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Oral health-related knowledge, attitudes, behavior, and family characteristics among Finnish schoolchildren with and without active initial caries lesions

RAIJA POUTANEN[1,2], SATU LAHTI[1,3], LIISA SEPPÄ[1], MIMMI TOLVANEN[1] & HANNU HAUSEN[1]

[1]*Institute of Dentistry, University of Oulu, Oulu, Finland,* [2]*Oral Health Services, Health Center of Seinäjoki, Seinäjoki, Finland and* [3]*Oral and Maxillo-facial Department, Oulu University Hospital, Oulu, Finland*

Abstract

Objective. The aim of this study was to determine whether the presence of active initial caries lesions among 11 to 12-year-old schoolchildren is associated with parental and child-related factors and whether there are gender differences in these associations. ***Material and Methods.*** The data were gathered by questionnaires from children and their parents, who replied without knowing the other's answers. All the children were invited to participate in a screening for the presence or absence of active initial caries lesions. Factors associated with children's initial caries were studied with logistic regression analyses. ***Results.*** The parents' self-assessed poor dental health, the parents' and the child's poor oral health-related behavior, and the child's response "I don't know" to the question concerning his/her parents' possible dental caries were associated with the presence of active initial caries lesions. The results of logistic regression analyses were different between girls and boys. Among the girls, many parent-related factors were associated with the presence of initial caries. Among the boys, most factors were related to the child; and of the parent-related factors, only parents' poor self-assessed dental health was associated with initial caries; the effect was modified by the father's occupational level. ***Conclusions.*** Parental factors affect boys' and girls' dental health differently. Among boys, the effect of the fathers was seen as the father's occupational level; among girls, parental knowledge and behavior were important. When school interventions to promote health are planned, the important role of the parents should be emphasized.

Key Words: *Attitude, children, initial caries, knowledge, parents*

Introduction

Knowledge, attitudes, and beliefs have been mentioned as factors that precede health behavior [1]. Among adolescents, favorable self-reported oral health-related attitudes have been found to be associated with favorable self-reported oral health behavior [2]; and unfavorable oral health-related knowledge has been associated with unfavorable self-reported oral health behavior [3]. However, no linear relationship has been found between changes in knowledge, attitudes, and behavior [4]. There is a range of factors related to the health behavior and health of children [5].

Among schoolchildren, unfavorable oral and other health habits have been found to accumulate in the same people [6–9]. Children with poor oral health-related habits have initial caries more often than those with favorable habits [7,10,11]. With regard to sugar consumption, however, some studies have suggested that among adolescents total sugar consumption and dental caries are either not associated or are at best only loosely associated [12,13]. Gender differences in oral health-related habits have been observed; boys brush their teeth less frequently than girls do [6,14–16] and tend to eat sweets and drink soft drinks more often than girls do [2,16,17]. However, in adolescents, caries experience has not been found to differ according to gender [18,19].

Parental and other family characteristics also influence children's health-related behavior and health [5]. Children's poor oral health has been found to be associated with low socio-economic status of the family [18,20,21] and parents' poor oral health-related behaviors [22,23]. In addition, parents' health-related attitudes, knowledge, and

Correspondence: Raija Poutanen, Höyhenviita 7, FIN-60150 Seinäjoki, Finland. Fax: +358 6 4255408. E-mail: raija.poutanen@oulu.fi

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health have been found to influence children's oral health behavior and oral health [22,24–26]. In an international study conducted in 17 countries, parental attitudes in relation to child's toothbrushing were associated with child's toothbrushing behavior [24]. Among 3-year-old children, mothers' oral health-related knowledge has been reported to associate with caries [25]. Mother's and father's previous caries experience has been found to be associated with their child's poor dental health [22,26].

It has been suggested that parent–child relations and family characteristics that facilitate or hinder children's health and health-promoting behavior need more research [5]. We did not find many studies conducted in this area, especially in relation to oral health [24,26,27]. The specific aim of the present study was to determine whether the presence of active initial caries lesions among 11- and 12-year-old schoolchildren was related to their parents' occupational level, parents' self-assessed dental health, children's and their parents' oral health-related knowledge, attitudes, beliefs, and behaviors. A further aim was to ascertain whether these associations differed according to gender. As the validity of self-reported knowledge, attitudes, beliefs, and behaviors has been questioned, we also determined whether children's self-reported toothbrushing and eating behaviors were associated with clinically determined oral hygiene, i.e. the presence of plaque and gingivitis, among a subgroup of those children who had active initial caries lesions.

