

The effect of parental dental health behavior on that of their adolescent offspring

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This study was designed to investigate the effect of parental dental health behavior on that of their adolescent offspring. The data stemmed from The Norwegian Longitudinal Health Behavior Study performed in 1993 in the County of Hordaland in Norway and comprised separate questionnaires for both parents and a 16-year-old child in 436 family units. A compound measure of parental dental health behavior was applied in logistic regression analyses. The results showed that there were statistically significant associations of use of dental floss, tooth brushing, and drinking of non-sugared mineral water among parents and their adolescent offspring. No significant gender interaction in the association between same- or different-sex parent–adolescent dyads was observed. These findings indicate that parents function as social models for their offspring well into the adolescent period with regard to several dental health behaviors. □ *Dental health education; modeling; socialization; Social Cognitive Theory*

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There seems to be a well-established rationale for promoting behaviors conducive to dental health among adolescents. First, a substantial amount of evidence has proved that several dental health behaviors can be applied for the prevention of caries and periodontal diseases (1, 2). Second, adolescence is believed to be an important period for learning and maintaining health- and dental health-related activities that may carry over into adulthood (3).

The socialization theory, in which the family constitutes the primary socializing agent, might be considered a valuable perspective for understanding how dental health-related activities are adopted, maintained, and discontinued (4). Numerous studies have provided evidence that parents influence their adolescent offspring with regard to a wide range of health-related behaviors (4–6). Within the dental health behavioral domain, the mother's impact on pre-school children is widely recognized (7, 8). Knowledge of parental influences on adolescents' dental health behaviors is more limited owing to a small number of studies in which only a few types of activities have been examined. In a previous study, however, adolescents' beliefs about whether their parents expected them to use dental floss and to drink non-sugared mineral water were related to adolescents' intention to use dental floss and to drink non-sugared mineral water (9). Honkala et al. (10) have reported on parental influence in terms of concordance of parents' and adolescents' tooth brushing and sugar consumption. Recently, Attwood et al. (11) have shown that whereas gender and smoking have independent effects on dental visiting behavior among adolescents, the most important influence is that

resulting from the parents' own dental visiting behaviors.

From the point of view of Bandura's social cognitive theory (12), overt behaviors of significant others represent important sources of social influence. Socialization to dental health behaviors may be considered a modeling process in which children imitate the behavior of their parents, who are available and valued role models for their offspring (12). Parental modeling has proved to be a powerful mean for establishing novel behaviors among children such as tooth brushing behavior (13) but has rarely been studied as a maintenance factor. However, the intensity and duration of parental contact and influential potential may imply that parental modeling has strong and lasting effects on the behaviors of their offspring. Since reproduction of modeled behavior may be instantaneous or delayed (12), learning through modeling predicts that there should be significant associations between parents' dental health-related behaviors and those of their offspring well into the adolescent period.

Most studies on the effect of parental modeling have assessed the association between children's health behaviors and those of a single parent model (6). Yet, in natural settings children and adolescents often observe the behaviors of more than one parent in a given situation. Since consistency in modeling cues is assumed to operate additively (14), the characteristic of parents that they usually function in twos may be important. This leads to the expectation that modeling would be more effective if parents are concordant in their performance of dental health behaviors than if they are discordant. Furthermore, 'as a general rule the

more alike observers are to models in status and characteristics, the greater is the likelihood that similar actions will produce comparable results' (12). On the basis of this assumption one would expect that same-sex family members represent more powerful models than do opposite-sex members.

The aim of the present study was to study parents as role models for their adolescent child with regard to the use of dental floss, use of toothpicks, tooth brushing, consumption of non-sugared mineral water, and consumption of sugared mineral water. The responses to dental health behaviors were given by each family member separately, enabling the following questions to be addressed: 1) Are dental health behaviors of parents, either one or both, significantly associated with the corresponding behaviors of their adolescent offspring? 2) Are dental health-related behaviors of the same-sex parent more strongly associated with adolescents' dental health behaviors than those of the opposite-sex parent?

Materials and methods

Design and methods

The data presented here are from the Norwegian Longitudinal Health Behaviour Study initiated in 1990. Two separate mail surveys were included. The first was performed in September and October 1993 among adolescents (mean age, 16.3 years for boys and girls), and the second in November 1993 among their parents. An eligible sample of 1195 7th-grade pupils in the county of Hordaland in western Norway and their parents were asked to participate in the base-line survey in 1990. The sample of pupils was regarded as representative of the 1977 cohort of schoolchildren in the region. A total of 924 7th graders (55% of this sample was boys), 642 fathers, and 729 mothers participated in the base-line study in 1990. The base-line sample of pupils, consent procedures, and confidentiality are described in more detail elsewhere (15).

