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Longitudinal study of factors predicting toothbrushing less than twice daily at age 2 years in the FinnBrain Birth Cohort Study

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Abstract

We aimed to identify factors predicting toothbrushing less than twice daily at the age of 2 years. The data from the FinnBrain Birth Cohort Study of 506 mother–father pairs (with 506 children) were used. Logistic regression analyses were conducted of the outcome (brushing less than twice daily) at the age of 24 months. Independent variables were parental age, parental education, siblings in the household, use of childcare service, and information about whether the parents are divorced, as well as brushing of the child's teeth and the parents' own teeth at 12 months with their first order interactions. More than one quarter of the parents reported brushing their child's teeth less than twice daily at the age of 2 years. The strongest predictor for brushing the child's teeth less than twice daily at the age of 24 months was brushing child's teeth less than twice daily at the age of 12 months; the effect was significantly stronger for those children whose fathers had low education than for those whose fathers had medium/high education. Other predictors were mother's and father's own brushing at 12 months, childcare at home, and mother's low education. To improve toothbrushing in young children, early intervention is needed in families where parents brush their own teeth less than twice daily and in families with low education.

INTRODUCTION

Oral diseases are largely preventable, provided good oral hygiene is maintained; the universal

recommendation is to brush teeth twice daily with fluoride toothpaste to maintain good oral health and to prevent oral diseases [1-3]. Among children, the most common oral disease is caries [4]. It is a multifactorial chemical dissolution of the tooth surface resulting from a complex interaction over time between acid-producing micro-organisms and fermentable carbohydrates obtained from food [5, 6]. Early childhood is an important phase when toothbrushing behavior begins to take shape [7] and the foundations for good oral hygiene are created. Toothbrushing behavior learned before a child is 5 years old seems to be quite consistent and stable [8-10].

Parents act as models, and strong daily routines may have a positive and long-lasting impact on their children's health behavior, like eating and toothbrushing [11, 12]. In our previous study, we found that less than twice daily toothbrushing of both mothers and fathers was strongly associated with the less than twice daily toothbrushing of their child, when adjusted for parents' age and education, and the gender of the child and siblings. In families where at least one parent brushed his/her teeth twice daily, the child's teeth were more often brushed twice daily [13].

Other family-related factors, for instance, living conditions and parents' educational level, are also associated with toothbrushing behavior [14-17]. Hence, changes in family-related factors, such as a child starting day care or the parents' divorce, may affect the toothbrushing behavior of the parents or the child and the kind of behavior that the child adopts.

The mother's toothbrushing behavior is a strong predictor of children's brushing behavior [18-23]. However, there is a scarcity of studies examining the role of fathers or the effects of both parents' toothbrushing behavior on the brushing of their child's teeth [13, 18, 24]. Furthermore, to the best of our knowledge, there are no longitudinal studies that have investigated the influence of both parents on the toothbrushing of a very young child. In our previous study, we found that both parents have an important role in brushing a 1-year-old child's teeth—not just the mother [13].

The general aim of this study was to examine changes in brushing a child's teeth when the child grows from 1 year old to 2 years old, when the behavior starts to stabilize. The specific aim was to identify factors predicting less than twice daily brushing of the child's teeth at the age of 2 years, adjusting for the brushing at the age of 1 year. We hypothesized that the parents' age and education, and their toothbrushing behavior at 12 months, would predict less than twice daily brushing of a child's teeth at the age of 24 months.

MATERIAL AND METHODS

This study is a secondary analysis of longitudinal data obtained from the multidisciplinary

FinnBrain Birth Cohort Study (www.finnbrain.fi) in Finland. The FinnBrain Birth Cohort Study is investigating the combined effects of the environment and genes on a child's brain development and health [25]. The participants at the start of the study were recruited among pregnant women and their partners attending ultrasonography appointments that were offered at municipal maternity clinics during the first trimester of their pregnancy (gestational week [gwk] 12) in the South-Western Hospital District and the Åland Islands in Finland in 2011–2015. Mothers were asked to invite partners (later called fathers), who did not attend the ultrasonography appointment, to participate in the study.

