Time trends in oral health behaviors among Norwegian adolescents: 1985–97

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The purpose of this study was to investigate 1) the temporal changes in oral health behaviors and 2) the development of the distribution of oral health behaviors on the basis of socioeconomic factors among Norwegian adolescents from 1985 to 1997. Large-scale national surveys to assess smoking, intake of sweets, soft drink consumption, and toothbrushing among Norwegian adolescents were conducted in November 1985, 1989, 1993, and 1997. The surveys were part of the World Health Organisation (WHO) international study, Health Behaviour in School-aged Children. A total of 3955 (1985), 5037 (1989), 4952 (1993), and 5026 (1997) 11-, 13-, and 15-year-old students completed anonymous questionnaires at school. The response rates varied from 79% to 90%. The results showed a strong increase in the percentages reporting ever smoking and daily intake of soft drinks and sweets with age from 11 to 15 years in each survey year. In 1997, at the age of 15 years, most students reported toothbrushing more than once a day (94% boys, 97% girls) and ever smoking (39% boys, 36% girls), whereas moderate proportions confirmed daily intake of soft drinks (28% boys, 19% girls). Comparison of the results across the survey years, from 1985 to 1997, showed an overall decrease in ever smoking (boys, 59% versus 39%; girls, 52% versus 36%) and toothbrushing more than once a day (boys, 95% versus 94%; girls, 99% versus 97%). Contemporary increases occurred with regard to daily soft drink consumption. Inequalities in ever smoking and daily soft drink consumption between socioeconomic status groups decreased and increased, respectively, from 1985 to 1997. The sex disparities observed in 1985, with boys being more likely than girls to report ever smoking and daily soft drink consumption, leveled off in 1997. □ *Adolescents; oral health behaviors; time trends*

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Evidence of the oral health consequences of frequent sugar consumption, inappropriate use of oral hygiene measures, and use of tobacco is fairly well documented (1–3). Moreover, results from previous studies have provided support for the assumption that adolescence is an important period for learning health-related activities that might carry over into adulthood (4, 5). In this regard, the patterns of stability and change over time in adolescents' oral health-related behaviors and the factors that influence them have been identified as an important research topic (6).

A wealth of studies have been devoted to adolescents' oral health behavior, showing, for instance, that behaviors conducive to oral health are least common in the lowest socioeconomic status groups (2, 7–9). In contrast, relatively few studies have addressed the central issues of stability and change in oral health-related behaviors. In the Nordic countries several prospective studies have followed up their subjects from adolescence into young adulthood and identified age or time effects on health-related behaviors (10–12). Friestad & Klepp (10) followed up approximately 600 participants of the Norwegian Longitudinal Health Behaviour Study (NLHB) from 1990 to 1995 and discovered that smoking prevalence increased markedly with increasing age, from 5% to 37% regular smokers at the ages of 13 and 18 years, respectively. A higher percentage of regular smokers was observed among girls than among boys at age 16 years. From that age on, the increase in regular smoking was largest among boys, resulting in less pronounced sex differences at age 18. Åstrøm and Jakobsen (11) followed up 600 participants of the NLHB study from 1992 (15 years) to 1995 (18 years). Across the survey period girls were more likely than boys to change from less frequent to frequent daily toothbrushing, whereas boys changed their status from occasional to daily consumption of soft drinks more often than did girls. Corresponding findings have been reported among Finnish adolescents, studied between the ages of 14 and 18 years, in that the greatest improvement in toothbrushing frequency occurred among girls, whereas the deterioration rate was highest among boys (12).