Material and methods

Study sample and measurements

This study was part of a research project aimed at controlling caries among schoolchildren. To support the overall aim, the objective of the subproject conducted in Pori, Finland was to promote oral health in a school program that emphasized social reinforcement and social norms. The census-based sample consisted of all 5th and 6th graders (except mentally disabled and handicapped children attending special schools) and their parents. At the beginning of the school year, there were 1691 children who met the study criteria, ages ranging from 11 to 12 years. The data were gathered with a questionnaire that included structured and open-ended questions concerning oral health-related knowledge, attitudes, beliefs, and behaviors. Knowledge, attitudes, and beliefs were measured with 4-point Likert-scale questions; the alternatives were: strongly agree, partly agree, partly disagree, strongly disagree. Behaviors were measured with 7-point Likert-scale questions with alternatives that described the frequency of the behavior. The questions concerning dietary habits were chosen from questionnaires used in previous studies [7,28]. The questions concerning knowledge, attitudes, beliefs, and brushing were pilot-tested among 53 children of the same age in Seinäjoki. The parents' questionnaire, including the questions on habits and beliefs and some of the questions concerning attitudes, was pilot-tested among 212 parents in Loimaa. To improve comparability between child–parent pairs, in the final version of the parents' questionnaire we included questions pertaining to knowledge, attitudes, beliefs, and habits that were similar to those in the children's questionnaire. The questions used in this study were found to be reliable. Cronbach's alphas for the parents' knowledge, attitude factors, and behaviors were 0.74, 0.70–0.84, and 0.72, respectively. The Cronbach's alphas for children's knowledge and behaviors were 0.70 and 0.85, respectively [3]. Of the two questions concerning beliefs, we dropped the statement "I believe I can't prevent dental decay without professional help" from the analyses because we found that children had difficulty understanding it.

In November 2001, oral health personnel administered the questionnaires to 1691 pupils, who filled them out at school. The pupils took a questionnaire to one of their parents to be filled out at home and returned the completed questionnaire at school.

All children included in the sample were invited to participate in the baseline dental screening that was used to find suitable candidates for a randomized clinical trial. In screening for the presence (at least one lesion) or absence of active initial caries lesions, we used the criteria of Nyvad et al. [29], where a combination of visual and tactile criteria is used to assess caries activity. Both the color of the lesion and the texture of the surface were used to distinguish between active and inactive lesions. One experienced public health dentist (RP), who had been carefully trained for the examination and was not participating in the dental care of the children, carried out the procedure. Children with at least one active lesion ($n = 706$) were given an informed consent form to take home for parental permission. Those for whom consent was obtained were invited for a comprehensive dental examination. From that examination, data on visible plaque determined in six teeth using the Plaque Index [30] and gingival bleeding using the Gingival Index [31] were used for the present study.

In the first phase of the study, the data used concerned those children who took part in the questionnaire survey and dental screening and whose parents had completed the questionnaire. The completed questionnaires were received from 1649 children and from 1523 parents. Of those children, 1575 were screened for active initial caries lesions. The number of eligible children was 1441 (85% of those who were screened). The number of children in the second part of the study was 489

(69% of those with at least one active initial caries lesion).

Statistical analyses

At the first stage, groups of children and groups of parents with favorable (GB), moderate (MB), and poor (PB) behavior were created. The recommended behavior consisted of brushing the teeth with fluoride toothpaste at least twice a day, snacking on sweets not more than once a week, drinking soft drinks not more than 2–3 times per week, and chewing xylitol gum at least once a day. The children whose behaviors in all four areas were favorable formed the "good behavior group" (GB). The children whose behavior was poorer than recommended in one, two, or three areas formed the "moderate behavior group" (MB). If all four behaviors were poorer than recommended, the child was assigned to the "poor behavior group" (PB). To obtain a parental group of adequate size, the criterion for poor behavior was three out of the four unfavorable behaviors.

To reduce the number of variables for further analyses, explorative factor analysis with varimax rotation was performed for questions concerning the knowledge, attitudes, and beliefs of the children and their parents. Factors were extracted using principal component analysis with eigenvalue >1 as a cut-off point. Eleven factors, explaining 60.9% of the common variance, were revealed. The factors and the items loading >0.46 on each factor are presented in Table I. Sum scores for the items were calculated, and the scores then dichotomized for further analyses as 0 = favorable and 1 = unfavorable. Bivariate associations between active initial caries (at least one lesion or no lesions), background variables, the sum scores for the 11 factors and self-reported data on behaviors were analyzed using cross-tabulations. The data for those children who participated in the comprehensive dental examination were used when the associations between dental plaque, gingivitis, and self-reported behaviors were evaluated. Statistical significances were evaluated using chi-square tests.