In 1993, 709 pupils (51.8% were boys), of whom 665 pupils were follow-up cases from the base-line study, 499 fathers (mean age, 42.2 years), and 578 mothers (mean age, 42.2 years) completed separate postal

questionnaires at home. The adolescents' and parents' questionnaire covered several health- and dental health-related topics. Included in the present analysis are only those adolescents ($n = 436$; 57.3% were boys) whose mother and father completed the parental questionnaires. Thus, the final sample of the present analysis consisted of 436 family units. The adolescents who had both parents included in the study ($n = 436$) did not differ significantly appreciably or systematically on any of the dental health behavior variables investigated from the adolescents who had either mother or father or neither parent included ($n = 273$).

Dependent variables: adolescent dental health behaviors

Dental health behaviors were assessed by asking adolescents how often they had used the following measures during the past 3 months: 1) dental floss, 2) toothpicks, and 3) toothbrush, and how often they had been drinking: 4) non-sugared mineral water and 5) sugared mineral water during the past 3 months. The response categories for use of dental floss and use of toothpicks ranged from 1 = several times a day to 7 = never; tooth brushing frequency and drinking of sugared mineral water and non-sugared mineral water ranged from 1 = several times a day to 5 = never. The lower the score on each scale, the more frequent the use of the specific measures and the more frequent the consumption of drinks.

Independent variables: parental dental health behaviors

The same questions and response categories as described above for the adolescents were used to collect information from mothers and fathers with regard to the use of dental floss and toothpicks, tooth brushing frequency, and consumption of non-sugared mineral water and sugared mineral water.

Control variables

Gender has been found to be associated with performance of dental health behaviors among adolescents in Norway (16). Since this also was the case in the

Table 1. Percentage distributions of adolescents being active with regard to use of dental floss and toothpicks, tooth brushing, and consumption of non-sugared mineral water (non-sug. water) and sugared mineral water (sug. min. water) by the respective dental health behaviors of mothers and fathers. Number of subjects in parentheses. Chi-square statistics were calculated for the bivariate associations

Behavior	Mother active	Mother inactive	Father active	Father inactive	Both active	Both inactive
Dental floss	31 (52)	23 (63)	32 (32)	24 (83)	35 (21)	22* (51)
Toothpicks	20 (58)	13 (19)	18 (50)	17 (27)	20 (40)	13 (9)
Tooth brushing	85* (346)	56 (17)	88* (298)	68 (66)	89 (291)	52** (11)
Non-sug. water	22* (6)	7 (29)	22* (4)	7 (31)	42 (5)	7** (28)
Sug. min. water	55 (10)	44 (183)	53 (23)	43 (171)	57 (4)	44 (165)

* $p < 0.05$; ** $p < 0.001$.

Table 2. Wald test, odds ratios, and 95% confidence interval (CI) of adolescents' use of dental floss in accordance with parental use of dental floss and gender. Cases included in the analysis ($n = 436$)

Independent variables	Regression coefficient	Wald	Odds ratio	95% CI
Only mother active versus both inactive	0.56	3.87*	1.74	1.01–3.02
Only father active versus both inactive	0.34	0.69	1.40	0.62–3.13
Mother and father active versus both inactive	0.67	4.10*	1.95	1.03–3.73
Gender	1.44	37.91*	4.23	2.67–6.71

* $p < 0.05$.

present study, the adolescent's gender (boy = 1, girl = 2) was included as a control variable and possible moderator in the multivariate analysis. Socioeconomic status has also been reported to be closely associated with dental health behaviors (11, 16) but not in this study as measured by the educational level and occupational status of the mother and father. Thus, these variables were not included in the analysis.

Analysis

Data analyses were performed using the SPSS-PC + Version 4.0.1. Simple bivariate associations between adolescents' and parents' dental health behaviors were tested by means of Pearson's chi-square statistics. The relationships between the dental health behaviors of parents and their adolescent offspring were analyzed multivariately, using logistic regression analysis (17). Logistic regression was preferred to linear regression analysis because the logistic regression coefficients are assumed to be more easily interpretable and may therefore be more useful for practical purposes than are the linear regression coefficients of non-intervally scaled variables.