Attempts to analyze young people's oral health behaviors across time using a repeated cross-sectional cohort design are seemingly less modest. This is surprising, considering that longitudinal studies are not only very expensive but also present difficulties with regard to locating and assessing students over time. Søgaard et al. (13) have reported on time trends in oral health behaviors among Norwegian adults aged 15 years and more. Whereas the proportion that confirmed daily use of oral hygiene measures increased from 1981 to 1985 in all age groups, a marked decrease in the use of inter-dental remedies occurred up to 1987. A Norwegian national time trend survey conducted between 1973 and 1995 showed

Table 1. Number of participants by age and survey year

	11 years	13 years	15 years	Total	Response rate, %
1985	1362	1302	1291	3955	86
1989	1756	1633	1648	5037	90
1993	1614	1701	1637	4952	82
1997	1733	1623	1670	5026	79

that the prevalence of smoking rose among 16- to 19-year-olds in a period otherwise marked by an overall decrease in regular smoking (14). Large-scale national surveys of 11-, 13-, and 15-year-old adolescents showed an encouraging decrease in regular smoking from 1983 to 1989, less pronounced, however, among females than males (15). Honkala et al. (16) analyzed time trends in oral hygiene habits among Finnish adolescents from 1977 to 1981. During those years no systematic change occurred in the frequencies of toothbrushing and flossing. In a subsequent study including the period 1977 to 1995 Kuusela et al. (17) found that, although boys' toothbrushing frequency had seemingly improved, it lagged behind that of girls. Moreover, the percentage of Finnish adolescents who visited a dentist increased from 1977 to 1981 and remained stable up to 1995 (18). Socioeconomic differences in adolescents' dental attendance patterns were observed up to 1983 but not thereafter.

Increased population-based preventive efforts aimed at younger cohorts have resulted in strong improvements in their oral health status (19, 20). Evidence suggests, however, a recent increase in class-based oral health inequalities due to a faster decrease in DFS (decayed filled surfaces) observed among the upper than the lower socioeconomic status groups (21). Although individual lifestyle is acknowledged as providing an important area of explanation for socioeconomic differences in oral health, time trends in oral health behaviors have infrequently been assessed at the national and regional level. It was the aim of this study, therefore, to examine time lag differences in oral health behaviors among Norwegian adolescents 11, 13, and 15 years old and to study the development of the distribution of adolescents' oral health behaviors by age, sex, and parental socioeconomic status from 1985 to 1997.

Materials and methods

Health behavior in school-aged children

This study is based on an ongoing survey entitled 'Health Behaviour in School-aged Children—A WHO Cross-National Survey' (HBSC), initiated in 1982. A key aim of the HBSC survey is to develop national information systems with regard to lifestyles among school-aged children in Europe. Since the start, several oral health behaviors have been assessed. Questionnaire surveys have been conducted in the participating countries in accordance with a standard protocol. A standard cluster sampling method is followed, providing target groups that are representative of the national populations in terms of age, sex, and geographical distribution. The philosophy, study design, and methods of the HBSC surveys have been described in detail elsewhere (22–24).

Procedures

The analyses are based on data from the HBSC surveys undertaken in Norway between 1985 and 1997. The number of respondents by age and survey year is presented in Table 1. The number of in-school children in the 6th, 8th, and 10th grade levels who participated and returned satisfactory data was 3955, 5037, 4952, and 5026, and the proportion of boys was 50.5%, 49.7%, 50.5%, and 50.7% in 1985, 1989, 1993, and 1997, respectively. The total response rates varied between 79% and 90%, with the lowest rate recorded in 1997. The two main sources of non-responses were schools or classes refusing to participate and individual pupils refusing to participate or who were absent on the day of the administration of the questionnaire. The mean ages of the three target groups have been set at 11.5, 13.5, and 15.5 years, with 90% of the respondents falling within a 6-month range of the mean.