A multiple logistic regression analysis was conducted as the next step. The dependent variable was presence of active initial caries. The independent variables were gender (girl = 0, boy = 1), mother's occupation (high skill occupation level = 0, low skill occupation level = 1), father's occupation (high skill occupation level = 0, low skill occupation level = 1), child's belief in keeping his/her own teeth throughout life (favorable = 0, unfavorable = 1), dichotomized sum scores for factors 1–11 (favorable = 0, unfavorable = 1), parents' self-assessed dental health (good = 0, poor = 1), child's oral health-related behavior (good = 0, moderate or poor = 1), parents' oral health-related behavior (good = 0, moderate or poor = 1), and child's reply to the question: Does your mother/father have cavities in her/his teeth (yes or no = 0, I do not know = 1). The initial model was a full one that included all independent variables and their first-order interactions. We then proceeded with the manual backward-elimination method excluding the interaction terms for which the regression coefficient did not reach a significance level of $p < 0.05$. The main effects for which the regression coefficient did not reach $p < 0.05$ or were not part of an interaction term included in the model were then eliminated, resulting in a model that was parsimonious and fit sufficiently well. The final model included those main effects and first-order interactions for which the 95% confidence intervals for odds ratios did not include the null value (one). To further analyze differences between genders, multiple logistic analyses were conducted separately for girls and boys using the same variables as above. Statistical analyses were conducted using SPSS 12.0 for Windows and SAS 9.1.

Ethical aspects

The ethics committee of Oulu University Hospital and the Pori Board of Health gave permission for the study to be carried out.

Results

Children with poor oral health-related behavior and children of parents with poor oral health-related behavior were more likely to have at least one active initial caries lesion than were children with good or moderate behavior and children of parents with good or moderate behavior (Table II). In addition, statistically significant differences in having active initial caries were found between the children whose father's occupation level was high and those whose father's occupation level was low, between children who believed and who did not believe in keeping their own teeth, between children whose parents' self-assessed dental health was good or poor, and between children who reported knowing whether their parents did or did not have dental caries lesions (Table II).

Of the child-related factors acquired through factor analysis, only two were significantly related to the presence of initial caries in bivariate analysis. Children who did not consider toothbrushing to be important for health and appearance more often had initial caries than did children who considered this important (11% versus 8%, $p = 0.041$). Children who did not consider toothbrushing to be important for acceptance of parents and friends less often had initial caries than did children who considered this important (36% versus 43%, $p = 0.008$). Of the parent-related factors, none was related to the presence of initial caries. Within the factor "health

Table I. Summary of the results of the factor analysis on children's and their parents' knowledge, attitudes and beliefs

Percentage of common variance explained	Factor loading	FACTOR Variables
6.763		FACTOR 1. CHILD'S DISTRESS ABOUT GETTING CARIES
	0.602	Distress about caries in her/his own teeth
	0.921	Distress about caries in mother's teeth
	0.918	Distress about caries in father's teeth
	0.791	Distress about caries in friend's teeth
		Cronbach's alpha coefficient: 0.843
6.101		FACTOR 2. PARENTS' ATTITUDE "THE IMPORTANCE OF TOOTHBRUSHING WHEN GOING TO SOCIAL SITUATIONS"
	0.660	Brushing the teeth is very important for me when going to work
	0.748	Brushing the teeth is very important for me when going to a party
	0.738	Brushing the teeth is very important for me when going to sports/hobbies, etc.
	0.810	Brushing the teeth is very important for me when going to a friend
		Cronbach's alpha coefficient: 0.742
6.096		FACTOR 3. CHILD'S ATTITUDE "THE IMPORTANCE OF TOOTHBRUSHING FOR HEALTH AND APPEARANCE"
	0.732	Brushing the teeth is very important for me for avoiding caries
	0.672	Brushing the teeth is very important for me for fresh breath
	0.762	Brushing the teeth is very important for me for avoiding tooth discoloration
	0.524	Brushing the teeth is very important for me for better appearance
		Cronbach's alpha coefficient: 0.699
5.978		FACTOR 4. PARENTS' KNOWLEDGE
		Favorable knowledge about the next statements:
	0.630	A person has to brush his/her teeth twice a day
	0.750	A person can prevent caries by using fluoride toothpaste
	0.766	To assure sufficient fluoride supply, one has to brush the teeth at least twice a day
	0.695	A person can prevent caries by using xylitol products after meals
	0.565	A person can reduce the risk of caries by omitting one sweet snack daily
		Cronbach's alpha coefficient: 0.736
5.955		FACTOR 5. PARENTS' DISTRESS ABOUT GETTING CARIES
	0.761	Distress about caries in his/her own teeth
	0.760	Distress about caries in child's teeth
	0.828	Distress about caries in mate's teeth
	0.698	Distress about caries in friend's teeth
		Cronbach's alpha coefficient: 0.787
5.801		FACTOR 6. CHILD'S ATTITUDE "THE IMPORTANCE OF TOOTHBRUSHING WHEN GOING TO SOCIAL SITUATIONS"
	0.799	Brushing the teeth is very important for me when going to a disco
	0.800	Brushing the teeth is very important for me when going meet my girl-/boyfriend
	0.605	Brushing the teeth is very important for me when going to meet my best friend
		Cronbach's alpha coefficient: 0.748
5.628		FACTOR 7. CHILD'S ATTITUDE "THE IMPORTANCE OF TOOTHBRUSHING FOR PLEASING AUTHORITIES"
	0.708	Brushing the teeth is very important for me when going to school
	0.568	Brushing the teeth is very important for me when going to a dentist
	0.537	Brushing the teeth is very important for me when going to sports/hobbies, etc.
	0.648	Favorable knowledge about the next statement "A person has to brush the teeth twice a day"
		Cronbach's alpha coefficient: 0.693
5.619		FACTOR 8. PARENTS' ATTITUDE "THE IMPORTANCE OF TOOTHBRUSHING FOR HEALTH AND APPEARANCE"
	0.664	Brushing the teeth is very important for me for avoiding caries
	0.695	Brushing the teeth is very important for me for fresh breath
	0.731	Brushing the teeth is very important for me for avoiding tooth discoloration
	0.534	Brushing the teeth is very important for me for better appearance
	0.674	Brushing the teeth is very important for me for healthy gingiva
		Cronbach's alpha coefficient: 0.701
4.457		FACTOR 9. PARENTS' ATTITUDE "THE IMPORTANCE OF TOOTHBRUSHING FOR THE ACCEPTANCE OF CLOSE PERSONS"
	0.856	Brushing the teeth is very important for me for mate's acceptance
	0.851	Brushing the teeth is very important for me for child's acceptance
		Cronbach's alpha coefficient: 0.840

