kindergartens varied from 62% to 93%.

Ethical Considerations. The permission for the examination of children was granted by the Lithuanian Bioethics Committee. The aims and procedures of the study were introduced to the children's parents. Written informed consent was obtained from each child's parents.

Study Instruments and Organization. The study was conducted in 2000 and repeatedly in 2010. The study consisted of two parts: during the first part, the questionnaires on oral health behavior were filled out by parents, and during the second one, clinical examination of their children's teeth was carried out. The dental examination was performed in accordance to the methodology of oral status evaluation recommended by the WHO, using a dental mirror, a probe, and a light source. The results of the dental examination were registered in the forms, prepared according to the WHO recommendations (6). The data from the questionnaires were also recorded, and the parents were informed about their children's dental status and the fact whether dental treatment was necessary.

Children's teeth were examined in preschool settings by two researchers (pediatric oral health professionals) who were trained and calibrated earlier according to the same assessment standard. Interobserver reliability between the two examiners, measured with kappa statistics, was 0.85. The study evaluated the severity and prevalence of dental caries, as well as oral hygiene of the children. Healthy, caries-affected, filled, extracted, and sealed teeth

were recorded. Five different surfaces of the teeth were evaluated separately.

Dental caries experience and caries severity were evaluated using the dmf-t (number of decayed [d], missing [m], and filled [f] teeth) and dmf-s (number of decayed [d], missing [m], and filled surfaces) indices. The sum of all the dmf-t or dmf-s values divided by the total number of examined individuals provides the mean dmf-t or dmf-s.

Oral hygiene status was assessed using the Silness-Loe plaque index (PLI) (9). The index describes the amount and the location of plaque. The probe is scratched along the surface of a tooth, and the result is given in the following form: 0, no plaque; 1, plaque is located on gums and tooth neck area; 2, plaque is seen on tooth neck area and interdentially; 3, plaque covers a whole surface of a tooth.

The PLI is calculated by adding scores and dividing by the number of teeth. The index is scored as follows: 0, excellent oral hygiene; from 0.1 to 0.9, good; from 1.0 to 1.9, satisfactory; and from 2.0 to 3.0, poor.

The questionnaires were filled in by parents. They provided information for the evaluation of tooth brushing skills as well as parental attitudes toward their children's oral hygiene. Tooth brushing skills were evaluated as follows: if a child brushes his/her teeth twice a day, a score of 1 was given; once a day, a score of 2; irregularly (2–4 times a week), a score of 3; and if a child does not brush his/her teeth at all, a score of 4.

Statistical data analysis was conducted using SPSS 16. The data were analyzed using descriptive statistics and statistical hypotheses about average rate differences. The χ^2 criterion and the Fisher test were used to check hypotheses. Binary logistic regression analysis was employed. Odds ratios (ORs) with 95% confidence intervals were calculated in order to assess the effect of gender and age on caries development and oral hygiene skills. All the analyses were performed separately for different years of observation. The level of significance of 0.05 was chosen to assess the statistical hypotheses.

Results

Age and Gender Distribution of the Study Population. A total of 941 children aged 4 to 6 years were examined: 708 in 2000 and 233 in 2010. According to the age, there were 204 and 72 4-year-old children, 234 and 82 5-year-old children, and 270 and 79 6-year-old children in 2000 and 2010, respectively. In 2000, the study enrolled 392 boys and 316 girls; the corresponding numbers for the year 2010 were 110 and 123. A more detailed distribution by age and gender is presented in Table 1.

Prevalence and Severity of Dental Caries. The prevalence of dental caries among 4- to 6-year-

Table 1. Gender and Age Distribution of the Study Population

Gender and Age	Year	
	2000	2010
Boys		
4-year-old	109	30
5-year-old	129	36
6-year-old	154	44
Girls		
4-year-old	95	42
5-year-old	105	46
6-year-old	116	35

Values are numbers.

old children was found to be increased in 2010 as compared with 2000, but the difference was not significant (85.4% and 88.4%, respectively; $P=0.28$). However, the comparison of caries severity in 2000 and 2010 showed a significant increase in the dmf-s index from 7.42 (SD, 7.7) to 12.03 (SD, 11.9), respectively ($P<0.001$). Comparison of the prevalence of dental caries in 2000 and 2010 by gender and age did not reveal any significant differences, though the prevalence of dental caries was higher in most cases in 2010 (Table 2).