In each survey year the samples were selected independently on a random basis with school classes (6th, 8th, and 10th) as the sampling unit. Classes were drawn from a list of all the grade-specific school classes in Norway (sequential selection from a geographically sorted list), starting with a random number on the list to obtain a national representative sample. Data were collected anonymously through self-completion questionnaires, which focused on key health areas such as smoking, use of alcohol, sugar consumption, and oral hygiene. Data collection took place under supervision in the classroom. Teachers administered the data collection following a standard set of instructions, and the participants were provided with individual envelopes in which to seal their questionnaires before returning them to the teachers. All data have been cleaned and re-ordered, when necessary, into a consistent format at the Databank Management in Bergen, Norway. The international standard questionnaire, intensively pilot- and reliability-tested, includes a core of questions repeated in each survey year. The core section contains selected demographic questions, behavioral questions relevant to major health and oral health problems, and psychosocial aspects of health.

Dependent variables

Oral health behaviors were measured by means of four single questions on ever smoking, the frequency of toothbrushing, and the intake of soft drinks, chocolate, and sweets (for example, 'have you ever tried to smoke cigarettes?', and 'how often do you eat chocolate and

Table 2. Percentage distribution for those who confirmed ever smoking, intake of soft drinks, chocolate, and sweets, and toothbrushing in accordance with age and survey year. Average odds ratio (OR) (95% confidence interval (CI)) per 4-year survey period

	1985 %	1989 %	1993 %	1997 %	85/89/93/97 OR (95% CI)
Ever smoking					
11-year-olds	32	15**	13	12	0.7 (0.6–0.7)
13-year-olds	62	36**	34	39*	0.8 (0.7–0.8)
15-year-olds	73	59**	59	63*	0.9 (0.8–0.9)
Soft drinks at least daily					
11-year-olds	15	9**	11*	18**	1.1 (1.1–1.2)
13-year-olds	18	8**	15**	24**	1.2 (1.1–1.2)
15-year-olds	29	17**	23**	31**	1.1 (1.0–1.1)
Chocolate/sweets at least daily					
11-year-olds	16	10**	10	16**	1.0 (0.9–1.1)
13-year-olds	21	14**	18*	22**	1.1 (1.0–1.2)
15-year-olds	24	19*	21	29**	1.1 (1.0–1.2)
Brushing more than once a day					
11-year-olds	95	95	98**	96*	1.1 (0.9–1.2)
13-year-olds	97	96	96	95*	0.8 (0.7–0.9)
15-year-olds	97	96	97	95*	0.9 (0.8–0.9)

** $P < 0.001$, *$P < 0.05$ (differences 1985/89, 1989/93, and 1993/97).

sweets?'). Ever smoking was assessed by using the response categories 1 = 'yes', 0 = 'no'. Consumption of soft drinks, consumption of sweets, and toothbrushing performance were assessed on a scale ranging from 1 = 'more than once a day' to 4 = 'never'. For cross- tabulation and logistic regression analysis dichotomous variables were constructed, yielding the categories 0 = 'less than once a day' and 1 = 'at least daily' for consumption of soft drinks, chocolate, and sweets and 1 = 'more than once a day' and 0 = 'once a day or less', with regard to toothbrushing.

Independent variables

On the basis of practical considerations such as applicability and comparability between the annually conducted surveys, a crude direct measure of parents' SES was used in this study (24). Responses on mother's and father's occupation were categorized into five classes ranging from 1 = 'high SES' to 5 = 'low SES', following the classification of the Central Bureau of Statistics in Norway. Each variable was dichotomized on the basis of a median split. Parental socioeconomic status was constructed as a combined measure from the two dummy variables distinguishing between no parent, father only, mother only, and both parents having high SES. This combined measure is supposed to reflect how well off the family is. In 1997 being from a well-off family predicted higher parental socioeconomic status.