Table I (*Continued*)

Percentage of common variance explained	Factor loading	FACTOR Variables
4.335		FACTOR 10. CHILD'S KNOWLEDGE Favorable knowledge about the next statements
	0.678	A person can prevent caries by using fluoride toothpaste
	0.628	To assure sufficient fluoride supply, one has to brush the teeth at least twice a day
	0.722	A person can prevent caries by using xylitol products after meals
		Cronbach's alpha coefficient: 0.621
4.144		FACTOR 11. CHILD'S ATTITUDE "THE IMPORTANCE OF TOOTHBRUSHING FOR THE ACCEPTANCE OF CLOSE PERSONS"
	0.799	Brushing the teeth is very important for me for parents' acceptance
	0.752	Brushing the teeth is very important for me for friends' acceptance
		Cronbach's alpha coefficient: 0.658

and appearance", however, of those children whose parents did not consider toothbrushing to be important for avoiding caries, 11% had initial caries, while the percentage of children whose parents considered this important was 8 ($p=0.046$).

Visible plaque was found more often among boys, among children of parents with low occupational level, among children who drank soft drinks daily, and among children who chewed xylitol gum once a day or less often. Gingivitis was diagnosed more often among children whose father's occupation level was low and among children who brushed their teeth once a day or less often (Table III).

The results of logistic regression analysis for the whole group indicated that the parents' self-assessed poor dental health, parents' and child's poor oral health-related behavior, and the child's response "I don't know" to the question concerning his/her mother's and/or father's possible dental caries were associated with active initial caries. The children who considered toothbrushing to be important for pleasing parents and friends were more likely to have

Table II. Percentages of children with at least one active initial caries lesion or without lesions according to gender, parents' occupation level, child's and parents' oral health behaviors, child's belief in keeping his/her own teeth, child's knowledge of parents' dental health and parents' self-assessed dental health

		Active initial caries		
	Total (%)	Present (%)	Absent (%)	*p*-value
Gender				
Girl	49	43	57	0.311
Boy	51	45	55	
Mother's occupation				
High level	31	41	59	0.138
Low level	69	45	55	
Father's occupation				
High level	26	37	63	<0.001
Low level	74	47	53	
Child's oral health behavior				
Moderate or good	77	42	58	0.013
Poor	23	50	50	
Child's reported knowledge about his/her parents' dental health				
Child knows	59	39	61	<0.001
Child does not know	41	52	48	
Child's belief on keeping his/her own teeth throughout life				
Positive	55	37	63	<0.001
Negative	45	52	48	
Parents' oral health behavior				
Good	9	40	60	0.003
Moderate	80	43	57	
Poor	11	56	44	
Parents' self-assessed dental health				
Good	36	33	67	<0.001
Poor	64	50	50	

Table III. Percentages of children with active initial caries who in dental examination had visible plaque on the teeth or were diagnosed with gingivitis according to gender, parents' occupation level and oral health-related habits