Due to parallel visits and some other occasional resource constraints, only 65.1% (= study population) of the newly pregnant women visiting the recruitment sites during the specified period could be contacted and informed about the study [25]. The Ethics Committee of the Hospital District of Southwest Finland has approved the study protocol (14.6.2011 ETMK:57/180/2011 § 168). The number of participants at the different phases of the study is presented in Figure 1. The parents gave written informed consent on their own and their child's behalf.

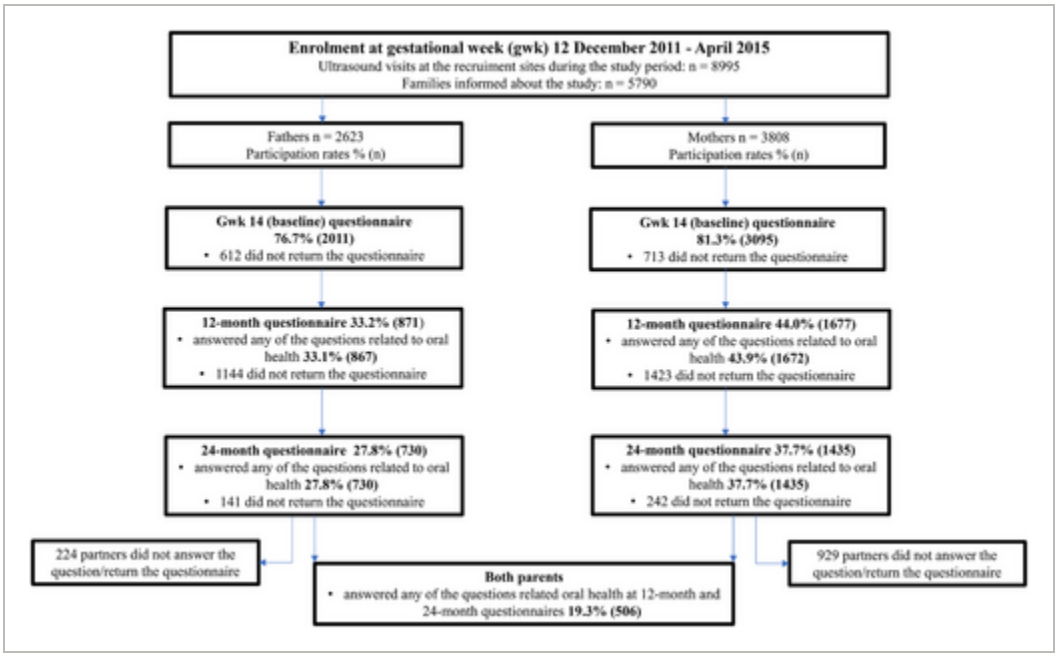

FIGURE 1

Open in figure viewer | PowerPoint

Flowchart presenting a number of participants at different phases of the study.

The inclusion criterion required both parents to have answered at least one of the questions related to oral health at both the 12- and 24-month time points. The study population was thereby restricted to 506 mother–father pairs with 506 children. The study population

comprised 30.3% of those mothers and 58.4% of those fathers who answered at least one of the questions related to their own and their child's oral health at the time point of 12 months. Attrition analysis of the overall loss in the FinnBrain Cohort study has been presented earlier [25]; those who dropped out of the study were statistically significantly younger, had lower education, and a higher proportion of them were male.

Oral health-related questions were included in the questionnaire for every participant, but not everyone answered them. Questions on the frequency of toothbrushing and the use of fluoridated toothpaste were asked with seven response alternatives: 3–4 times per day, twice daily, once daily, 2–3 times per week, once a week, twice a month, and seldom or never. All toothbrushing frequencies and the use of fluoridated toothpaste were dichotomized into twice daily or more often, or less than twice daily. Dichotomizations were done according to Finnish Current Care Guidelines [3].

For examining the changes in the brushing of the children's teeth between the ages of 12- and 24-months, a new brushing variable was created. Child's toothbrushing frequencies at the age of 1 and 2 years were combined and categorized similarly: toothbrushing at least twice daily at both times, toothbrushing less often than twice daily at both times, toothbrushing at least twice daily at the 12 months but less than twice daily at age 24 months, and vice versa.