Analyses

Time-lag differences in oral health behaviors were assessed by means of cross-tabulation analyses and chi-square statistics—for example, by assessing the relationships between 1985 and 1989, 1989 and 1993, 1993 and 1997, and between 1985 and 1997. Cross-tabulation analyses and chi-square statistics were used to assess bivariate relationships with age, sex, and parents' SES. Time trends were estimated by use of logistic regression analyses, with year of data collection as a categorical variable, and by calculating the average odds ratio per 4-year survey period. Stepwise multivariate logistic regression analyses were performed using the logit model, with 95% confidence intervals given for the odds ratios indicating statistically significant relationships if both values are either greater or less than 1. The fit of the regression models was estimated by means of Nagelkerke's R^2. All independent variables, age, sex, parents' SES, and survey year (1985/1997), and their corresponding interaction terms (survey year × age, survey year × sex, and survey year × parents' SES) were checked by logistic regression analyses. The significance of adding a variable or an interaction term into the model was tested with Pearson's chi-square test ($P < 0.05$).

Results

Distribution of adolescents by oral health-related behavior and age in 1985, 1989, 1993, and 1997

Table 2 depicts, by survey year and age, the percentages of adolescents who confirmed ever smoking, at least once a day intake of soft drinks, chocolate, and sweets, and more than once a day toothbrushing. Within each survey year there were statistically significant differences by age with regard to the rates of ever smoking, daily intake of soft drinks, and daily intake of chocolate and sweets ($P < 0.001$). In contrast, in all survey years except 1985, no statistically significant difference by age was observed with regard to toothbrushing. In 1985, 95%, 97%, and 97% of adolescents 11, 13, and 15 years old reported toothbrushing more than once a day ($P < 0.05$).

Table 3. Percentage distribution (*n*) of adolescents by ever smoking, at least daily intake of soft drinks, at least daily intake of chocolate and sweets, and more than once a day tooth brushing by sex and age in 1985 and 1997

	Boys				Girls			
	All	11 years	13 years	15 years	All	11 years	13 years	15 years
1985	(1999)	(720)	(612)	(667)	(1956)	(642)	(690)	(624)
Smoking	59**	40	67	72	52	23	57	75
Soft drink	27**	19	28	38	14	11	12	19
Sweets	24**	20	25	28	17	12	18	20
Brushing	95*	94	96	95	99	98	99	99
1997	(2547)	(875)	(826)	(848)	(2479)	(860)	(797)	(822)
Smoking	39*	15	41	61	36	9	36	65
Soft drink	28**	21	26	37	19	14	18	24
Sweets	26**	19	28	30	20	13	20	27
Brushing	94*	95	93	93	97	97	97	97

** $P < 0.001$, *$P < 0.05$ (sex differences for the age groups combined).

Time-lag differences: 1985–1989, 1989–1993, and 1993–1997

Ever smoking (Table 2). In a time-lag perspective the proportion of ever smokers 11, 13, and 15 years old decreased from 1985 to 1989. Whereas 32%, 62%, and 73% of adolescents 11, 13, and 15 years old reported ever smoking in 1985, the corresponding rates had decreased to 15%, 36%, and 59% ($P < 0.001$) in 1989. Up to 1993 the rates remained generally stable and increased thereafter up to 1997 among the 13- (34% versus 39%, $P < 0.05$) and 15-year-olds (59% versus 63%, $P < 0.05$). Average odds ratio (OR) for ever smoking per 4-year period was 0.7 (95% confidence interval (CI), 0.6–0.7), 0.8 (95% CI, 0.7–0.8), and 0.9 (95% CI, 0.8–0.9) among 11-, 13-, and 15-year-olds, respectively.

At least daily intake of soft drinks (Table 2). A steep decrease in the rates of soft drink consumption occurred between 1985 and 1989 among 13- and 15-year-olds. After 1989 and up to 1997 the rate of daily consumption increased gradually at all ages. Among 11-, 13-, and 15-year-olds 11%, 15%, and 23% and 18%, 24%, and 31% reported daily intake of soft drinks in 1993 and 1997, respectively.

Average odds ratio for daily intake of soft drinks per 4-year survey period was 1.1 (95% CI, 1.1–1.2), 1.2 (95% CI, 1.1–1.2), and 1.1 (95% CI, 1.0–1.1) among 11-, 13-, and 15-year-olds, respectively.