Comparison of regular tooth brushing skills among children of both sexes revealed an overall trend toward the decreased percentages of children who brushed their teeth regularly. However, the percentage of children brushing their teeth irregularly increased significantly only among girls, i.e., from

Table 2. The Comparison of Dental Caries Prevalence and Oral Hygiene Skills by Age and Gender in 2000 and 2010

Criterion	Year		χ^2	P value
	2000	2010		
Caries prevalence by age				
4-year-old	71.1	81.9	3.3	0.71
5-year-old	85.2	90.2	1.3	0.25
6-year-old	96.1	92.4	1.8	0.17
Caries prevalence by gender and age				
Boys				
4-year-old	68.8	80	1.4	0.23
5-year-old	87.6	88.9	0.1	0.83
6-year-old	94.5	88.6	1.9	0.17
Girls				
4-year-old	73.7	83.3	1.5	0.22
5-year-old	82.9	91.3	1.8	0.18
6-year-old	98.3	97.1	0.2	0.67
Regular tooth brushing skills by gender and age				
Boys				
4-year-old	89.0	83.3	0.7	0.53
5-year-old	83.7	66.7	5.1	0.03
6-year-old	78.7	81.8	0.2	0.83
Girls				
4-year-old	85.3	66.7	6.2	0.02
5-year-old	84.8	63.0	8.8	0.01
6-year-old	84.5	71.4	3.0	0.09

Values are percentages.

Table 3. Comparison of dmf-s Index by Gender and Age in 2000 and 2010

Gender and Age	dmf-s Index		P value
	2000	2010	
Boys			
4-year-old	3.53 (4.08)	6.07 (6.98)	0.006
5-year-old	7.56 (7.26)	12.67 (13.54)	0.035
6-year-old	10.40 (9.28)	11.11 (10.44)	0.68
Girls			
4-year-old	4.2 (4.99)	9.74 (11.60)	0.005
5-year-old	7.25 (8.73)	15.78 (14.16)	<0.001
6-year-old	9.53 (6.77)	15.43 (10.68)	0.004

Values are presented as means (standard deviation).

15.2% in 2000 to 33.3% in 2010 ($P=0.002$); among boys, the corresponding increase was not significant.

In both studies, the mean number of decayed, missing, and filled surfaces increased with an increasing child's age. The mean dmf-s for the deciduous dentition was 5.30 (SD, 6.8) in 2000, while the corresponding index in 2010 was significantly increased to 8.91 (SD, 9.8) ($P<0.001$). The mean number of filled surfaces per child was 1.98 (SD, 3.1) and 2.54 (SD, 4.5), and the mean number of missing teeth was 0.13 (SD, 0.73) and 0.57 (SD, 2.6) in 2000 and 2010, respectively; however, the differences were not significant ($P=0.8$ and $P=0.1$, respectively).

Dental caries experience by age and gender is displayed in Table 3.

Children's Oral Hygiene. This study also examined the changes in plaque coverage on tooth surfaces by comparing the data obtained in 2000 with those documented in 2010 (Fig. 1)

During the period of the study, significant changes in the accumulation of plaque on children's tooth surfaces were documented ($P=0.001$). In 2010, there were more children having plaque covering a whole tooth surface, but the difference was not significant ($P=0.8$). The percentage of children who had no plaque on their teeth was greater in 2010 than 2000 ($P=0.02$) (Fig. 1). It might be associated with better oral hygiene skills as the comparison of children who brushed their teeth regularly with their counterparts brushing their teeth irregularly revealed that in 2010 as compared with 2000 among children brushing their teeth regularly, there were a 3-fold decrease in the percentage of children with plaque covering a whole tooth surface (3.8% vs. 1.2%, $P<0.05$) and a 2-fold increase in the percentage of children with no plaque (12.7% vs. 24.6%, $P<0.05$).

During the study, oral hygiene according to the Silness-Loe index was assessed as well (Fig. 2).