Information about family-related variables (age and education level of the mother and father) was collected at the baseline (gwk 12). Other family-related variables (siblings in the household, form of childcare, and information about whether the parents are divorced or separated) were collected at the time point of 24 months. Family-related variables were selected based on the literature and availability in this study. The parents' age was used as a continuous variable. Education was chosen from different socio-economic variables due to its best predictive ability in this population [26]. Education was categorized into two levels: low (high school/vocational ≤ 12 years) or medium (polytechnics), plus high (university degree or comparable). The categorization is based on both the number of years and the orientation of education according to the Finnish system, which has a compulsory level (9 years), a secondary level with vocational or general/academic (11–12 years) orientation, and an advanced level with vocational (polytechnics) or academic (university degree or comparable) orientation.

The data on siblings were categorized into two separate variables because of the longitudinal setting: firstborn child and younger siblings. Based on the percentage distribution and literature [27, 28], childcare was dichotomized into at-home childcare or out-of-home childcare. Parents' divorces were categorized as "no" (parents are not divorced or separated when the child is 2 years old) or "yes" (parents are divorced or separated when the child is 2 years old). Table 1 shows the coding of the variables for subsequent analyses.

TABLE 1. Frequencies of toothbrushing behaviors and family-related factors separately for mothers and fathers at the child's age of 12 and 24 months in the FinnBrain Birth Cohort study (n = 506).

			Mothers		Fathers	
			12 months	24 months	12 months	24 months
Variable	Categories	Code	% (n)	% (n)	% (n)	% (n)
Toothbrushing (child)	At least twice daily	0	58.8 (297)	73.5 (372)	57.4 (290)	70.0 (354)
	Less than twice daily	1	41.2 (208)	26.5 (134)	42.6 (215)	30.0 (152)
Toothpaste (child)	At least once daily	0	73.6 (371)	97.0 (488)	71.9 (361)	96.6 (485)
	Less than twice daily	1	26.4 (133)	3.0 (15)	28.1 (141)	3.4 (17)
Toothbrushing (parent)	At least twice daily	0	80.3 (404)	82.9 (416)	70.2 (353)	70.4 (356)
	Less than twice daily	1	19.7 (99)	17.1 (86)	29.8 (150)	29.6 (150)
Toothpaste (parent)	At least twice daily	0	80.2 (404)	82.9 (418)	69.5 (348)	70.0 (354)
	Less than twice	1	19.8	17.1 (86)	30.5	30.0

Note: The coding used in the logistic regression analyses is also given.

Bivariate associations between frequencies of toothbrushing for the parents' own and their child's teeth at 12 and 24 months, as well as family-related factors, were evaluated using cross-tabulations and Pearson Chi-squared tests. Associations with parental age were evaluated with mean and standard deviation and with Student's t-test or one-way ANOVA. The Wilcoxon signed-rank test and Cohen's kappa test were used when studying whether the mothers reported the frequency of brushing their child's teeth differently from the fathers.

Firth penalized likelihood logistic regression analyses were conducted of the outcome, brushing a child's teeth less than twice daily, at the age of 24 months. In the initial model, independent variables were brushing of the child's teeth at the age of 12 months, toothbrushing frequencies of the mother and father at 12 months, educational level of the parents, age of parents, child's gender, childcare, firstborn child, and younger siblings. The coding of these variables is shown in Table 1. We also included interaction terms between brushing of the child's teeth at the age of 12 months and all other independent variables. To arrive at a parsimonious and sufficiently fitting model, a manual backward method was used for the selection of variables. Interaction terms and main effects that did not reach the significance level of $p < 0.05$ or did not improve model fit were eliminated. Of the models tested, the selected one was the most parsimonious and robust model. The statistical analyses were conducted using SPSS STATISTICS FOR WINDOWS (IBM), version 26.0, or the statistical analysis software SAS VERSION 9.4 (SAS Institute).

RESULTS

Of the children, 48.2% were girls. The toothbrushing behavior and sociodemographic characteristics of the parents at the child's age of 12 and 24 months are shown in Table 1. The average age of the mother at childbirth was 31.2 years (SD 4.3), and the average age of the father at childbirth was 33.2 years (SD 5.1). Parents reported brushing their child's teeth at least twice daily, more often when the child was 24 months old than they did at the child's age of 12 months. A similar trend was seen in the brushing habits of the parents themselves. About half of the children had either younger or older siblings at the age of 24 months. Sixty-two (12.3%) children who had no siblings at the age of 1 year had a sibling by the age of 2 years. Two-thirds of the children were in out-of-home childcare at the age of 24 months. Only a few parents had divorced or separated when the child was 24 months old (Table 1).