At least daily intake of chocolate and sweets (Table 2). Comparison of the data from 1985 and 1989 showed decreasing rates of daily consumption among 11-, 13-, and 15-year-olds, respectively. Thereafter the rates remained generally stable until 1993, although a slight increase was observed at age 13 between 1989 and 1993. From 1993 to 1997 the rates of daily intake of sweets increased significantly among the 11-year-olds (10% versus 16%, $P < 0.001$), 13-year-olds (18% versus 22%, $P < 0.001$), and 15-year-olds (21% versus 29%, $P < 0.05$). The average odds ratio for daily intake of chocolate/sweets per 4-year survey period was 1.0 (95% CI, 0.9–1.1), 1.1 (95% CI, 1.0–1.2), and 1.1 (95% CI, 1.0–1.2) among 11-, 13-, and 15-year-olds, respectively.

Toothbrushing more than once a day (Table 2). Comparison of the data from 1985, 1989, and 1993 showed generally stable rates of frequent daily toothbrushing in all age groups. A weak but significant decrease was observed, however, between 1993 and 1997 in that 98% versus 96% ($P < 0.05$), 96% versus 95% ($P < 0.05$), and 97% versus 95% ($P < 0.05$) of the 11-, 13-, and 15-year-olds confirmed toothbrushing more than once a day, respectively. The average OR for more than once a day toothbrushing per 4-year survey period was 1.1 (95% CI, 0.9–1.2), 0.8 (95% CI, 0.7–0.9), and 0.9 (95% CI, 0.8–0.9) for the 11-, 13-, and 15-year-olds, respectively.

Distribution of adolescents' oral health behavior on the basis of sex and age in 1985 and 1997

Table 3 shows the distribution of oral health behaviors among boys and girls on the basis of the respondents' age in 1985 and in 1997. With one exception consistent sex differences, with boys being more likely than girls to report ever smoking, were observed at 11 and 13 years. In 1997 girls reported ever smoking more frequently than boys at age 15. In both survey years consistent sex differences, with boys being more likely than girls to confirm daily intake of soft drinks and daily intake of chocolate and sweets, were observed for the age groups combined and at each age level. The sex differences in toothbrushing, with girls being more likely to confirm more than once a day performance than boys, remained stable at each age level across the survey period.

Distribution of adolescents' oral health-related behaviors on the basis of parents' socioeconomic status in 1985 and 1997

When the age groups were considered combined, parents' SES was statistically significantly associated with ever smoking in 1985 and 1997 ($P < 0.05$) and with daily intake of soft drinks ($P < 0.001$), daily intake of sweets ($P < 0.001$), and toothbrushing more than once a day ($P < 0.05$) in 1997. A total of 55%, 55%, 73%, and 51% of adolescents having neither parent, father only, mother

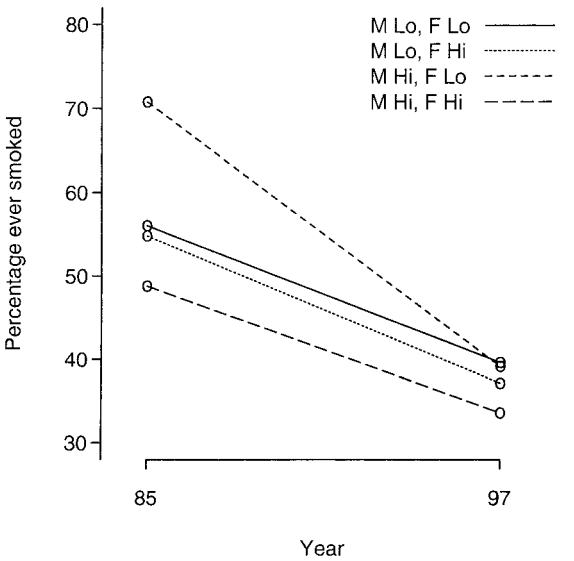

Fig. 1. The percentage of subjects who reported ever smoking by survey year and parents' socioeconomic status in terms of mother low and father low SES (M Lo, F Lo), mother low and father high SES (M Lo, F Hi), mother high and father low SES (M Hi, F Lo), and mother high and father high SES (M Hi, F Hi).

