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ORIGINAL ARTICLE

Oral health behavior at age of 11–12 years predicting educational plans at age of 15–16 years

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Abstract

Objective. The aim was to determine if oral health-related behavior at the age of 11–12 years predicts adolescents' educational plans at the age of 15–16 years when adjusting for gender and parents' occupational level. ***Materials and methods.*** The study population consisted of all fifth and sixth graders starting in the 2001–2002 school year in Pori, Finland ($n = 1691$); of these, 1467 returned properly filled questionnaires on behavior (toothbrushing and consumptions of xylitol products, candies, soft drinks and sports drinks) in 2001 and on educational plans in 2005. Parents' occupational levels were reported in 2001 by one of the parents of 1352 of these children. Associations between adolescents' educational plans and their behavior, gender and parents' occupation were evaluated using logistic regression model. ***Results.*** Children's oral health-related behavior at age 11–12, gender and parent's occupational level predicted their educational plans at age 15–16. Association between educational plans and behavior, especially cumulative health behavior, remained statistically significant when controlling for gender and parent's occupation: OR = 1.4 for difference of one good habit, and OR = 5.3 for difference of five good habits. ***Conclusions.*** Since difference in oral health-related behavior can be seen already in primary school, even when controlling for parents' occupational level, polarization of adolescents may begin already in primary school stage or even earlier.

Key Words: *behavior, children, dental health, education, longitudinal*

Introduction

Oral health-related behavior among children and adolescents is influenced by their knowledge, beliefs and attitudes on oral health [1,2]. During the last decade, clustering of cognitive, attitudinal and behavioral aspects of oral health have been reported among adolescents both in longitudinal [3] and cross-sectional set-ups [4–14]. Besides intentions, beliefs, knowledge and attitudes, behavior is also affected by numerous other things, such as peers, parents and environment [1,15]. Especially socioeconomic status of the family has been shown to be strongly associated with children's oral health-related behavior [16–19] and this association can be seen even when the children have grown up [20].

Good behavior of the child usually means adopting healthy habits, doing the home work and also being good at school. Oral health-related behavior has also been shown to relate to attitudes towards school [11,12,21]. Adolescents' attitudes towards school and their school performance reflect also to their future educational plans [22]. Adolescents' school career is also related to that of their parents [22–26]. In addition, there are gender differences in educational track and health habits, both in favor of girls [27–29].

It has been suggested that persons with less favored health behavior end up having lower education more often than persons with better behavior [22,25,26]. Smoking, alcohol consumption and toothbrushing frequencies have been reported to have strong

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association with adolescents' chosen educational strains; pupils in upper secondary school are reported to have better oral hygiene performance and lower smoking rates than pupils in lower secondary school [19,25,27,30,31].

However, there is only little evidence if this difference in behavior emerges during the secondary school or if it exists already in primary school. We found one study reporting that sociodemographic background and health-related behavior at age 12 influence the process of selection into educational tracks [32]. A few studies have reported behavior at adolescence predicting attained education level at adulthood [23,27,28].

Health-related behavior can also result from living situations which also affect the educational track chosen. Thus, including living conditions or a proxy of it such as parents' occupational or educational level can lead to more accurate results. This study aimed to determine if oral health-related behavior at the age of 11–12 years predicts adolescents' educational plans at the age of 15–16 years when adjusting for gender and parents' occupational level.

Materials and methods

The data for this study were collected in Pori, Finland in 2001–2005. The study population consisted of all 5th and 6th graders (11- and 12-year-olds), except for mentally disabled and handicapped children attending special schools, who started the 2001–2002 school year in the town of Pori (n = 1691). During the same time-period a program of oral health promotion (OHP) and a randomized clinical trial (RCT) for controlling caries were performed. All children were exposed to OHP and those with at least one active lesion were included the RCT. For details of the RCT, see Hausen et al. [33] and for details of the OHP, see Tolvanen et al. [34]. The Ethics Committee of the Northern Ostrobotnia Hospital District and the City of Pori gave their approval for the study.

Data for this study were gathered with two surveys. In 2001, questionnaires were administered to 1691 children and one of their parents. Completed questionnaires were received from 1649 (98%) children and 1527 (90%) parents. The children's questionnaires included child's gender and open-ended and structured questions about oral health-related habits and the parents were asked their and the other parent's occupation. In 2005, other questionnaires were administered to the same children to whom questionnaires were administered in 2001. Children were asked about their educational plans after elementary school. Completed questionnaires were received from 1467 (87%) children. Of those children, 115 were dropped out because of missing parental occupation data, leading to the study sample of 1352 children, of which 666 were boys and 686 girls. There were no differences between the children who were included in the study and those who were dropped out in terms of gender, habits, educational plans or parents' occupational level. The questions included in this study have been found to be reliable [4] and valid [13,35]. Reliability for habits was measured with Cronbach's alpha, which was 0.85. Validity was measured with correlations between reported behavior and clinically visible plaque and gingivitis at baseline. The correlation between toothbrushing and gingivitis increased with age (11-year-olds r = 0.09, 12-year-olds r = 0.13, 13-year-olds r = 0.26, 14-year-olds r = 0.29, 15-year-olds r = 0.40; $p < 0.05$, except for 11-year-olds). Details of the baseline survey have been reported previously [4] and in the following survey the procedures were the same.