At the child's age of 24 months (Table 2), parents in all age groups tended to brush their child's teeth at least twice daily more often than they did when the child was 12 months old. At the child's age of 24 months, parents with lower levels of education reported brushing their child's teeth at least twice daily less frequently than did parents with higher education.

TABLE 2. Proportions (%) of parents brushing their child's teeth at least twice daily at the ages of 12 and 24 months, according to family-related factors in the FinnBrain Birth Cohort (n = 506).

		Mother's report: Child's toothbrushing at least twice daily		Father's report: Child's toothbrushing at least twice daily	
		12 months	24 months	12 months	24 months

Variable	Categories	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Education	Low	61 (54)	72 (64) *	102 (56)	113 (62) *
	Medium/High	226 (61)	288 (77)	175 (59)	220 (74)
Parental age, years	Mean (SD)	30.9 (0.2)	31.2 (0.2) **	32.4 (0.3) ***	33.0 (0.3)
Childcare	At home	104 (59)	131 (74)	99 (57)	118 (67)
	Out-of-home	193 (59)	241 (73)	191 (58)	236 (72)
Firstborn child	No	102 (56)	136 (75)	97 (54)	125 (69)
Younger siblings	Yes	49 (65)	58 (76)	49 (65)	57 (75)

* $p < 0.05$ for Chi-squared tests within the groups of mothers and fathers.

** $p < 0.05$ for *t*-tests within the groups of mothers and fathers

*** $p < 0.05$ for the Wilcoxon rank-sum test within the groups of mothers and fathers.

At the child's age of 12 months, mother–father pairs reported an 84% agreement in brushing their child's teeth, 50% brushing at least twice daily, and 34% less often. In 9% of the pairs, the mother reported brushing more often than the father, and in 7%, vice versa. At the child's age of 24 months, mother–father pairs reported with 87% agreement (65% at least twice daily, and 22% less often). In 8% of the pairs, the mother reported brushing more often than the father, and vice versa in 5%. Kappa-values were 0.67 at both time points, indicating a good strength of agreement in the parents' reports on the toothbrushing frequency of their child.

The final logistic regression model showed (Table 3) that the strongest predictor for brushing the child's teeth less than twice daily, as reported by the mother at the age of 24 months, was brushing the child's teeth less than twice daily at the age of 12 months when the father had low education. The effect was less strong for those children whose fathers have medium/high education, but 95% confidence intervals for both groups were wide, indicating uncertainty. The strongest predictor for brushing the child's teeth less than twice daily, as reported by the father at the age of 24 months, was brushing the child's teeth less than twice daily at the age of 12 months when the father had medium/high education. Other predictors for brushing the child's teeth less than twice daily at the age of 24 months were the mother and the father themselves

brushing their teeth less than twice daily at the time point of 12 months, childcare at home, and the mother's low education. The effects of all these were close to each other.

TABLE 3. Results from logistic regression analysis of the parental reporting of the outcome brushing child's teeth less than twice daily at the age of 24 months as a function of family-related variables and parents' toothbrushing behavior (*n* = 466 children).

	Mothers reporting toothbrushing less than twice daily		**Fathers reporting toothbrushing less than twice daily**	
Categories	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***
Mother brushes teeth less than twice daily at child age of 12 months	1.94 (1.06–3.56)	0.032	2.93 (1.60–5.35)	0.001
Father brushes his teeth less than twice daily at child age of 12 months	1.88 (1.09–3.23)	0.023	1.92 (1.13–3.28)	0.017
Brushing a child's teeth less than twice daily at child age of 12 months among those				
whose fathers have low education	21.05 (8.25–53.74)	<0.001	9.83 (4.57–21.13)	<0.001
whose fathers have medium/high education	4.74 (2.52–8.89)	<0.001	12.38 (6.04–25.38)	<0.001
Mother's low education	1.94 (1.05–3.61)	0.035	1.33 (0.72–2.47)	0.362
(ref. medium/high)				

Attrition analyses revealed that compared with participating pairs, mothers who participated without the father more often had more than one child (40.4% and 45.8%, respectively) and lower education (26.7% and 31.9%, respectively). Compared with participating pairs, the fathers who participated without the mother tended to have higher education (30.6% and 32.7%, respectively). No differences in age or toothbrushing and the use of fluoridated toothpaste were observed between these groups.