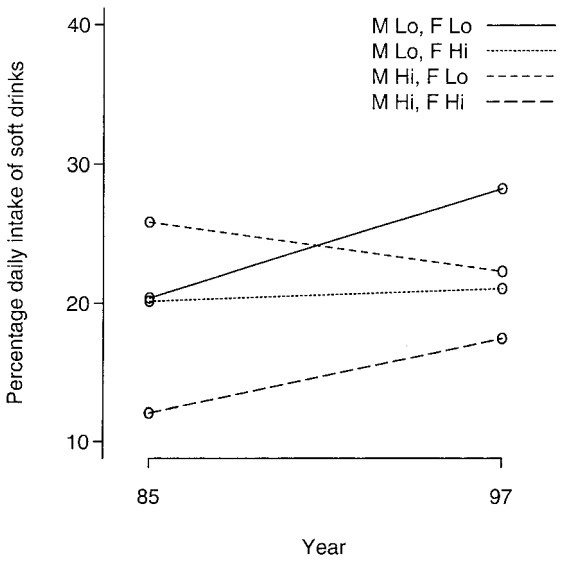

Fig. 2. The percentage of subjects who reported daily intake of soft drinks, by survey year and parents' socioeconomic status (see Fig. 1 legend for explanation of abbreviations).

only, or both parents with high SES reported ever smoking in 1985. The corresponding rates in 1997 were 39%, 38%, 39%, and 34%, respectively. Moreover, a total of 20%, 20%, 27%, and 12% of adolescents having neither parent, father only, mother only, or both parents with high SES reported at least daily intake of soft drinks in 1985. The corresponding figures in 1997 were 28%, 21%, 22%, and 17%, respectively. In 1985 and 1997 adolescents having neither parent with high SES were, respectively, more and less likely than their counterparts having both parents with high SES to report daily intake of chocolate and sweets and toothbrushing more than once a day.

Secular trends 1985–1997

A significantly lower proportion ($P < 0.001$) of respondents surveyed in 1985 than in 1997 confirmed having parents with high SES. Moreover, the sex distribution differed significantly with age in 1985 ($P < 0.05$) but not in 1997. Logistic regression analyses controlling for age, sex, survey year, and parents' SES and their interaction terms showed significant main effects of all independent variables ($P < 0.001$ and $P < 0.05$) with regard to ever smoking, daily intake of soft drinks, and daily intake of sweets. With regard to toothbrushing more than once a day, the main effects ($P < 0.001$ and $P < 0.05$) occurred for all the independent variables except age. The fit of the models in terms of Nagelkerke's R^2 ranged from 0.07 (soft drinks) to 0.24 (smoking). The secular trends at all ages showed a reduction in the rates of ever smoking and frequent daily toothbrushing and an increase in the rates of daily intake of soft drinks and daily intake of sweets. As compared with being assessed in 1985 (OR = 1), the odds ratios in 1997 were 0.4 (95% CI, 0.4–0.5), 1.3 (95% CI, 1.2–1.6), 1.2 (95% CI, 1.1–1.5), and 0.5 (95% CI, 0.4–0.7) with regard to ever smoking, daily intake of soft drinks, daily intake of chocolate and sweets, and more than once a day toothbrushing, respectively.