	Visible plaque present %	*p*-value	Gingivitis present %	*p*-value
Gender				
Boy	40	0.000	49	0.076
Girl	23		41	
Mother's occupation				
High level	22	0.002	40	0.086
Low level	36		48	
Father's occupation				
High level	22	0.004	38	0.028
Low level	35		49	
Toothbrushing				
≥Twice a day	29	0.173	41	0.042
≤Once a day	35		50	
Sweets				
≤Once a week	28	0.238	43	0.594
>Once a week	34		46	
Soft drinks				
≤2–3 times per week	26	0.001	43	0.076
daily	42		52	
Xylitol chewing gum				
≥Once a day	24	0.002	42	0.272
Less frequently than daily	38		47	

active initial caries lesions than were the children who did not consider toothbrushing important for pleasing parents and friends (Figure 1).

In addition to main effects, statistically significant interactions were found between attitudes, belief, father's occupational level, and some of the attitudes. The children who did not believe in keeping their own teeth throughout life were more likely to have initial caries, and the probability was higher if the child was not distressed about getting caries. The children who did not consider toothbrushing to be important for health and appearance but did consider this important for pleasing the authorities were more likely to have initial caries than children who had different attitudes towards toothbrushing for health and for appearance and pleasing the authorities. Children of parents who did not consider toothbrushing important in social situations but did consider this important for pleasing their mate and child were less likely to have initial caries if the father's occupational level was low (Figure 1).

The results of logistic regression analyses differed for girls and boys (Figures 2 and 3). Among the girls, there were many parent-related factors, such as parents' poor oral health-related behavior, that were associated with the presence of initial caries lesions (Figure 2). Among boys, most factors associated with the presence of initial caries lesions were related to the child rather than the parent. Of the parent-related factors, among boys only the parents' poor self-assessed dental health was associated with the presence of active initial caries lesions; and the effect was modified by the father's occupational level irrespective of the mother's occupational level (Figure 3).

Discussion

The school-based approach used to collect data for this study contributed to the high participation rates. The result that children's poor self-reported oral health behavior was associated with clinically visible plaque and gingivitis indicates that the questions were valid for measuring behaviors.

The objective here was to determine which child-related and parent-related characteristics were associated with active initial caries in children. According to the analyses for the whole group of children, both parental and child-related factors were found to be associated with active initial caries lesions. In addition, some attitudes modified the effect of beliefs, father's occupational level and other attitudes on the presence of active initial caries lesions. The results of the study support earlier findings that parents' oral health-related attitudes and behavior, as well as parents' oral health, influence their child's dental health [11,22,32]. Our results suggest that parents' and children's oral health-related attitudes, knowledge, belief, and behavior form a complicated system that affects children's oral health. This has also been proposed by Christensen [5], who has described the "family ecocultural pathway" including values, goals, needs, and family practices that influence the child's health status.

When studying which child-related and parent-related characteristics were associated with the