Of the available information on oral health habits, data on toothbrushing with fluoride toothpaste, usage of xylitol products and consumption of soft drinks, candies and sports drinks were chosen. Habits were measured with questions using 7-point reply alternatives: 3–4 times per day, twice a day, once a day, 2–3 times per week, once a week, twice per month and less often or never. Variables were recoded to describe the quality of behavior (0 = good or 1 = poor) based on the recommendations commonly given in Finland. Recommended habits were brushing teeth with fluoride toothpaste at least twice a day, using xylitol products at least 3-times a day, eating candies less than daily, drinking soft drinks less than daily and not drinking sports drinks more than once a week. For clustering of habits, sum variable (cumulative health behavior) was calculated describing how many habits for each child were considered good (scale 0–5). Of the background information, gender and parents' occupational strata were considered as confounders. Parents' occupational levels were trichotomized to 0 = both low (both parents blue collar workers, 52% of the parents), 1 = high + low (other parent blue and other white collar worker, 32% of the parents), and 2 = both high (both parents white collar workers, 16% of the parents). Children's educational plans were dichotomized to 0 = lower secondary (children attempting to vocational school, 10th class or end studies) and 1 = upper secondary (children attempting to upper-secondary school). Percentages of children who did not know yet where they are attempting were also reported.

Cross-tabulations and chi-squared tests were used to evaluate if children's educational plans and habits were associated with their gender and their parents occupational level, to see if gender and parents occupation should be considered confounding factors. Associations between habits and educational plans were evaluated using cross-tabulations and chi-squared tests, separately for boys and girls and separately for children in three groups according to

Table I. Percentage of children with healthy habits according to educational plans among all children and separately for boys and girls and percentage of children with good behavior among those who did not know their plans yet.

		Upper secondary	Lower secondary	$p^\star$	Don't know	All
n	All	723	470		159	1352
	Boys	307	279	< 0.001	80	666
	Girls	416	191		79	686
Toothbrushing with fluoride toothpaste at least twice-a-day	All	57.0	44.5	< 0.001	47.4	51.5
	Boys	49.5	36.0	0.001	34.2	42.0
	Girls	62.7	56.9	0.181	60.5	60.8
Consumption of xylitol products at least 3-times a day	All	18.3	22.9	0.069	15.3	19.5
	Boys	17.1	21.1	0.240	15.8	18.6
	Girls	19.2	25.3	0.100	14.9	20.3
Consumption of candies less than daily	All	83.7	72.5	< 0.001	74.1	78.8
	Boys	82.9	70.8	0.001	60.0	75.1
	Girls	84.4	74.9	0.007	89.7	82.3
Consumption of soft drinks less than daily	All	78.6	65.5	< 0.001	68.2	73.0
	Boys	73.9	63.0	0.007	57.3	67.4
	Girls	81.9	68.9	< 0.001	79.5	78.1
Consumption of sports drinks less than once a week	All	81.8	72.1	< 0.001	72.7	77.4
	Boys	79.7	71.9	0.033	68.0	75.0
	Girls	83.3	72.5	0.003	77.3	79.6

* Chi-squared test.

their parents' occupational level. For these associations, as an adjustment for multiple comparisons (five habits), *p*-values smaller than 0.05/5 = 0.01 were considered statistically significant. Logistic regression analysis with manual backward elimination was conducted. The dependent variable was child's educational plans and the independent variables were oral health-related habits (toothbrushing with fluoride toothpaste, use of xylitol products and consumption of soft drinks, candies and sports drinks), gender and parents' occupational level. The initial model included all independent variables and interaction terms between habits and gender and parents' occupational level. Using the manual backward elimination method we at first excluded the interaction terms for which the regression coefficient did not reach $p < 0.05$, and then the main effects, respectively, resulting in a model that was parsimonious and fit sufficiently well. The independent variables in the final model were eating candies, drinking sports drinks, gender and parents' occupational level.

Association between cumulative health behavior and educational plans were evaluated using *t*-test, separately for boys and girls, and separately for children in three groups according to their parents' occupational level. Logistic regression analysis with manual backward elimination was conducted, the dependent variable being the child's educational plans and the independent variables being cumulative health behavior, gender and parents' occupational level. The initial model included all independent variables and their interaction terms. The final model included all main effects of the independent variables, but no interaction terms. Statistical analyses were conducted using SPSS 19.0.