The results of our study showed that children's oral hygiene according to the Silness-Loe index in all age groups could be assessed as satisfactory. There were no significant differences in the Silness-Loe index in all age groups of girls comparing 2000 and

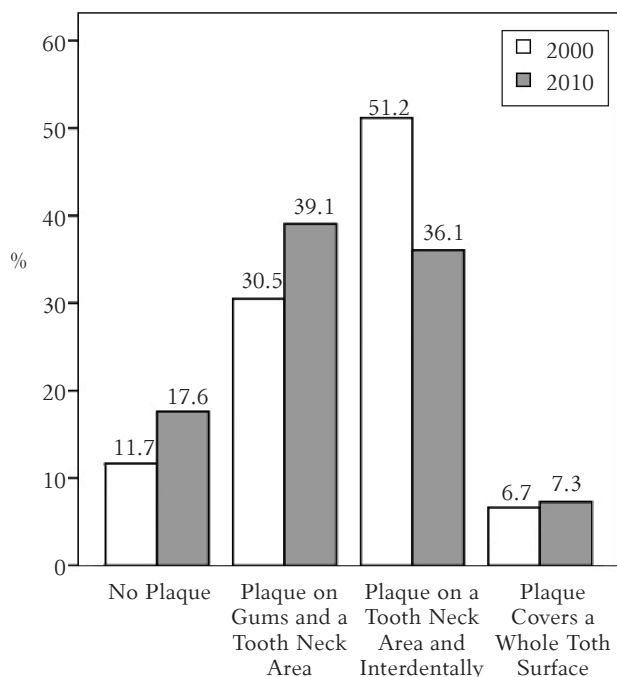


Fig. 1. The comparison of plaque coverage on tooth surfaces in 2000 and 2010
 $\chi^2=17.3$; $df=3$; $P=0.001$.

2010, but significant differences in the Silness-Loe index were observed in the groups of 5- and 6-year-old boys, i.e., oral hygiene was found to be significantly improved in 2010 as compared with 2000.

Effect size of Gender and Age. To assess the effect size of gender and age for caries development and oral hygiene skills, a multivariate logistic regression model was designed (Table 4).

Logistic regression analysis revealed that gender had no significant impact either on caries development or oral hygiene skills. Age was found to be a significant factor for caries development. The probability of developing dental caries was related to being a 5- or 6-year old.

Discussion

The prevalence of childhood caries is high in developing and developed countries. Global trends have showed a decline in dental caries experience since the 1970s, but the recent data indicate an increase of the disease both in the primary and permanent dentition (10).

Comparison of oral health status among 4- to 6-year-old children in Kaunas city in 2000 and 2010 revealed that the prevalence and severity of dental caries has remained very high. The assessment of caries severity in separate age groups showed a considerable increase in the number of decayed surfaces and missing teeth. Although there was an increase in the number of filled surfaces in 2010, the majority of carious deciduous teeth were found to be left untreated. This suggests that dental care of children in Kaunas city has remained insufficient. It might be associated with the fact that no preventive oral health care program for the children of such age has been running in Kaunas since 2005, and previous studies have showed that a 45.4% to 65.2% reduction in dental caries experience could be achieved by applying caries preventive measures (7). Moreover, a general increase in caries severity among different age groups has been observed (10–12). This could