DISCUSSION

This longitudinal study showed that parents brushed their 2-year-old child's teeth according to recommendations more often than when the child was 1 year old. The strongest predictor for brushing the child's teeth less than twice daily at the age of 2 years was brushing the child's teeth less than twice daily at the age of 1 year. This effect was considerably stronger for children whose fathers had lower levels of education compared with those whose fathers had medium or high levels of education.

There are very few longitudinal and representative studies on the toothbrushing behavior of children as young as in this study [9, 29]. This birth cohort study sample was large and has been shown to represent well the general population in the geographic area. However, the findings should be generalized with caution to families with small children in Finland [25], since the drop-out rate was quite high. One of the strengths of this study was also that the population included fathers, whose impact on the toothbrushing behavior of children had only been marginally studied. This study also had limitations. In families with more than one child, both parents were more likely to remain in the study and to be included in the population at the 24-month time-point than families with only one child. Highly educated parents and parents over 27 years of age were better represented in the 2-year pairwise data than those who dropped out from the study. When comparing those mothers and fathers whose partners did not participate in the study at the 24-month time point with those mothers and fathers who both participated to the study, no statistically significant differences in toothbrushing behavior were observed. Highly educated parents were also slightly overrepresented compared with the Finnish population [30]. Thus, the findings about toothbrushing frequencies of parents and their children might be better than they would be in the general population. However, the findings about toothbrushing frequencies were similar among women, but somewhat better among men in our study than in a national study among women and men of a similar age in Finland [31]. Another limitation of this study was that the data were collected using self-reported questionnaires which could lead to more socially acceptable answers. The number of fathers was smaller than the number of mothers, possibly due to the recruitment during ultrasonography visits. Since we do not have information on if the mothers attended these visits alone or with the father/partner, we cannot calculate the percentage of the fathers who agreed to participate. Of the mothers, 97.3% reported in the baseline questionnaire living with the child's father or other male partner. There was only one two-female couple in the data, thus limiting the findings to heterosexual couples.

The findings of the overall improvement of the toothbrushing frequency at the age of 2 years are in line with previous longitudinal studies of small children [9, 29]. In considering changes in the toothbrushing behavior of parents of children aged of 1 and 2 years, this study revealed that only a small percentage, approximately 10%, of parents altered their brushing behavior

during that period. If the parent changed brushing behavior, the change often also affected the brushing of a child's teeth, especially for mothers. However, the change in parental toothbrushing did not predict the brushing of the child's teeth at the age of 2 years. To the best of our knowledge, there are no previous studies in which the change of both parents' toothbrushing behavior or its impact on brushing a child's teeth has been examined.

The finding that the father's low education was strongly associated with the brushing of the child's teeth at the age of 2 years is consistent with a previous study [32]. However, the 95% confidence intervals were very wide, indicating that the results on the strength of the effect should be interpreted with caution. One reason for this could be the limited sample size used when modelling the interaction. Interestingly, the parents' education was not shown to have an impact on toothbrushing of the 1-year-olds in our previous study [13]. One of the reasons for this may be that toothbrushing habits begin to form at the age of 1 year, as the children may have only a few teeth present at that time.

Other family-related variables were not associated with the frequency of brushing of the child's teeth at age 2 years. The gender of the child had no statistically significant association with brushing the child's teeth, neither at the 12-month-time point, nor at the 24-month time point [13]. However, toothbrushing frequency has been shown to have an association with gender in adolescence and adults [32-36]. Moreover, although parents brushed their 1-year-old child's teeth more often if the child was an only child than if the child had siblings [13], no similar association was seen when the child was 2 years old. Wigen and Wang [9] reported contradictory findings to our studies; children with one older sibling brushed more frequently during preschool age than children without older siblings [9].