The variables were dichotomized for the logistic regression analyses. The same criteria have been used for parents and their offspring to classify them as 'active' or 'inactive' with regard to the performance of dental health behaviors. With regard to use of dental floss and use of toothpicks, active performers were defined as all those who reported using dental floss and toothpicks several times a week or more (value ≥ 4) during the past 3 months. Active performers of tooth brushing were

defined as all those who said they brushed at least twice a day (value ≥ 2) during the past 3 months. Active consumers of non-sugared mineral water and sugared mineral water were defined as all those who said they had been drinking non-sugared mineral water and sugared mineral water three to six times a week or more (value ≥ 3) during the past 3 months.

A combined measure for parental dental health behavior was used, distinguishing between both parents, mother only, father only, and neither parent being active with regard to use of dental floss, toothpicks, tooth brushing frequency, consumption of non-sugared mineral water, and consumption of sugared mineral water. The effect of each category of parental dental health behavior on that of their adolescent offspring was analyzed by multivariate logistic regression analyses. Logistic regression analyses were performed by use of the logit model. The logistic regression coefficients were used to calculate the adjusted odds ratios for the effect of parental dental health behavior. The level of statistical significance for each partial effect was calculated by using the Wald test. Ninety-five per cent confidence intervals are given for the odds ratios and indicate statistically significant relationships if both values are either greater or less than 1.

Results

Table 1 shows that among adolescents whose mothers were defined as active with regard to consumption of non-sugared mineral water and tooth brushing frequency, a significantly ($p < 0.05$) higher percentage

Table 3. Wald test, odds ratios, and 95% confidence interval (CI) of adolescents' use of toothpicks in accordance with parental use of toothpicks and gender. Cases included in the analysis ($n = 434$)

Independent variables	Regression coefficient	Wald	Odds ratio	95% CI
Only mother active versus both inactive	0.49	1.21	1.64	0.67–3.95
Only father active versus both inactive	0.06	0.02	1.06	0.40–2.82
Mother and father active versus both inactive	0.50	1.58	1.66	0.75–3.64
Gender	0.80	9.82*	2.24	1.36–3.71

* $p < 0.05$.

Table 4. Wald test, odds ratios, and 95% confidence interval (CI) of adolescents' tooth brushing frequency in accordance with parents tooth brushing frequency and gender. Cases included in the analysis ($n = 434$)

Independent variables	Regression coefficient	Wald	Odds ratio	95% CI
Only mother active versus both inactive	1.01	3.33	2.73	0.93–7.99
Only father active versus both inactive	1.00	1.29	2.72	0.48–15.22
Mother and father active versus both inactive	2.18	17.99*	8.83	3.24–24.13
Gender	1.83	24.06*	6.25	3.01–12.90

* $p < 0.05$.

could be described as active with regard to those behaviors than among the corresponding adolescents with mothers defined as inactive. Similar differences were observed with regard to the fathers' tooth brushing frequency and consumption of non-sugared mineral water. With regard to the mother's and father's use of dental floss and the mother's use of toothpicks the bivariate associations approached significance and were significant ($p < 0.05$) when all mothers and all fathers were included in the analysis. Possibly in part due to a low number of subjects, few of the bivariate associations were statistically significant.

The estimated multivariate models, adjusted odds ratios, and 95% confidence intervals of the adolescents' use of dental floss, use of toothpicks, tooth brushing, consumption of non-sugared mineral water, and consumption of sugared mineral water are given in Tables 2 to 6. The adjusted odds ratios are directly interpretable estimates of the predictive value of the influence of parental dental health behavior on that of their adolescent offspring. Odds ratios of frequent daily tooth brushing and the use of dental floss and toothpicks at least several times a week were higher among girls than among boys (Tables 2 to 4), whereas the odds ratio of consumption of sugared mineral water at least several times a week was highest among boys (Table 6). The clearly strongest predictive value of adolescents' use of dental floss and tooth brushing and drinking of non-sugared mineral water was observed for the category of both parents being active with regard to those behaviors (Tables 2, 4, and 5). Thus, the odds ratio of frequent daily tooth brushing among the adolescents was 2.73 if only the mother (approached significance), 2.72 if only the father (not significant), and 8.83 (significant) if both

parents brushed several times a day, compared with if neither of the parents brushed several times a day, which gave an odds ratio of 1.00 (Table 4).

