

# Utilization of dental health services by Danish adolescents attending private or public dental health care systems

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The objectives of the study were: 1) to describe the choice of dental care system among 16-year-olds, 2) to describe the utilization of dental services among 16–17-year-olds enrolled in either public or private dental care systems, and to compare the dental services provided by the alternative systems. The study comprised 1,245 adolescents from 3 municipalities; the historical cohort study design was applied; and data were collected from dental records (public dental service) and dental claims (private practice). At age 16, 12% preferred being enrolled in the private practice system, while 88% remained in the public dental care system. During the 2-year study period the attendance rate was 99% for the public system, while 90% attended the private practice system ( $P < 0.001$ ). Preventive dental services were provided more frequently by the public than the private system ( $P < 0.001$ ). Despite the fact that the economic barrier was eliminated a lower attendance rate was observed for patients transferred to the private practice system. □ *Adolescents; dental care system; dental services; evaluation; utilization*

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In Denmark, the Act on Child Oral Health Care was passed in 1971 and all municipalities enforced to offer systematic preventive and curative dental care free of charge to school children (1). Essentially, the public program is school-based and outreach service principles were adopted to ensure a high participation rate in regular dental care. In addition, an epidemiological recording system was introduced as an integral part of the child dental health services in order to provide systematic data for planning and evaluation of dental healthcare (1). Since the establishment of the public dental program, the attendance rate has been nearly 100% and the annual examinations of all children and adolescents thereby provide for population surveys. Data collected since 1972 show that the proportion of caries-free individuals has grown, caries experience has declined over time and now skewed distributions of caries are observed (2). In 1986 the program was expanded by the Act on Dental Care to cover pre-school children and adolescents aged 16–17 (3). The 16- and 17-year-olds were eligible for dental care either from the public dental care system or from private dental practitioners. The youth dental health program has now existed for 15 years, but no attempts have been made to evaluate the utilization of the dental services. Previous reports on the former scheme have indicated that certain proportions of adolescents tended to become non-users of the regular dental health care system when transferred from the public to the private service (4, 5). Such non-attendance was found particularly in adolescents of low socio-economic background, those

who were raised in families with a weak tradition of regular dental care, and the young living in rural areas (4–7). After the introduction of the dental health program for 16–17-year-olds in 1986, several questions were raised. In particular, whether the two alternative systems would be equally effective in accomplishing the goals of regular dental care, and whether different approaches to the control of oral diseases in adolescents would be applied by the 2 systems (8). Therefore, the purpose of the present study was to describe the choice of dental care system among 16-year-olds and to analyse whether the level of oral health differed between those who chose each of the alternative dental care systems. Furthermore, the intention was to describe and analyse the utilization of dental health services for 16–17-year-olds enrolled either in the public or in the private dental care system and to compare the dental services provided to the target groups.

## Study population and methods

The present study was conducted as a historical cohort study. The cohort comprised all adolescents born in 1980 and who were living in one of three Danish municipalities (Lyngby, Vaerloese, and Herning). The municipalities were identified in order to provide data on adolescents of urban as well as rural areas. Two suburbs north of Copenhagen (Lyngby and Vaerloese) took part in the study and the level of dental caries was shown to be lower than the national average (9). The third municipality chosen for

the study (Herning) is situated in the western part of Denmark (Jutland) and includes both rural and urban areas. Children and adolescents from this part of the country have a higher level of caries experience compared to the national figure (9).