Results

Of the girls ($n = 739$), 60% were aiming to upper and 28% to lower secondary school and 12% did not know yet. For boys ($n = 728$), the corresponding numbers were 45%, 42% and 13%, respectively. Children who at the age of 15–16 years were planning to apply to upper secondary school had more often healthier habits in toothbrushing and consumption of candies, soft drinks and sports drinks at the age of 11 and 12 than those planning to apply to lower secondary school, but unhealthier habit in use of xylitol products (Table I). Among both genders, the differences were statistically significant for consumption of candies, soft drinks and sport drinks. In addition, for boys, a statistically significant difference was found in toothbrushing.

Children aiming to upper secondary school tended to have better oral health-related habits than children aiming to vocational school regardless of their parents' occupational level (Table II). The differences between educational plan groups in habits related to consumption of sugary products were statistically significant among children whose parents, one or

Table II. Percentages of children with healthy habits according to their parents' occupational level and their educational plan (upper or lower secondary school or do not know yet).

				Children's educational plan			
	Parents' occupational level	All	$p^\star$	Upper secondary	Lower secondary	$p^\star$	Don't know
n	Both high	217		168	31		18
	High + low	437		268	126	< 0.001	43
	Both low	698		287	313		98
Toothbrushing with fluoride toothpaste at least twice-a-day	Both high	63.4		68.3	48.4	0.033	44.4
	High + low	54.4	< 0.001	59.8	48.4	0.035	39.0
	Both low	45.9		47.7	42.5	0.210	51.6
Consumption of xylitol products at least 3-times a day	Both high	19.2		20.5	18.5	0.812	6.7
	High + low	17.0	0.259	16.3	20.9	0.292	10.3
	Both low	21.2		18.9	24.1	0.145	18.8
Consumption of candies less than daily	Both high	84.3		85.6	75.0	0.159	87.5
	High + low	82.4	0.002	87.3	74.3	0.002	74.4
	Both low	74.8		79.3	71.5	0.034	71.6
Consumption of soft drinks less than daily	Both high	80.1		80.6	82.8	0.788	70.6
	High + low	73.9	0.017	79.2	64.0	0.002	69.2
	Both low	70.2		77.0	64.3	0.001	67.4
Consumption of sports drinks less than once a week	Both high	81.5		81.8	76.4	0.511	87.5
	High + low	79.8	0.044	83.0	74.4	0.050	75.6
	Both low	74.5		80.6	70.7	0.007	68.8

* Chi-squared test.

both, had low occupational level. For toothbrushing, the differences between educational plan groups were statistically significant among children whose parents, one or both, had high occupational level. Results of the logistic regression analysis revealed that parents' educational levels had higher OR's and significance levels than eating candies and drinking sport drinks had (Table III). Results for gender were almost similar. However, even after controlling gender and parents occupational levels, eating candies and drinking sport drinks predicted child educational plans.

Children's educational plans were also associated with the cumulative health behavior, regardless of gender or parents' occupational level (Table IV). Results of the logistic regression analysis revealed that gender and parents' educational levels had higher OR's than difference of one good habit in cumulative health behavior, but significance levels were similar (Table V). However, when controlling gender and parents' occupational levels as confounder, the cumulative health behavior predicted child's educational plans. Among all children the OR was 1.39 for difference of one good habit and OR was 5.29 for difference of five good habits (children without any healthy habits vs children with five healthy habits).

Table III. The final logistic regression model ($R^2 = 0.168$) on predictors of child's educational plans (0 = lower secondary school, 1 = upper secondary school) with independent variables being gender, parents' occupational level and those oral health-related habits (1 = good), for which $p < 0.05$.

Variable	Coding	Crude OR	OR	95% CI	*p*
Eating candies	0 = at least daily, 1 = less	1.95	1.68	1.21–2.33	0.002
Drinking sports drinks	0 = at least once a week, 1 = less	1.74	1.53	1.11–2.12	0.009
Gender	0 = boy, 1 = girl	1.98	2.09	1.60–2.74	0.002
Parents' occupational level	0 = both low, 1 = high + low	2.32	2.30	1.72–3.08	< 0.001
	0 = both low, 1 = both high	5.91	5.86	3.71–9.26	< 0.001

Crude OR's for variables not included in the final model: for toothbrushing with fluoride toothpaste at least twice-a-day 1.66, for using xylitol products at least 3-times day 0.76 and for drinking soft drinks less than daily 1.94.

Table IV. Mean value of cumulative health behavior (sum of healthy habits, scale 0–5) among children aiming to upper or lower secondary school, separately for both genders and according to parents' occupational level.