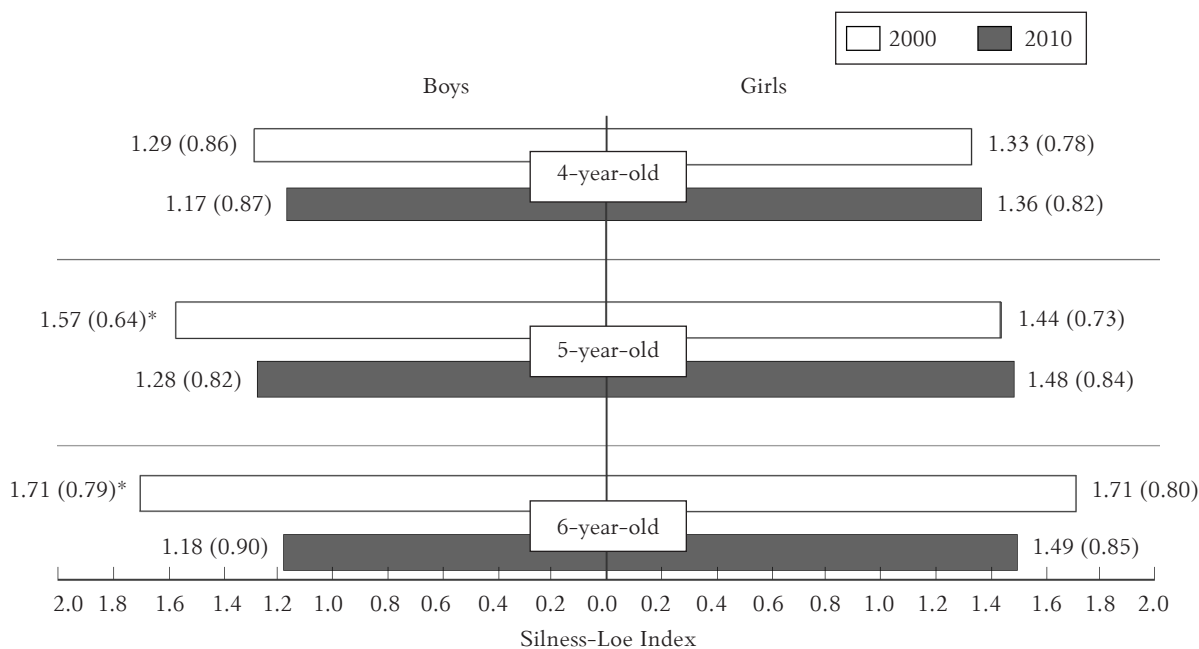


Fig. 2. Changes in the Silness-Loe Index in 2000 and 2010
 Values are mean (standard deviation). * $P<0.05$, year 2000 vs. year 2010.

Table 4. Binary Logistic Regression Model to Assess the Effect Size of Gender and Age for Caries Development and Oral Hygiene Skills in 2000 and 2010

	2000			2010		
	β	OR (95% CI)	<i>P</i>	β	OR (95% CI)	<i>P</i>
Caries development						
Gender						
Boys		1			1	
Girls	0.11 (0.22)	1.12 (0.72–1.74)	0.61	0.48 (0.42)	1.61 (0.71–3.66)	0.26
Age						
4-year-old		1			1	
5-year-old	0.88 (0.24)	2.40 (1.50–3.85)	<0.001	0.73 (0.48)	2.07 (0.80–5.35)	0.13
6-year-old	2.30 (0.35)	10.02 (5.10–19.68)	<0.001	1.06 (0.53)	2.88 (1.02–8.14)	0.046
Oral hygiene skills						
Gender						
Boys		1			1	
Girls	-0.11 (0.21)	0.89 (0.60–1.34)	0.58	0.50 (0.30)	1.65 (0.92–2.98)	0.10
Age						
4-year-old		1			1	
5-year-old	0.25 (0.28)	1.28 (0.75–2.21)	0.37	0.44 (0.36)	1.55 (0.77–3.12)	0.22
6-year-old	0.46 (0.26)	1.59 (0.96–2.65)	0.07	-0.13 (0.38)	0.88 (0.42–1.87)	0.74

be also associated with general changes (parental and child) in health behavior, sugar snacking, attitudes, parental efficacy to control oral health behavior of their children, and many other factors (5, 13).

The studies carried out in other countries show that children's dental status has been improving in different countries during the last decade. In Sweden, the prevalence of dental caries decreased from 46% in 2002 to 38% in 2007, and in Brazil, a decrease in the prevalence of dental caries among 4-year-old children from 52% in 1997 to 42% in 2008 was documented (14, 15). A study conducted in Israel revealed a constant decline in the mean dmf of 6-year-old children from 8.09 in 1990 to 5.07 in 2005 (16), meanwhile in Italy in 2005, the prevalence of dental caries among 4- and 5-year-old children was only 25% and 32% and severity of dental caries was 1.1 and 1.3, respectively (17). The decreasing prevalence of dental caries in many studies was linked to the improved children's oral hygiene, changes in social environment, implementation of preventive programs, and reduced consumption of sugary products (13–17). However, studies show that there are some countries where, as in Lithuania, a trend of increasing caries experience has been observed. Data from Norway showed a marginal increase in the prevalence of dental caries among 5-year-old children from 30.8% in 1997 to 38.9% in 2001 and in the mean dmf-t scores from 1.1 to 1.5, respectively (18), while a study carried out in New Zealand reported a 40% increase in the dmf-t of 5-year-old children during 1996–2005 (19). In England and Wales, caries experience among 5- to 6-year-old children increased from a mean dmf-t of 1.47 in 1983 to 4 in 2004 (20). A study by G. Llompart et al. carried out in 2009 showed that the