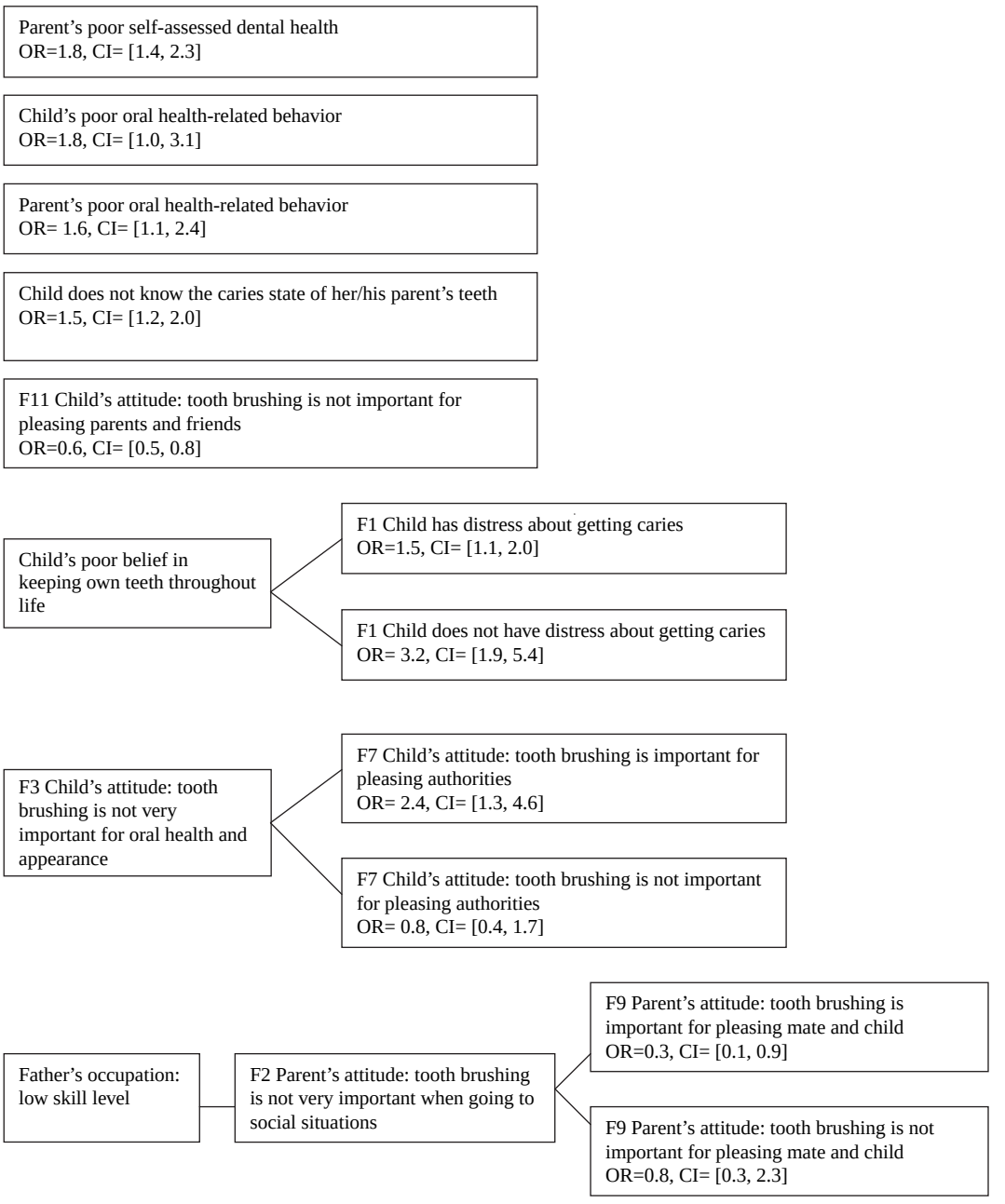

Figure 1. Summary of the results of logistic regression analysis among 11-year-old to 12-year-old schoolchildren in Pori, Finland, using presence of active initial caries lesions as the dependent variable. The independent variables were child's and parents' oral health-related behavior (favorable = 0, unfavorable = 1), 11 factors concerning child's and parents' knowledge, attitude and belief (favorable = 0, unfavorable = 1), parents' self-assessed dental health (good = 0, poor = 1), child's self-reported knowledge about her/his parents' dental health (0 = knows, 1 = does not know) and mother's and father's occupational levels (0 = high, 1 = low).

presence of active initial caries among boys and girls separately, we found that the models were different. Among girls, there were many parent-related factors associated with the presence of active initial caries lesions; but, among boys, factors related to the child were more often associated with active initial caries, and father's occupational level appeared to modify the effect of these factors. Wickrama et al. [33] found that fathers' health-risk lifestyle affected boys' health-risk lifestyle, whereas mothers' health-risk lifestyle affected girls' health-risk lifestyle. Furthermore, they found that, compared to the father's influence, the mother's lifestyle has a stronger influence on adolescent lifestyle. The result that parents' poor behavior was associated with the presence of initial caries among girls supports these findings. Girls probably take models for oral health behavior from their mothers, and boys from their fathers. However, 88% of the respondents were mothers, which may have influenced the results. If we had had more responses from fathers, the distributions of the attitudes, knowledge, and behaviors of parents might have been different.

