Outcome of public oral health services in relation to treatment mix

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Vehkalahti M, Helminen S. Outcome of public oral health services in relation to treatment mix. Acta Odontol Scand 1994;52:1–6. Oslo. ISSN 0001–6357.

We evaluated the outcome of public oral health services in relation to the treatment mix in the city of Helsinki, in which 7 independent districts provided dental care to 98,000 patients in 1989. Outcome was defined as the increase in numbers of DMF teeth over the 2 years from 1989 to 1991 in 16,000 patients 8, 10, 12, and 13 years of age. The share of each type of treatment in the treatment mix was calculated on the basis of the market price of the items of service. The greater the share of prevention, the more positive the outcome ($p < 0.01$)—that is, the lower the increase in numbers of DMF teeth. In a regression model the share of prevention alone accounted for 53% of the variation in the outcome by district. Addition of the share of checkups to the model increased its explanatory power markedly ($R^2 = 0.74$). A positive outcome was seen both in districts with poor and in those with good educational structures. □ *Children; dental health; effectiveness; evaluation; prevention*

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In the past decade research reports and official statistics have reported a marked decline in the prevalence of caries among children and adolescents in Finland (1–4). Similar trends have been reported for many industrialized countries (5–10). Evaluation of the received dental care by subject has, however, shown serious inadequacies in and a poor focusing of preventive treatment in relation to patients' needs for it (11, 12). Furthermore, a decline in caries prevalence among schoolchildren has been reported even in areas in which no preventive treatment was undertaken in connection with dental care (13). The role of professional preventive care in the improvement of dental health in young populations is therefore not yet clear.

This study evaluated the increase in caries experience (DMF teeth) over 2 years in populations of school age in relation to the treatment mix in public oral health care.

Background

In Helsinki, public oral health services are administered by seven independent districts. Each has responsibility and resources for providing all primary public care in its area. The coverage of oral health services is highest (around 95%) during years of attendance at school, from 7 to 16 years of age, whereas no more than 60% of young adults and 70% of children under school age attend check-ups in public clinics annually. The city of Helsinki has a non-fluoridated water supply containing 0.1 ppm fluoride. As a rule, fortnightly fluoride rinsing has been available at schools for children from 7 to 12 years of age.

In 1989, municipal oral health services were available free of charge for 96,000 citizens of Helsinki under 20 years of age and at a highly subsidized price to 100,000 citizens 20 to 31 years of age. Services were provided by 409 professionals, consisting of 137 dentists, 15 dental hygienists, and 257 assistants. The figures include those involved in administration full-time or part-time.

Data relating to all treatment given by the public oral health services are recorded by visit and by item of service. About 160 different items of treatment are coded for the

electronic data processing files in accordance with the classification scheme of the National Health Insurance System, the same codes being used in the private sector. In addition, for each district annual data on personnel and direct costs and on coverage of services and oral health by age are collected.

Materials and methods

The seven independent districts responsible for providing oral health services in Helsinki were taken as the basic units for the evaluation of outcome of oral health care. Data from electronic data processing files, based on patients' individual charts, and data from annual official statistics were aggregated to describe the practices and outcome in each district.

All items of service provided in 1989 were placed in one or other of six categories to characterize the treatment mix overall in each district. The categories were 1) examination including radiograms; 2) prevention; 3) fillings and root canal treatments; 4) periodontics; 5) orthodontics; and 6) others. The market price of services was calculated on the basis of the individual prices fixed for each item of service in the 1989 tariff of the Finnish Dental Association. The share of each category in the overall treatment mix was calculated on the basis of the market price of services, separately for each district, to describe the practice profile by district.

The outcome of services was defined as the increase in numbers of DMF teeth during the 2 years from 1989 to 1991 in the age groups of 8, 10, 12, and 13 years of age. The outcome was defined as the sum of the mean DMF increases in the four age groups by district as follows:

$$\text{Outcome} = \Delta DMFT_8 + \Delta MFT_{10} + \Delta DMFT_{12} + \Delta DMFT_{13},$$

where

$$\Delta DMFT_{age} = \text{mean } DMFT_{1991} - \text{mean } DMFT_{1989},$$

for each cohort.

The number of children in the 4 age cohorts followed up over the 2 years was 16,000. Their number was proportional to the population in each district, the total number of children varying from 1530 to 3350 by district and from 290 to 990 by age cohort in each district. The distribution of the four age cohorts within each district was similar to that in the whole city.

Education index (14), which describes the relative rate of population having only a basic education, was used as a demographic variable to express the difference in the children's background by district.