### Data collection

For all participants, information on dental caries experience was available at baseline and recorded by the public dental care system. The last record form registered before the participant's 16-year birthday was identified. The criteria for the recording of dental caries lesions at tooth surface level, fillings, and extractions are detailed by the Danish National Board of Health (1). Information on the dental services rendered was collected from two different sources. Data on patients served by the public dental care system were available from the dental records. Data on sex, municipality, and dental caries experience were retrieved from the last dental record form filled in before the 16-year birthday. The following information was included for persons attending the public dental care system. 1) Number of dental examinations during the 2-year study period, 2) number of scalings and polishing of teeth, 3) number of X-rays, 4) number of dental fillings, 5) number of tooth extractions, 6) number of advanced curative services, i.e. crowns, bridges, surgery, periodontal, and endodontic treatment, 7) number of teeth provided with fissure sealing, 8) number of preventive activities such as fluoride applications, instruction in effective tooth-brushing, instruction in use of dental floss, and in use of toothpicks. As regards patients attending the private practice system, data were collected from the dental claims sent to the municipal administration office. The private practice system is based on fee-per-item payments and the dental claims include accurate information on the various treatment types and treatment courses for each patient. The following data were recorded for persons attending the private practice system. 1) Number of dental examinations, 2) number of scalings and polishing of teeth, 3) number of X-rays, 4) number of fillings, 5) number of tooth extractions, 6) number of advanced curative services, i.e. crowns, bridges, surgery, periodontal, and endodontic treatment, 7) number of teeth provided with fissure sealing, 8) number of 'Individual Preventive Treatment', 9) number of "Control Services", and 10) total number of dental claims per patient. 'Individual Preventive Treatment', an item of service included in the payment scheme for private practice, is indicated for use by the presence of caries and/or gingivitis and may include preventive care such as oral hygiene instructions, dietary counselling, and application of fluoride. 'Control Service' is another dental service of the private practice payment scheme used for follow-up of 'Individual Preventive Treatment'.

The data were registered and transferred from dental records and dental claims by one recorder (dentist) only, who had no relationship to the study sites. In order to ensure interpretation of the data records and the reliability

of data, 30 records and 10 dental claims were selected at random and carefully re-assessed by one of the authors (LBC) and the recorder jointly.

### Data analysis

A longitudinal database was constructed which implied that new arrivals and persons moving to another municipality during the study period were not included in the analysis, i.e. 12% of the total study population. The final study population comprised 1293 adolescents enrolled in the private and the public dental healthcare systems. However, 48 of these individuals had to be excluded from the analysis of dental visits and services provided since they gradually left the public dental care system during the 2-year study period and entered the private practice system. The DMFS index was calculated, and 3 levels of caries experience were specified on the basis of the empirical distributions: 1) caries-free individuals, 2) individuals with DMFS values 1–8, and 3) individuals with 9 DMFS or more. Non-attenders of the public dental care system were defined as those adolescents who had no dental visits recorded during the study period. For private practice, non-attenders were persons for whom no claims were sent to the municipal administration office. All other participants were considered being attenders of the dental care systems. Data were processed and analysed by means of the Statistical Package for the Social Sciences (SPSS version 10.0). Frequency distributions were used for the univariate and bivariate analyses of data. The chi-square test was applied for the statistical evaluation of proportions, whereas Student's *t* test or analysis of variance (ANOVA) was used to evaluate means.

## Results

### *Choice of dental care system and attendance rate*

At age 16, 12% of the adolescents preferred being enrolled in the private practice system, while 88% remained users of the public dental care system. The choice of dental care system was not associated with sex, geographical location, or level of caries experience. There were more caries-free persons and more individuals of the highest caries level among those who chose to remain in the public dental health service than among those who changed to the private practice system (Table 1); however, the difference was not statistically significant. Throughout the 2-year study period, the dental attendance rate was 99% for the public dental care system (Table 2), whereas 10% of those who chose a private practitioner never showed up for dental care. At baseline, the mean caries experience among non-attenders was relatively high (7.3 DMFS) compared to attenders of the dental care systems, public or private (4.4 DMFS) ( $P < 0.05$ , value 2.305,  $df = 1243$ ).

Table 1. The distribution (%) of 16–17-year-olds by level of caries experience at age 15 and in relation to participation in public or private dental care system

	Public dental care system (n = 1096)	Private practice system (n = 149)	Total (n = 1245)
Caries free	30	25	29
DMFS 1–8	52	61	53
DMFS 9+	18	14	18
Total	100	100	100

Table 2. The percentages of attenders and non-attenders among 16–17-year-olds by choice of alternative dental care systems

	Public dental care system (n = 1096)	Private practice system (n = 149)	Total (n = 1245)
Attenders during the 2-year study period	99	90	98
Non-attenders	1	10	2
Total	100	100	100

P < 0.0001.