Grouping		Upper secondary	Lower secondary	$p^\star$
All		3.2	2.8	< 0.001
Gender	Boys	3.0	2.6	< 0.001
	Girls	3.3	3.0	< 0.001
Parents' occupational level	Both high	3.4	3.0	0.037
	High + low	3.3	2.8	< 0.001
	Both low	3.1	2.7	0.001

* *t*-test.

Discussion

Children's educational plans at age 15–16 were predicted by their oral health-related behavior at age 11–12, gender and parent's occupational level. This association between educational plans and behavior remained even when considering their gender and parent's occupational level as confounders. Most clearly this association could be seen in the cumulative health behavior. When considering single habits (toothbrushing and consumptions of xylitol products, candies, soft drinks and sports drinks), statistically significant predictors were eating candies and drinking sports drinks for both genders and in addition toothbrushing frequency for boys.

Girls were planning to apply to upper secondary school more often than boys were. Children with healthier habits had statistically significantly higher educational plans than those with unhealthier habits for every single habit, except for consumption of xylitol products which was better among children who were applying to lower secondary school than among those applying to upper secondary school. This arouses the question if these children substitute lack of toothbrushing with use of xylitol products. In Finland xylitol is highly recommended by oral healthcare professionals and xylitol-containing products are reckoned as preventing tooth decay [36]. Nowadays there is also a big variety of xylitol products which are also regarded as a substitute of candies. Toothbrushing and candy eating frequencies were poorer and usage of xylitol products better among these same children, which empowers this suggestion of substitution. When studying genders separately, the trends were similar, even though the differences were statistically significant ($p < 0.01$) only for consumption of sugary products (candies, soft drinks and sports drinks) among girls and for toothbrushing and consumption of candies and soft drinks among boys.

Children's good oral health-related habits tended to be more prominent in higher than in lower occupational level families. Differences were statistically significant in toothbrushing and eating candies. When studying children in groups according to their parents' occupational level, some differences were found in consumption of sugary products: children aiming to upper-secondary school had better habits than did those aiming to vocational school. Out of these results, we can assume that, besides educational plans, social status also has an impact on adolescents' oral health habits, which has also been noticed elsewhere [16–18,37]. Parents' high occupational level seems to protect children; there were no differences between educational plan groups among children from families with both parents on a high occupational level. When habits and parents' occupational level were taken into account at same time, the impact of parents' occupational level diminished. This association between parents' occupational level and children's educational plans might easily have been over-estimated if habits had not been considered.

The strengths of this study are the large representative longitudinal data with a rather long follow-up time. Because the questionnaires were filled out at school during a lesson, the response rates were very

Table V. The final logistic regression model ($R^2 = 0.170$) on predictors of child's educational plans (0 = lower secondary school, 1 = upper secondary school) with independent variables being gender, parents' occupational level and cumulative health behavior (sum of healthy habits, OR for difference of one healthy habit).

Variable	Coding	OR	*p*	95% CI
Cumulative health behavior	Scale 0–5	1.39	< 0.001	1.20–1.62
Gender	0 = boy, 1 = girl	1.95	< 0.001	1.47–2.59
Parents' occupational level	0 = both low, 1 = high + low	2.16	< 0.001	1.59–2.94
	0 = both low, 1 = both high	5.42	< 0.001	3.37–8.72

high and only those children who were not at school that day or for some reason did not volunteer are missing from the data. In addition, some of the drop-outs were a result of children moving to another town. At baseline, children who were followed up throughout the study and children who dropped out during the follow-up were similar in terms of gender, habits, educational plans and parents' occupational level. On habits, our data were self-reported, which is often considered to be less reliable. However, the self-reported toothbrushing correlated with visible plaque and gingivitis, which supports its validity [13,35]. When studying associations with single behaviors, p-values < 0.01 were considered statistically significant as an adjustment for multiple comparisons, which strengthens our results. In cumulative health behavior variable, all habits accumulate, which naturally enables us to see the associations more clearly. It should be kept in mind that the outcome in this study was educational plans, which is not necessarily equivalent to future educational position. Parents' occupational level was used as an indicator of SES and was reported by the parents instead of the child, which increases its validity.

There are only a few studies which have reported an association between adolescents' education and oral health habits and parents' educational level in a longitudinal set-up [23,27,28,32] and more in a cross-sectional setup [22,25,26,31]. Parents' competence to educate and take care of child's well-being promotes appropriate behavior [38]. Teachers, clinicians and other people working with children and their parents have a key role in intervening in adolescents unfavorable health habits and this way trying to avoid division into fortunate and less fortunate people. Gathering information about children's oral hygiene behavior could also give information about children's situation in life and probable health risks. Since difference in behavior between children seeking to upper and lower secondary school can be seen already when they are in primary school, even when controlling for parents' occupational level, polarization of adolescents may begin already in primary school stage or even earlier.

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