dmf-s index scored 9.27 for 6-year-old girls and 8.78 for their male counterparts (21). In Turkey in 2002, the prevalence and severity of dental caries among 5- and 6-year-old children was 76.8% and 3.74, respectively (22). An Australian study reported a mean dmf-t index of 1.64, but the authors of the study emphasized that this figure indicated an increase in children's caries experience (23). Considering the data from the above studies, it may be assumed that the prevalence of dental caries among children in Kaunas city was very high both in 2000 and 2010. It is likely to be associated with an inadequate access to dental care, poor oral hygiene skills, and possible differences in the parental attitudes toward their children's oral hygiene (13, 24). Considerable differences in the prevalence of dental caries among different countries may be associated not only with the implementation of effective preventive measures, but also with the different criteria of caries recording, such as recording only cavitated lesions or both cavitated and noncavitated lesions, and cultural and ethnic differences in dietary habits (3). Moreover, the countries experiencing considerable economic and social changes are more likely to present a higher prevalence of dental caries and greater caries experience (25).

This study showed that during the period from 2000 to 2010, children's oral hygiene according to the Silness-Loe index improved among the boys of all age groups and 6-year-old girls, with significant differences being observed only among 4- and 5-year-old boys. Girls aged 4 and 5 years demonstrated slightly worse oral hygiene in 2010 as compared with 2000, but without any significant differences. The overall oral hygiene status according to the Silness-Loe index could be assessed as satisfac-

tory both in 2000 and 2010. With age both in 2000 and 2010, the deterioration of children's oral hygiene status was observed; older children brushed their teeth irregularly more frequently, and this is most likely to be associated with the fact that parents pay more attention to smaller children's oral hygiene and that older children are more independent. Studies have reported that children aged up to 8 years are not able to brush their teeth properly; therefore, they need parental assistance and supervision in brushing their teeth (26). The number of caries-affected teeth can be considerably reduced during a particular period if parents teach their children to brush their teeth properly (10, 26). Moreover, the importance of preventive dental services cannot be excluded (25).

The limitations of the present study are related to the application of cross-sectional study design; however, the study was carried out in 2000 and 2010, and this allowed assessing and disclosing the changes during the 10-year period. Furthermore, one of the advantages of this study is that the same methodology was employed in the assessment of caries prevalence and severity. In the future, it would be useful to evaluate the associations of pa-

rental oral hygiene skills and attitudes toward their children's oral hygiene with caries prevalence and its severity among children. The results of such a study would be valuable aiming to assess the effectiveness of various preventive measures being implemented and their impact on caries prevalence and severity.

Conclusions

An increase in the prevalence of dental caries among children aged 4 to 6 years was observed in Kaunas city from 2000 to 2010; however, the difference was not significant. The severity of dental caries differed significantly, being higher in 2010. Significant differences in regular toothbrushing skills were documented for 4- and 5-year-old girls and 5-year-old boys. Children's oral hygiene index by Silness-Loe was assessed as being satisfactory.

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Statement of Conflict of Interest

The authors state no conflict of interest.