In Finland, the promotion of the oral health of small children is naturally integrated into the oral health services provided to all families. Local authorities are obliged to provide at least one oral health evaluation and care assessment for each family expecting its first baby and to perform oral health examinations for each child under school age at 1 or 2 years, 3 or 4 years, and at 5 or 6 years [37]. This study showed that if twice daily toothbrushing is not established by the time a child is 2 years old, the likelihood of improving brushing behavior by the age of 2 years is small, particularly in low-educated families. Therefore, regular examinations and dental visits provided to families are essential in promoting oral health behavior and in preventing early childhood caries [38-40].

To improve the less than twice daily toothbrushing of young toddlers, early intervention is needed, especially in families where parents do not brush their own teeth or their child's teeth at the age of 1 year, as recommended. Further research should identify which health habits or family characteristics potentially cluster with less than twice daily toothbrushing to be able to recognize the possible accumulation of challenges in daily life.

AUTHOR CONTRIBUTIONS

Conceptualization: Hanna Suokko, Mimmi Tolvanen, Jorma Virtanen, and Satu Lahti. **Methodology**: Hanna Suokko, Mimmi Tolvanen, Jorma Virtanen, Auli Suominen, and Satu Lahti. **Formal analysis**: Hanna Suokko and Auli Suominen. **Investigation**: Linnea Karlsson and Hasse Karlsson. **Writing—original draft preparation**: Hanna Suokko. **Writing—review and editing**: Hanna Suokko, Mimmi Tolvanen, Jorma Virtanen, Auli Suominen, Linnea Karlsson, Hasse Karlsson, and Satu Lahti. **Project administration**: Linnea Karlsson and Hasse Karlsson.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

DATA AVAILABILITY STATEMENT

Data may be shared as part of research collaboration due to Finnish and EU legislation related to personal data protection and ethical issues in medical research. Access to data may be requested by contacting PI Prof Hasse Karlsson (hasse.karlsson@utu.fi) and co-PI Linnea Karlsson (linnea.karlsson@utu.fi).

REFERENCES

1 WHO. *Global oral health status report: towards universal health coverage for oral health by 2030*. Geneva: World Health Organization; 2022. Accessed January 10, 2024. Available from: Global oral health status report: towards universal health coverage for oral health by 2030: executive summary (who.int).

Google Scholar

2 Benzian H, Garg RM, Monse B, Stauf N, Varenne B. Promoting oral health through programs in middle childhood and adolescence. In: *Child and adolescent health and development*, 3rd edition. Washington: World Bank; 2017. p. 211–20.

Google Scholar

3 Duodecim. Caries (control). Duodecim; 2023 Accessed Jan 10, 2024. Available from: www.käypähoito.fi (English abstract: https://www.kaypahoito.fi/en/ccs00105)

Google Scholar

4 Peres MA, Macpherson LMD, Weyant RJ, Daly B, Venturelli R, Mathur MR, et al. Oral diseases: a global public health challenge. *Lancet*. 2019: **394**; 249–60.

PubMed | Web of Science® | Google Scholar

5 Anil S, Anand PS. Early childhood caries: prevalence, risk factors, and prevention. *Front Pediatr*. 2017; **5**: 157. https://doi.org/10.3389/fped.2017.00157

PubMed | Google Scholar

6 Chen X, Banan-Mwine Daliri E, Kim N, et al. Microbial etiology and prevention of dental caries: exploiting natural products to inhibit cariogenic biofilms. *Pathogens*. 2020; **9**: 569. https://doi.org/10.3390/pathogens9070569

CAS | PubMed | Web of Science® | Google Scholar

7 Alaluusua S, Malmivirta R. Early plaque accumulation—a sign for caries risk in young children. *Community Dent Oral Epidemiol*. 1994; **22**: 273–6.

CAS | PubMed | Web of Science® | Google Scholar

8 Mattila ML, Paunio P, Rautava P, Ojanlatva A, Sillanpää M. Changes in dental health and dental health habits from 3 to 5 years of age. *J Public Health Dent Fall*. 1998; **58**: 270–4.

CAS | PubMed | Web of Science® | Google Scholar

9 Wigen TI, Wang NJ. Tooth brushing frequency and use of fluoride lozenges in children from 1.5 to 5 years of age: a longitudinal study. *Community Dent Oral Epidemiol*. 2014; **42**: 395–403.

PubMed | Web of Science® | Google Scholar

10 Grytten J, Rossow I, Holst D, Steele L. Longitudinal study of dental health behaviors and other caries predictors in early childhood. *Community Dent Oral Epidemiol*. 1988; **16**: 356–9.