Significant second-order effects on ever smoking were shown for the term survey year × sex (B = 0.26, $P < 0.05$), survey year × mother only with high SES (B = 0.75, $P < 0.05$), and survey year × age group (B = 0.16, $P < 0.001$). Probing the results of logistic regression analysis in each survey year highlights the nature of the interaction terms. As compared with adolescents having neither parent with high SES (OR = 1), the ORs for those having only a mother with high SES decreased from 2.1 (95% CI, 1.2–3.9) in 1985 to 1.0 (95% CI, 0.7–1.2) in 1997. A significant weakening of the association between sex and ever smoking was shown in that the OR for boys as compared with girls (OR = 1) decreased from 1.4 (95% CI, 1.2–1.6) in 1985 to 1.1 (95% CI, 0.9–1.3) in 1997. Finally, as compared with the youngest age group (11 years) (OR = 1), the OR at age 15 was 5.8 (95% CI, 4.8–6.9) and 12.6 (95% CI, 10.3–15.5) in 1985 and 1997, respectively. Fig. 1 depicts the results of the multivariate analyses in terms of the percentage ever smoked by parents' SES in 1985 and 1997, respectively. As shown, the decrease in ever smoking was particularly strong among adolescents having only mother with high SES as compared with those having neither parent with high SES. Moreover, the decrease in ever smoking rates was more pronounced among boys than among girls.

With regard to daily consumption of soft drinks, significant second-order effects occurred for the terms survey year × sex (B = 0.31, $P < 0.05$) and survey

year × father only with high SES (B = 0.39, $P < 0.05$). Separate analyses showed that the risk of having soft drinks at least daily if being a boy as compared with being a girl (OR = 1) was 2.5 (95% CI, 2.1–2.9) in 1985 and 1.8 (95% CI, 1.5–2.1) in 1997. The risk of daily consumption of soft drinks if having neither parent with a high SES as compared with having father only with high SES (OR = 1) was 1.1 (95% CI, 0.9–1.2) and 1.6 (95% CI, 1.2–2.0) in 1985 and 1997, respectively. Fig. 2 depicts the results of the multivariate analysis in terms of the percentage daily intake of soft drinks by parents' SES in 1985 and 1997.

Discussion

A repeated cross-sectional survey is the most appropriate and straightforward design to provide series of survey estimates, by which changes in a population can be monitored over long periods of time (25). In the present HBSC surveys trend data were gathered at different points in time from the same population but, in contrast to the panel design, not from the same individuals. Although this study provides information representative of the entire Norwegian population of 11-, 13-, and 15-year-olds, the estimates need careful interpretation, as an observed change may be due to differences between samples rather than a true population change. This problem is particularly apparent in cluster samples such as the school-class-based samples used in the HBSC surveys. The potential homogeneity inherent in clusters produces inflated standard errors, and the resulting confidence intervals should be taken into account when interpreting the results. Previous analyses of the design effect suggest, however, that the homogeneity within classes is relatively low on most of the variables of the HBSC survey (26, 27). Cluster samples are also susceptible to selection bias in that the classes that refused to participate may differ from those who did not, which may lead to biased estimates of population change. In this study lack of information about non-attendees precludes any conclusion about possible selection biases.

Nevertheless, having data from four surveys allowed clear patterns to emerge. A steep decrease from 1985 to 1989, followed by a period of stability and more or less continuously increasing rates towards the end of the survey period, appears to have occurred with regard to all the oral health behaviors investigated except for toothbrushing. Thus, there have been minor changes in the proportion of 11-, 13-, and 15-year-olds who report toothbrushing more than once a day since 1985. This finding is particularly favorable, since the level of toothbrushing among Norwegian adolescents is recognized as being among the highest in Europe (28). The downward and upward trends seen in oral health behaviors are as yet unexplained. According to Palmore (29), the cross-sectional and time lag differences as described in this study may reflect age, period, and cohort effects. However, under the condition of the present study, age, cohort, and period effects cannot be separated.