Chi-square value 67.173, df = 1.

### Diagnostic and curative dental services

The mean number of dental examinations and X-rays was significantly higher for attenders of the public dental care system than the private system (Table 3). The distributions of participants by number of dental examinations offered by the 2 dental care systems are given in Table 4; for the public system, 3 or more examinations were most frequent. Patients of the public dental care system received on average 1.7 fillings against 1.1 for the private practice system (Table 3). Furthermore, fewer than 2% of persons enrolled in each of the alternative dental care systems had 1 or more teeth extracted, mostly third molars or premolars due to orthodontic reasons; 2% of all participants had endodontic treatment, and less than 1% received other kind of services.

### Specific preventive services

For patients served by the public dental care system, 63% had at least one preventive service such as fluoride

Table 3. Mean number of diagnostic and curative dental services delivered to 16–17-year-olds attending public or private dental care systems during the 2-year study period (standard deviation in parentheses)

	Public dental care system (n = 1089)	Private practice system (n = 134)	t value
Dental examination**	2.7 (0.6)	1.9 (0.8)	13.637
Scaling and polishing	1.9 (1.8)	1.7 (1.1)	0.905
X-ray**	3.0 (1.9)	1.5 (1.8)	8.539
Fillings*	1.7 (2.4)	1.1 (1.9)	2.523

\* P < 0.05; \*\* P < 0.001.

df = 1221.

Table 4. The distribution (%) of 16–17-year-olds by number of dental examinations offered during the 2-year-study period according to participation in dental care program

	Public dental care system (n = 1089)	Private practice system (n = 134)
No dental examination	1	0
1 dental examination	3	31
2 dental examinations	20	42
3 or more dental examinations	76	27
Total	100	100

P < 0.0001.

Chi-square value 202.769, df = 3.

application, fissure sealing, instruction in oral hygiene, instruction in use of dental floss, or instruction in the use of toothpicks. Against this, 45% of the patients attending the private practice system were offered 1 or more preventive service (P < 0.0001,  $\chi^2 = 12.458$ , df = 1) (i.e. 'Individual Preventive Treatment' and/or 'Control Service'). Fluoride application was the most frequent preventive service delivered by the public system (Table 5). During the 2 years of study, approximately 1 fluoride application was offered per patient and topical fluoride application was more frequent for adolescents with a high level of dental caries at age 15. However, provision of preventive services such as fissure sealing or oral hygiene instructions were not associated with caries experience (Table 5). Instructions in oral hygiene were given to 15% of attenders of the public dental health care system. Patients enrolled in the private

Table 5. Mean number of various preventive services rendered during the 2-year study period to 16–17-year-olds attending the public dental care system in relation to level of caries experience at age 15 (standard deviation indicated in parentheses)

Public dental care system	DMF-S = 0 (n = 327)	DMF-S 1–8 (n = 568)	DMF-S 9+ (n = 194)	Total (n = 1089)
Topical fluoride application*	0.6 (1.3)	0.9 (1.5)	1.3 (1.9)	0.9 (1.6)
Mean no. of teeth having fissure sealing	0.3 (0.8)	0.4 (1.0)	0.5 (1.0)	0.4 (1.0)
Oral hygiene instructions	0.2 (0.5)	0.2 (0.6)	0.1 (0.5)	0.2 (0.5)

\* P < 0.0001.

F = 13.165, df = 2.

practice system received on average 0.6 'individual preventive treatment' over 2 years and no difference was found in use of 'Individual Preventive Treatment' by level of DFMS at age 15. 'Control Service' was received by 7% of the attenders of private practice. Finally, 2% of patients attending private practice had fissure sealing against 22% of patients in the public dental health care system.