CAS | PubMed | Web of Science® | Google Scholar

11 Berzinski M, Morawska A, Mitchell AE, Baker S. Parenting and child behavior as predictors of toothbrushing difficulties in young children. *Int J Paediatr Dent*. 2020; **30**: 75–84.

PubMed | Web of Science® | Google Scholar

12 Edelstein BL. Forward to the US Surgeon General´s workshop on children and oral health. *Ambul Pediatr*. 2002; **2**: 139–40.

Google Scholar

13 Suokko H, Tolvanen M, Virtanen JI, Suominen A, Karlsson L, Karlsson H, et al. Parent's self-reported tooth brushing and use of fluoridated toothpaste: Associations with their one-year-old child's preventive oral health behaviour. *Community Dent Oral Epidemiol*. 2023; **51**: 311–7. https://doi.org/10.1111/cdoe.12742

PubMed | Web of Science® | Google Scholar

14 Santos J, Antunes L, Namorado S, Kislay I, Santos AJ, Rodrigues AP, et al. Oral hygiene habits in Portugal: results from the first Health Examination Survey (INSEF 2015). *Acta Odontol Scand*. 2019; **77**: 334–39.

PubMed | Web of Science® | Google Scholar

15 Luzzi L, Chrisopoulos S, Kapellas K, Brennan DS. Oral hygiene behaviours among Australian adults in the National Study of Adult Oral Health (NSAOH) 2017–18. *Aust Dent J*. 2020; **65**: 79–84.

PubMed | Web of Science® | Google Scholar

16 Soofi M, Pasdar Y, Matin BK, Hamzeh B, Rezaei S, Kazemi Karyani A, et al. Socioeconomic-related inequalities in oral hygiene behaviors: a cross-sectional analysis of the PERSIAN cohort study. *BMC Oral Health*. 2020; **20**: 63.

PubMed | Web of Science® | Google Scholar

17 Solar O, Irwin A. *A conceptual framework for action on the social determinants of health. Social Determinants of Health Discussion Paper 2 (Policy and Practice)*. Geneva: World Health Organization;2010. p. 17.

Google Scholar

18 Shearer DM, Thomson WM. Intergenerational continuity in oral health: a review. *Community Dent Oral Epidemiol*. 2010; **38**: 479–86.

PubMed | Web of Science® | Google Scholar

19 Soltani R, Eslami AA, Akhlaghi N, Sharifirad G, Alipoor M, Mahaki B. Toothbrushing frequency among 4-6-year-old Iranian children and associated maternal attitude and sociobehavioral factors. *Dent Res J*. 2017; **14**: 50–6.

Google Scholar

20 Finlayson TL, Siefert K, Ismail AI, Sohn W. Psychosocial factors and early childhood caries among low-income African American children in Detroit. *Community Dent Oral Epidemiol*. 2007; **35**: 439–48.

PubMed | Web of Science® | Google Scholar

21 Saied-Moallemi Z, Murtomaa H, Tehranchi A, Virtanen JI. Oral health behaviour of Iranian mothers and their 9-year-old children. *Oral Health Prev Dent*. 2007; **5**: 263–9.

CAS | PubMed | Google Scholar

22 Assimi S, Tajmouti R, Ennibi OK. Oral hygiene in Moroccan school children and their mothers. *SantePublique*. 2016; **28**: 245–50.

Google Scholar

23 Karamehmedovic E, Bajric E, Virtanen JI. Oral health behaviour of nine-year-old children and their parents in Sarajevo. *Int J Environ Res Public Health*. 2021; **18**: 3235. https://doi.org/10.3390/ijerph18063235

PubMed | Web of Science® | Google Scholar

24 Poutanen R, Lahti S, Tolvanen M, Hausen H. Parental influence on children's oral health-related behavior. *Acta Odontol Scand*. 2006; **64**: 286–92.

PubMed | Web of Science® | Google Scholar

25 Karlsson L, Tolvanen M, Scheinin NM et al. FinnBrain Birth Cohort Study Group. Cohort Profile: The FinnBrain Birth Cohort Study (FinnBrain). *Int J Epidemiol*. 2018; **47**: 15–6j.