A favorable finding is the downward secular trend observed with regard to ever smoking from 1985 to 1997. The rates decrease differently by age, with the strongest decrease observed among 11-year-olds, suggesting that there has been a decrease in the rate of recruitment to experimental smoking from the younger age groups. The less marked decrease in the oldest age group may in part reflect the fact that lifetime-prevalence of smoking is considered here. Nevertheless, the downward trends in smoking observed among Norwegian adolescents through the 1980s (15) appear to have ceased at the beginning of the 1990s, at least with regard to experimental or ever smoking. Moreover, the slight upward trend at 13 and 15 years from 1993 onwards corroborates the increase in daily smoking documented elsewhere (10, 14, 15). That finding, along with the most recent rates (1997) amounting to 63% ever smokers at age 15 years, is disturbing, indicating that smoking initiatives towards young people during recent years have not been very effective. Friestad & Klepp (10) identified a corresponding age-specific prevalence of more than 60% ever smokers, among which many had become daily smokers by the age of 16. They conclude that for about half of those who try smoking the experimentation seems to mark the beginning of a smoking career as regular smokers. The reduction in sex differences that occurred between 1985 and 1997 corroborates the findings from other studies of adolescents' smoking, in that a previously seen disparity, with more regular smokers among boys than girls, seems to have leveled off (10). Probing the cross-tabulation analyses suggests that the decrease in ever smoking was more pronounced among boys than girls, both in the age groups combined and at each age level. Accordingly, results reported by the National Council on Smoking and Health have clearly shown that the greatest decrease in daily smoking occurred among boys during the period from 1980 to 1990 (30).

A quite different secular trend was observed with regard to intake of soft drinks and sweets, in that the proportions of daily consumers increased modestly at all ages from 1985 to 1997. Increasing frequency of boys' and girls' soft-drink consumption from age 15 (1992) to 18 years (1995) has also been observed in longitudinal cohort studies (11). Nevertheless, the sex difference, with boys being more likely than girls to report daily intake of soft drinks, decreased markedly across the survey period mainly due to a more pronounced increase in soft-drink consumption among girls. In light of previous evidence suggesting that the consumption of soft drinks is lower in Norway than in several other European countries (31), the upward trend observed here seems disturbing.

It has been recognized that high economic growth in conjunction with increasing unemployment and low-paid jobs has lead to widening income gaps and to increasing social inequality in Western European welfare states and other highly developed countries (26). The present results indicate, however, decreasing social disparity in ever

smoking, although a downward trend could be observed in each social class category. Accordingly, national surveys of adults' smoking conducted between 1983 and 1994 have shown that the proportion of current smokers has decreased more strongly among the upper than the lower social class individuals (32). Socioeconomic differences in parents' smoking behavior persist, and numerous social influence studies suggest that parental smoking is the most important long-term predictor of adolescents' smoking initiation (for a review, see Ref. 10). One might therefore expect that the decrease seen in smoking prevalence among higher social class parents would imply a decrease in ever smoking among their adolescent offspring. On the other hand, a contemporary increase in social inequalities occurred with regard to daily intake of soft drinks. This development corroborates the increase in class-based oral health inequalities observed among young Norwegian adults between 1993 and 1994 (21). Whereas a leveling off of socioeconomic differences in ever smoking is favorable, increased disparities with regard to intake of soft drinks indicates a trend in the opposite direction of the WHO target to achieve considerable reductions between groups within countries by the year 2000 (33).

Since the present data rely on self-reports, the rates of oral health behaviors might be biased by under- and over reporting due to socially desirable responses and poor recall effect. However, the reliability and validity of the core HBSC questions have been examined in separate national and cross-national studies and found to be satisfactory (24, 26). As a matter of precaution, the data presented here may be regarded as minimum estimates of adolescents ever smoking in Norway. On the other hand, there is no reason to suspect changes in the accuracy of self-reported behavior across the survey period. Given this, the change or lack of change in adolescents' oral health-related behaviors is likely to be reasonably accurate.

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