As can be observed in Table 1, the dummy variables on mother's and father's use of dental floss were not statistically significantly associated with those of their adolescent offspring. However, the compound variable on parental use of dental floss was significantly associated with adolescents' use of dental floss (Table 2). Specifically, if the mother but not the father used dental floss at least several times a week, the odds ratio was 1.74 (approached significance); if only the father was active, the odds ratio was 1.40 (not significant), and if both mother and father used floss on a weekly basis, the odds ratio was 1.95 (significant) as compared with if neither of the parents were active, which gave an odds ratio of 1.00.

Girls ($n = 182$) seemed to consistently score more favorably than boys ($n = 248$) on the measures of use of dental floss and toothpicks, tooth brushing, and drinking of non-sugared mineral water. Given this gender patterning of adolescents' dental health behaviors, the analysis proceeded by testing whether the associations between parents and adolescents varied with gender. A model was constructed entering mother's and father's dental health behaviors as two separate variables (instead of a compound parental measure) to ascertain whether there were differences between same-gender and different-gender parent/adolescent dyads. There was no significant gender interaction in the association between mother's or father's and their offspring's dental health behaviors and thus no evidence of significant differences in the associations on the basis of whether parent and adolescent were the same gender. Thus, the

Table 5. Wald test, odds ratios, and 95% confidence interval (CI) of adolescents' consumption of non-sugared mineral water in accordance with parental use of non-sugared mineral water and gender. Cases included in the analysis ($n = 431$)

Independent variables	Regression coefficient	Wald	Odds ratio	95% CI
Only mother active versus both inactive	0.82	1.55	2.27	0.67–8.23
Only father active versus both inactive	0.25	0.06	1.29	0.15–10.41
Mother and father active versus both inactive	2.33	8.32*	10.23	2.11–49.60
Gender	0.11	0.08	1.11	0.54–2.30

* $p < 0.05$.

Table 6. Wald test, odds ratios, and 95% confidence interval (CI) of adolescents' use of sugared mineral water in accordance with parental use of sugared mineral water and gender. Cases included in the analysis ($n = 432$)

Independent variables	Regression coefficient	Wald	Odds ratio	95% CI
Only mother active versus both inactive	0.40	0.40	1.49	0.43–5.18
Only father active versus both inactive	0.45	1.48	1.57	0.75–3.26
Mother and father active versus both inactive	0.43	0.29	1.53	0.32–7.25
Gender	–1.08	27.27*	0.34	0.23–0.52

* $p < 0.05$.

more favorable behavior with regard to dental health which was observed among females than among males in both generations was not reflected in a stronger tendency for boys and girls to take after their fathers and mothers, respectively.

Discussion

This study provides empirical support for the assumption that dental health-related behaviors of parents and their adolescent offspring are significantly and positively associated, at least with regard to use of dental floss, tooth brushing, and consumption of non-sugared mineral water. Honkala et al. (10) also reported a significant association between parental and adolescent tooth brushing behavior in the Finnish population. In contrast, the observed lack of significant association between parental and adolescent consumption of sugared mineral water is at odds with the Finnish results (10), a finding possibly ascribed to differences in the methods of measurement of behavior, age, and population groups between studies.

Since dental health behaviors were reported by each separate family member, the observed associations are less likely to be due to systematic measurement errors, as can be expected if adolescents had been used as informants of their parents' behavior. Although modeling depends on what the offspring perceives as parental behavior (12), from a methodologic point of view, the use of children's reports of their parents' health- and dental health-related behavior reduces the accuracy of such reports. This is because people can project their own beliefs and behaviors onto others, a phenomenon known as the false consensus effect (18). The importance of distinguishing between perceived parental behavior and parent's self-reported behavior has been demonstrated by Aas et al. (19) in relation to the drinking behavior of parents and their children.

Since this study has relied solely on self-reports, the absolute levels of the variables on dental health behaviors might be biased by under- and over-reporting due to socially desirable responses. It is difficult to assess the degree of reliability on health- and dental health-related behavior variables in surveys, but self-reports provide information not easily available, if at all, from

other independent sources. The questions on dental health behaviors were probably sufficiently simple and unambiguous to achieve a reasonable degree of validity on the dental health behavior variables. In fact, previous research has shown such self-reports to be quite accurate (20).