PubMed | Web of Science® | Google Scholar

26 Härkönen J, Lindberg M, Karsson L, et al. Education is the strongest socio-economic predictor of smoking in pregnancy. *Addiction*. 2018; **113**: 1117–26.

PubMed | Web of Science® | Google Scholar

27 Petrauskienė S, Narbutaitė J, Petrauskienė A, Virtanen JI. Oral health behaviour, attitude towards, and knowledge of dental caries among mothers of 0- to 3-year-old children living in Kaunas. *Lithuania. Clin Exp Dent Res*. 2020; **6**: 215–24. https://doi.org/10.1002/cre2.272

PubMed | Web of Science® | Google Scholar

28 Tervahartiala K, Karlsson L, Pelto J, Kortesluoma S, Hyttinen S, Ahtola A, et al. Toddlers' diurnal cortisol levels affected by out-of-home, center-based childcare and at-home, guardian-supervised childcare: comparison between different caregiving contexts. *Eur Child Adolesc Psychiatry*. 2020; **29**: 1217–29. https://doi.org/10.1007/s00787-019-01432-3

PubMed | Web of Science® | Google Scholar

29 Franzman M, Levy S, Warren J, Broffitt B. Tooth-brushing and dentifrice use among children ages 6 to 60 months. *Pediatr Dent*. 2004; **26**: 87–92.

PubMed | Web of Science® | Google Scholar

30 Statistics Finland. *Educational structure of the population. 2018*. Helsinki: Statistics Finland; 2019. Accessed 12 February 2024. Available from: https://www.stat.fi/til/vkour/2018/vkour_2018_2019-11-05_en.pdf

Google Scholar

31 Koskinen S, Lundqvist A, Ristiluoma N. Health, functional ability, and well-being in Finland 2011. Tampere: Finnish Institute for Health and Welfare (THL); 2012. Accessed 12 February 2024. Available from: Terveys, toimintakyky ja hyvinvointi Suomessa 2011 (julkari.fi)

Google Scholar

32 da Mata L, Azevedo A, de Pereira M. Socioeconomic inequalities in oral health-related behaviors in 18-year-old adolescents: a cross-sectional study. *J Int Soc Prev Community Dent*. 2021; **11**: 703–11.

PubMed Google Scholar

33 Sabbah W, Suominen AL, Vehkalahti MM, Aromaa A, Bernabé E. The role of behaviour in inequality in increments of dental caries among Finnish adults. *Caries Res*. 2015; **49**: 34–40.

PubMed Web of Science® Google Scholar

34 Maes L, Vereecken C, Vanobbergen J. Tooth brushing and social characteristics of families in 32 countries. *Int Dent J*. 2006; **56**: 159–67.

CAS PubMed Web of Science® Google Scholar

35 Bombert F, Manso AC, Sousa Ferreira C, Nogueira P, Nunes C. Sociodemographic factors associated with oral health in 12-year-old adolescents: Hygiene behaviours and health appointments. A cross-sectional national study in Portugal. *Int Dent J*. 2018; **68**: 327–35.

PubMed Web of Science® Google Scholar

36 Leary S, Do LG. Changes in oral health behaviours between childhood and adolescence: findings from a UK cohort study. *Community Dent Oral Epidemiol*. 2019; **47**: 367–73.

PubMed | Web of Science® | Google Scholar

37 Government Decree (338/2011) on maternity and child health clinic services, school and student health services and preventive oral health services for children and youth. Section 23 of the Health Care Act (1326/2010).

Google Scholar

38 Haque F, Folayan MO, Virtanen JI. Preventive behaviour and attitudes towards early childhood caries amongst mothers of toddlers in Bangladesh. *Acta Odontol Scand*. 2024; **83**: 76–82.

PubMed | Web of Science® | Google Scholar

39 Cagetti M, Salerno C, Ionescu AI, et al. Knowledge and attitudes on oral health of women during pregnancy and their children: an online survey. *BMC Oral Health*. 2024; **85**: 1–10. https://doi.org/10.1186/s12903-023-03732-2

Google Scholar

40 Sahu P, Agrawal A, Jain D, Choudhary N. Association of early childhood caries and multiple variable factors in 3-6-year-old children. *Int J Clin Pediatr Dent*. 2023; **16**: 42–7.

PubMed | Google Scholar