## Discussion

The present study on use of dental care schemes by Danish adolescents was carried out in order to assess the accomplishment of program objectives as stated in the Act on Dental Care. Accordingly, adolescents should participate in systematic dental care and preventive dental services should be offered by either a public or a private system. Three Danish municipalities were chosen in order to compare the use of 2 alternative dental care systems and the study population was representative of Danish 16–17-year-olds, by sex, urbanization, and level of caries experience (2). Dental records and dental claims were the sources of data and it should be emphasized that such data originally were collected for administrative purposes. Meanwhile, due to the standardized recording system and systematic storing of dental health record files in the public dental service and the standardized payment scheme for the private practice system, such data may be used for health systems research as well (2, 9–11). The reliability of the clinical data transferred was ensured by the calibration procedure between the data recorder and one of the authors. The data included persons only who lived in the study areas throughout the 2-year study period. About one-tenth of adolescents moved in or out of the municipalities during the study period. The group of movers might be less steady as concerns dental attendancy. The implication of such potential bias would be that the attendance rates for both dental care systems may be too optimistic. Furthermore, a minority of the participants (3.7%) was excluded from the longitudinal analysis since they left the public dental care system gradually during the study period and entered the private practice system. A somewhat lower level of dental caries was found among those persons compared to the rest of the study population.

In an international perspective, utilization of professional dental services is generally high in Scandinavia and the present study confirms the high figures of attenders for dental care for youths in Denmark (12). Two important factors may explain the relatively high attendance rate. Firstly, during childhood the children are encouraged to adopt systematic dental care habits due to the preventive approach of the municipal dental services and health education program in schools (3, 13). Secondly, the economic barrier to dental visits in youth was eliminated in 1986 since dental care is now offered free of charge. Thus, the present findings support previous reports indicating that the outreach activities of the public dental care system seem highly effective to ensure attendance

rates at nearly 100% (8, 9). Against this, a lower attendance rate was found among those who chose the private practice system at age 15. Regardless of which dental care system was chosen, non-attenders badly needed preventive dental services, since the mean caries experience of those individuals was significantly higher than among attenders.

### *Dental services provided*

Preventive services were offered more often to patients under the public dental care system than in private practice. According to the payment scheme for private dental practice system, preventive activities are restricted to patients suffering from active caries or gingivitis. Against this, the public dental care system provides primary as well as secondary preventive services according to population directed strategies (13). For both systems, no association was found between the level of caries experience measured at baseline and the provision of preventive services, and those results are in line with previous reports (14, 15). Besides the different delivery models of preventive services the 2 dental systems also had different principles for recall of patients. The public dental health service is responsible of making contact with all persons eligible to care through outreach activities. In contrast, the private practice system provides dental health care mainly on patient demand. The private practice system is based on fee-per-item payments, but no fees are included for additional administration in relation to recall of patients. It is therefore likely to assume that no special effort would be spent on patients who do not respond to standard procedure. This might be one important explanation why the actual survey showed that dental examinations were less frequent for patients covered by the private dental system. The use of X-rays and the number of fillings per patient were found to be significantly higher for the public dental care system, irrespective the level of caries experience, and this may be due to several factors. Firstly, in a previous study, supplementary use of radiographs for caries diagnosis was shown to induce higher treatment rate (16). Secondly, the differences in number of X-rays and fillings between the 2 systems may be ascribed to the quality performance by dentists of the public dental care system. The dentists might ensure the optimal standard of the dental services delivered before the patients were to be transferred to the private dental care system at the age of 18. Thirdly, we cannot rule out the possibility that the public dental care system provides too high a level of services and it is worth notifying that with the existing form of remuneration there are no incentives for dentists in private practice to under-provide services.

The current dental program for 16–17-year-olds in Denmark was established to ensure regular dental care under the principle of patients' free choice of dental care provider and dental care system. Such concern of patients' individual rights has been given more attention during recent years. The WHO European Health Care Reform

policy emphasizes quality of care, patients' right to information, and to the choice of care provider (17). However, the present study demonstrated a lower attendance rate for youth served by the private dental practice system compared to the public scheme.

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