References

- Mejia GC, Ha DH. Dental caries trends in Australian school children. *Aust Dent J* 2011;56(2):227-30.
- Vanobbergen J, Martens L, Lesaffre E, Bogaerts K, Declerck D. The value of a baseline caries risk assessment model in the primary dentition for the prediction of caries incidence in the permanent dentition. *Caries Res* 2001;35:442-50.
- Slabšinskienė E, Milčiuvienė S, Narbutaitė J, Vasiliauskienė I, Andruskevičienė V, Bendoraitienė EA, et al. Severe early childhood caries and behavioral risk factors among 3-year-old children in Lithuania. *Medicina (Kaunas)* 2010;46(2):135-41.
- Milčiuvienė S. Pirmųjų krūminių dantų ęduonis. (Caries of first permanent molars.) *Stomatologija* 1999;3:7-9.
- Razmienė J, Vanagas G, Bendoraitienė E, Vyšniauskaitė A. The relation between oral hygiene skills and the prevalence of dental caries among 4-6-year-old children. *Stomatologija* 2011;13(2):62-7.
- World Health Organization. Oral health surveys. Basic methods. Geneva: WHO; 1997. p. 678.
- Andruskevičienė V, Milčiuvienė S, Bendoraitienė E, Saldunaitė K, Vasiliauskienė I, Slabšinskienė E, et al. Oral health status and effectiveness of caries prevention programme in kindergartens in Kaunas city (Lithuania). *Oral Health Prev Dent* 2008;6(4):343-8.
- National Health Committee Report 2006. Available from: URL: http://www3.lrs.lt/pls/inter/w5_show?p_r=697&p_k=1
- Löe H, Silness J. Periodontal disease in pregnancy. I. Prevalence and severity. *Acta Odontol Scand* 1963;21:533-51.
- Bagramian RA, Garcia-Godoy F, Volpe AR. The global increase in dental caries. A pending public health crisis. *Am J Dent* 2009;22:3-8.
- Zaborskis A, Milčiuvienė S, Narbutaitė J, Bendoraitienė E, Kavaliauskienė A. Caries experience and oral health behaviour among 11-13-year-olds: an ecological study of data from 27 European countries, Israel, Canada and USA. *Community Dent Health* 2010;27(2):102-8.
- Zubiene J, Milčiuvienė S, Klumbienė J. Evaluation of dental care and the prevalence of tooth decay among middle-aged and elderly population of Kaunas city. *Stomatologija* 2009;11(2):42-7.
- Vanagas G, Milašauskienė Ž, Grabauskas V, Mickevičienė A. Associations between parental skills and their attitudes toward importance to develop good oral hygiene skills in their children. *Medicina (Kaunas)* 2009;45(9):718-23.
- Stecksén-Blicks C, Kieri C, Nyman JE, Pilebro C, Borsén E. Caries prevalence and background factors in Swedish 4-year-old children – a 40-year perspective. *Int J Paediatr Dent* 2008;18:317-24.
- Bönecker M, Ardenghi TM, Oliveira LB, Sheiham A, Marcenes W. Trends in dental caries in 1- to 4-year old children in a Brazilian city between 1997 and 2008. *Int J Paediatr Dent* 2010;20:125-31.
- Sgan-Cohen HD, Amram-Liani D, Livny A. Changing dental caries levels in the 1980's, 1990's and 2005 among children of a Jerusalem region. *Community Dent Health* 2009;26(1):62-4.
- Ferro R, Besostri A, Olivieri A, Stellini E, Mazzoleni S. Preschoolers dental caries experience and its trend over 20 years in a North-East Italian Health District. *Eur J Paediatr Dent* 2007;8:199-204.
- Birkeland JM, Haugejorden O. Reversal of the caries decline among Norwegian children. *Caries Research* 2002;36:174-222.
- New Zealand Ministry of Health. Improve oral health: DHB Toolkit. Available from: URL: <http://www.newhealth.govt.nz/>
- Downer MC, Drugan CS, Blinkhorn AS. Dental caries experience of British children in an international context. *Community Dent Health* 2005;22(2):86-93.
- Llompарт G, Marin GH, Silberman M, Merlo I, Zurriaga

- O; GIS (Grupo Interdisciplinario para Salud). Oral health in 6-year-old schoolchildren from Berisso, Argentina: falling far short of WHO goals. *Med Oral Patol Oral Cir Bucal* 2010;15(1):e101-5.
22. Namal N, Yüceokur AA, Can G. Significant caries index values and related factors in 5–6-year-old children in Istanbul, Turkey. *East Mediterr Health J* 2009;15(1):178-84.
23. Armfield JM, Spencer AJ. Quarter of a century of change: caries experience in Australian children, 1977–2002. *Aust Dent J* 2008;53:151-9.
24. Vaitkevičienė V, Milčiuvienė S, Zaborskis A. Kauno miesto ikimokyklinio amžiaus vaikų burnos higiena ir tėvų požiūris į vaikų burnos sveikatą. (Oral hygiene of preschool children in Kaunas city and their parents' attitude towards children's oral health.) *Medicina (Kaunas)* 2005;41(5):427-34.
25. Wigen TI, Wang NJ. Caries and background factors in Norwegian and immigrant 5-year-old children. *Community Dent Oral Epidemiol* 2010;38:19-28.
26. Skeie MS, Espelid I, Riordan PJ, Klock KS. Caries increment in children aged 3–5 years in relation to parents' dental attitudes: Oslo, Norway 2002 to 2004. *Community Dent Oral Epidemiol* 2008;36:441-50.

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