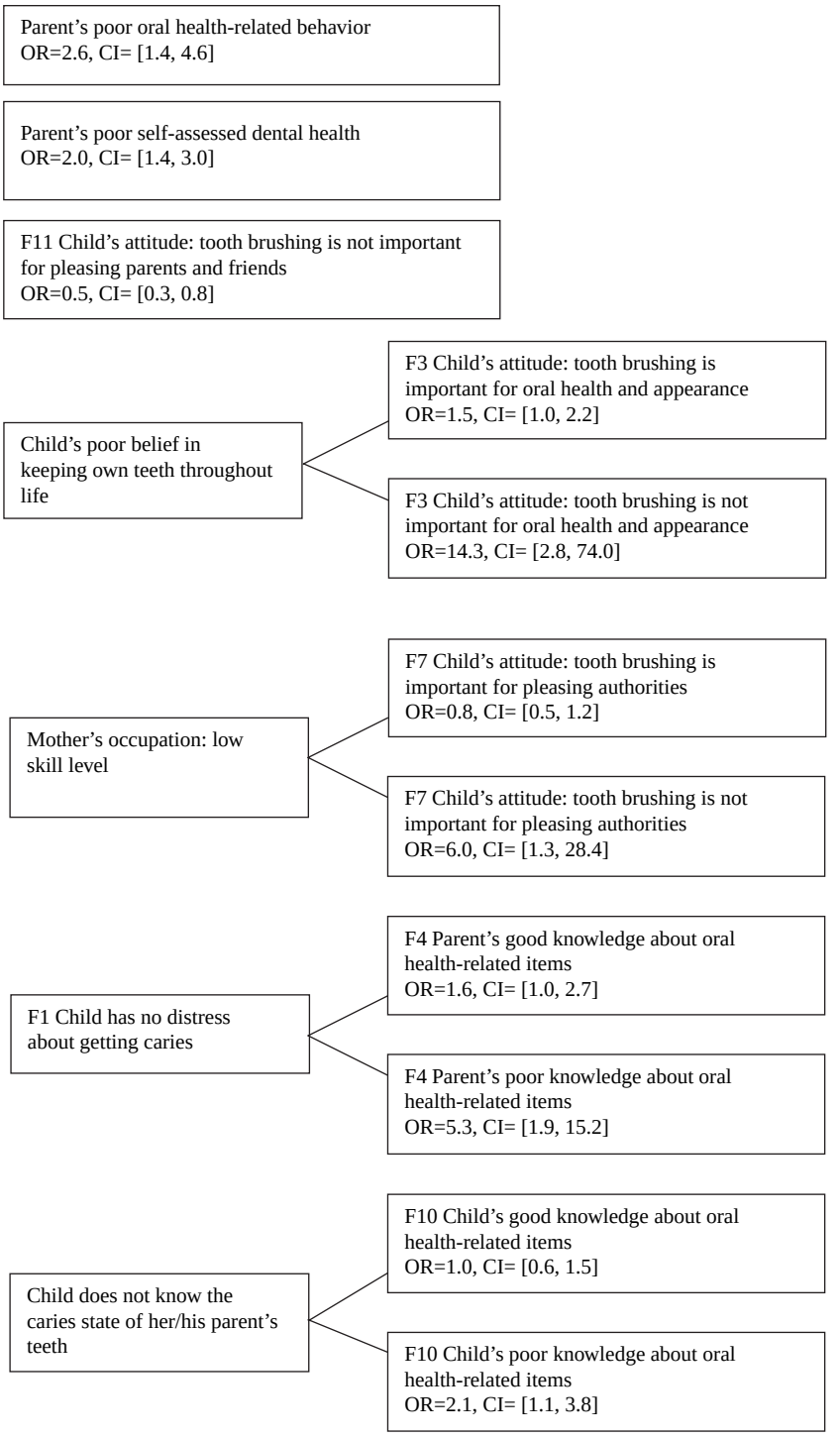

Figure 2. Summary of the results of logistic regression analysis among 11-year-old to 12-year-old girls in Pori, Finland, using presence of active initial caries lesions as the dependent variable. The independent variables were child's and parents' oral health-related behavior (favorable = 0, unfavorable = 1), 11 factors concerning child's and parents' knowledge, attitude and belief (favorable = 0, unfavorable = 1), parents' self-assessed dental health (good = 0, poor = 1), child's self-reported knowledge about her/his parents' dental health (0 = knows, 1 = does not know) and mother's and father's occupational levels (0 = high, 1 = low).

The effect of child's attitude also differed between boys and girls. Among girls, lack of distress about getting caries and pleasing authorities were associated with the presence of active initial caries lesions. Among boys, there were associations between the presence of initial caries and poor attitudes to toothbrushing. It is well known that the health-related behaviors of boys and girls differ [15,16], but differences have not been found between the occurrence of dental caries of boys and girls in adolescence [18,19]. Raitio et al. [34] reported that saliva-related factors associated with caries differ between boys and girls. We found no studies evaluating gender differences that had simultaneously taken into