The results indicate that parents function as role models for their offspring well into the adolescent period with regard to behaviors related to dental health. The case for parental influence is made even stronger by the fact that these links were observed at an age when adolescents are seeking independence from parents, and thus less concordance might have been expected. With regard to other health-related activities among adolescents, such as physical activity, smoking, alcohol consumption, and food habits, numerous investigations have reported that these behaviors are influenced by the corresponding behaviors of parents (4–6).

The results further suggest that it is not one particular parent (either father or mother) who is important but rather that they constitute multiple role models for their adolescent offspring. This implies that an estimate of one parent's dental health behavior may not be a valid measure of parental influence in terms of modeling effect. It seems that the effect of parental modeling depends on whether mother and father are congruent with regard to dental health behaviors. Hence, the probability of using dental floss and drinking non-sugared mineral water on a weekly basis and the probability of frequent daily tooth brushing was highest when both parents could be described as active with regard to those behaviors. Similar effects of parents' smoking, use of alcohol, intake of fat, and sports participation on the respective behaviors of their adolescent child have also been reported (21).

Considering the various strengths of the associations between parental and adolescent behavior, it may be anticipated that this reflects the relative extent to which the different kinds of behavior are associated with the family as a setting for performance. Adolescents' tooth brushing and use of dental floss are preferably carried out at home within the family. Consumption of non-sugared mineral water may be seen as part of a common household diet and, as such, being reproduced from parents to adolescents. Studies concerned with

similarity in dietary behavior between parents and their offspring have suggested that parental modeling is an important determinant of children's food choice preferences (4). Consumption of sugary products has been recognized as parents' behaviors being adopted by the child, and, as such, sugar consumption is closely related to the characteristics of the parents (8). Among adolescents, however, sugar consumption seems not to be attached to the family but might be performed in other social contexts. It might be anticipated that the peer group rather than the parents is the most influential socializing agent with regard to adolescents' sugar consumption.

Several authors have emphasized the importance of acknowledging the multidirectionality in family influences on health behavior (22). Whereas parents ordinarily provide the initial opportunities for socialization into dental health behaviors, it is widely recognized that parents learn from and are influenced by their children, particularly their older children (21, 22). The present cross-sectional data make it difficult to draw causal inferences from the reported findings which could reflect that parents actually become involved in dental health behaviors because of their adolescent child's involvement. On the other hand, it might be argued that parents to a greater extent than their adolescent offspring have the power and authority which enable them to exercise control. Thus, they may be more likely to serve as models for their offspring than vice versa. This is an argument in favor of the present interpretation of the observed associations as effects of parental influence.

Overall, the strength of the associations is quite low and might give the impression of weak parental influence. It is important to note, however, that whereas modeling seems to be one process by which parents influence their offspring's dental health behavior during the secondary socialization, there are other forces operating. This is so because socializing agents like parents may work their influence in more ways than one. Neglected in the present analyses are several dimensions that might have been taken into consideration in addition to social modeling to get a thorough understanding of parental influence. These are, for instance, the influences of social reinforcement when adolescents respond to what parents explicitly define as appropriate dental health behaviors and the quality of the relationship between parents and their offspring (5).

In spite of these limitations, the present findings point to the importance of parents as targets in strategies for promoting dental health behavior among their adolescent offspring. In several programs directed towards dental health-related behavior, parental involvement has in fact been found to be effective (23, 24). Parents should be made aware of the fact that what they do in relation to dental health behavior affects the corresponding behaviors of their adolescent offspring, since they continue to serve as role models for their offspring

beyond the childhood period. Dental health education messages should also emphasize that when parents engage concordantly in a dental health-related behavior, they increase the likelihood that their adolescent offspring behave in the same manner.

In conclusion, this study has provided empirical support for the assumption that the dental health behavior of parents and their adolescent offspring is significantly associated, at least with regard to the use of dental floss, tooth brushing, and consumption of non-sugared mineral water. This indicates that parents constitute important social models for their offspring even at an age when they are particularly open to other socializing agents. There were no significant interactions with gender (of the adolescent), suggesting that mother and father are equally important models for both sexes. According to the present results, however, conformity in adolescent and parental behavior appears to be more likely when mother and father are consistent in their behaviors than when they are discordant. The results may have important implications for dental health educational programs aimed at promoting behaviors conducive to dental health among adolescents.

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