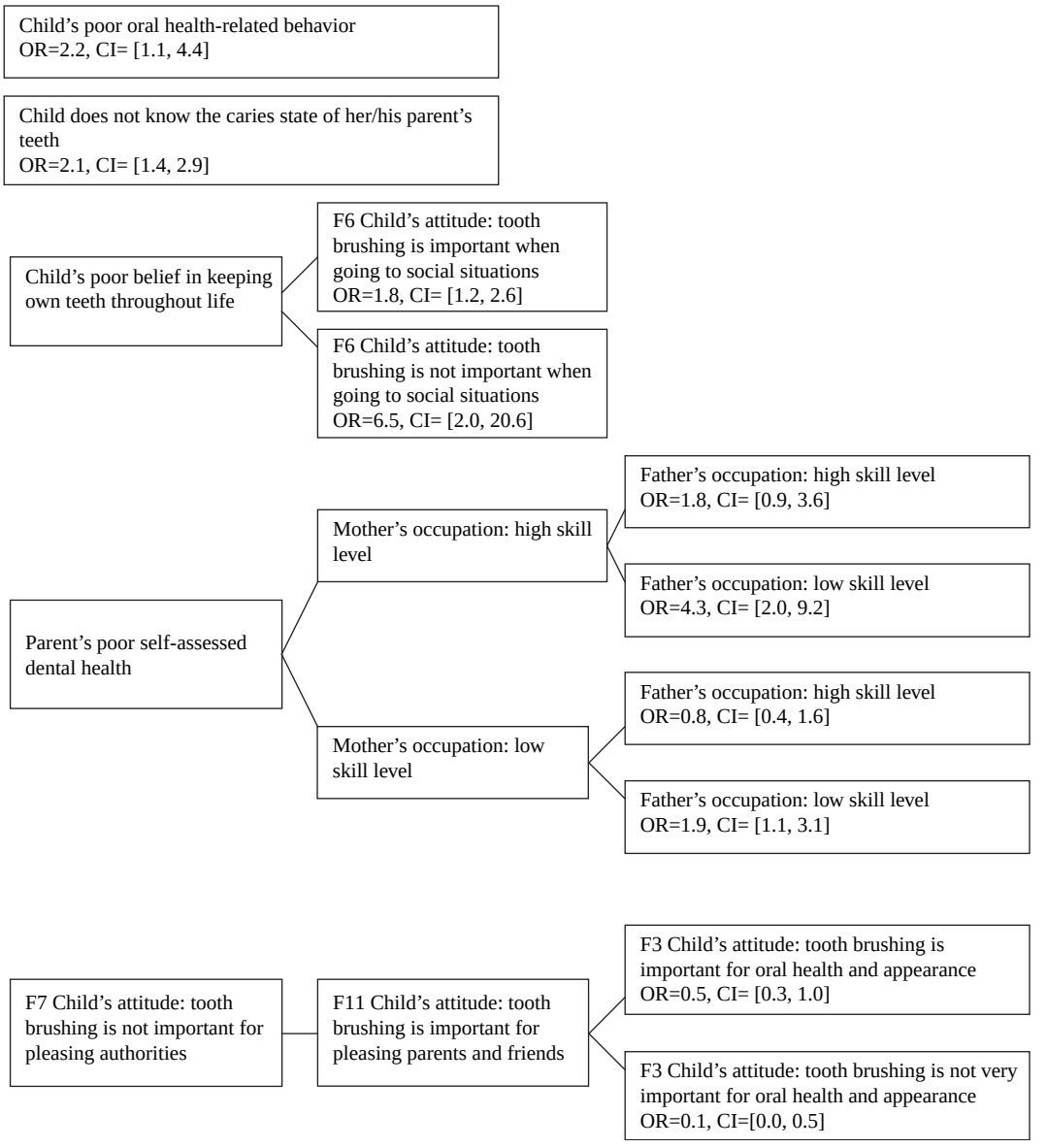

Figure 3. Summary of the results of logistic regression analysis among 11-year-old to 12-year-old boys in Pori, Finland, using presence of active initial caries lesions as the dependent variable. The independent variables were child's and parents' oral health-related behavior (favorable = 0, unfavorable = 1), 11 factors concerning child's and parents' knowledge, attitude and belief (favorable = 0, unfavorable = 1), parents' self-assessed dental health (good = 0, poor = 1), child's self-reported knowledge about her/his parents' dental health (0 = knows, 1 = does not know) and mother's and father's occupational levels (0 = high, 1 = low).

account knowledge, attitude, beliefs, and behaviors of children and their parents.

The girls who did not know whether their parents had caries lesions or not and had a poor knowledge about oral health-related items were more likely to have active initial caries lesions than did girls who said they had information about their parents' dental health. Among boys, poor knowledge about parents' caries lesions was also associated with the child's initial caries. Presumably, in families where the members discuss each other's oral health, there are other factors that contribute to acquiring health-related knowledge. This is in accordance with the "family ecocultural pathway", which implies that a health-promoting family empowers the child to be a health-promoting actor [5].

In conclusion, parental factors affect the dental health of adolescents, but the models for boys and girls differ. Among boys, the effect of fathers was seen as father's occupational level; but, among girls, parental knowledge and behavior were important. The results indicate that when school health promotion interventions are planned the challenge is in transmitting the appropriate messages to boys and girls. Traditionally, the role of the mother in promoting the health of children has been emphasized. However, fathers evidently should also be more strongly integrated as part of the health-promoting family. In future, more research is needed to determine the pathways leading to favorable or unfavorable oral health-related behavior among boys and girls.

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