Pearson's correlation coefficient was used to show relationships between the variables describing oral health services, children's background, and dental health. A linear regression model was used to analyze the difference in the outcome between the districts. Proportions of prevention, checkups,

Table 1. Descriptions of populations and public oral health services by district in Helsinki in 1989

	Total population		Dental personnel			
District	No. × 1000	Education index*	No. of dentists	Nurses/ dentist	No. of patients treated	No. of DMF teeth at age 12
South	92	77	19	2.00	13,319	1.66
West	90	89	26	1.73	19,146	1.73
Middle	74	109	30	1.93	15,773	1.49
North	41	104	12	1.67	8,597	1.98
Northeast	75	114	22	2.23	17,810	2.10
Southeast	37	111	10	2.00	7,663	1.49
East	76	115	18	2.33	15,853	1.78
Total	485	100	137	1.99	98,161	1.76

* The index is based on the proportion of population having only a basic education, the mean value for the whole city being rated 100 (14).

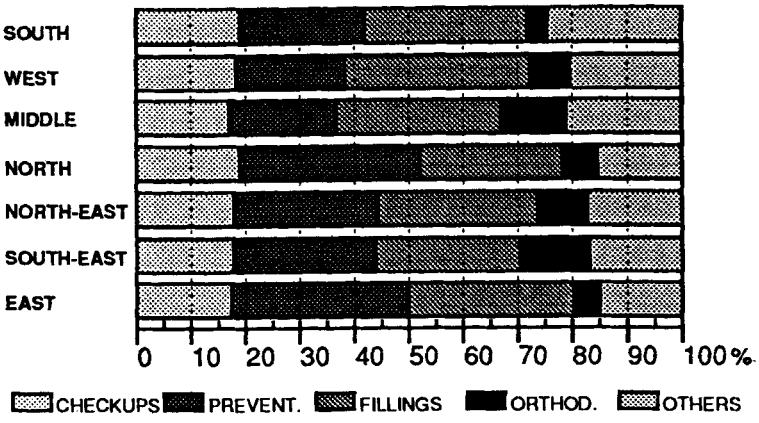

Fig. 1. Treatment mix of the public oral health services in Helsinki by district in 1989.

and orthodontics in the treatment mix were used as independent variables in regression models.

Results

Table 1 shows demographic statistics and details of personnel and output in municipal oral health services by district in Helsinki in 1989. The mean numbers of DMF teeth for 12-year-olds are also shown here.

The public oral health services in 1989 provided 668,470 different items of service. In the treatment mix the market price of fillings accounted for 30%, prevention for 25%, check-ups for 18%, and orthodontics for 8%. Of the remaining 19%, periodontics accounted for 8%, surgery for 4%, and miscellaneous items for 7%. The treatment mixes in the various districts were mainly characterized by prevention (range, 19.6% to 33.3%) and orthodontics (range, 3.7% to 12.6%). All districts were fairly similar with regard to the share of checkups and periodontics, the greatest differences being around 2% points. Treatment mixes by district are shown in Fig. 1.

The total outcome, the increase in the number of DMF teeth over the 2 years for the four selected age groups, was 2.80 DMF teeth in the whole city. This means an annual increase of 0.35 DMF teeth per subject and about 5600 new DMF teeth for these four age cohorts in 1 year. Fig. 2 shows the overall outcome by district and by age cohort. The

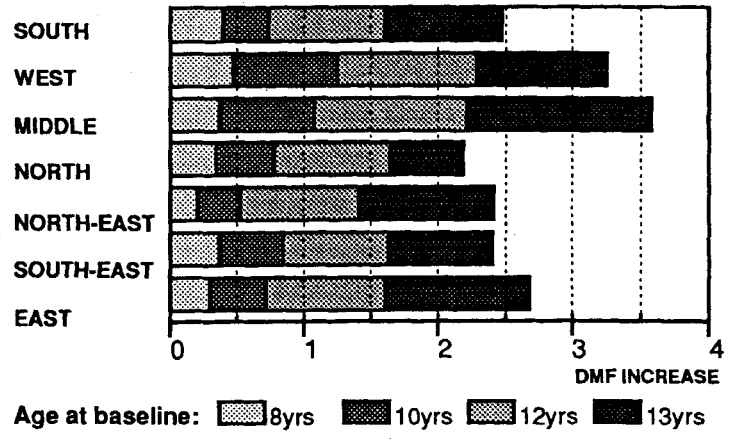

Fig. 2. Mean DMF increases in Helsinki by age cohort and district from 1989 to 1991.

smallest overall increase was 2.19 DMF teeth, and the greatest was 3.58 DMF teeth, which was 63% greater than the minimum. The smallest increase gives for the selected cohorts in the whole city an estimate of 4400 new DMF teeth in 1 year, compared with 7200 seen with the maximum increase. The greatest differences in the 2-year increase in caries experience between districts in each of the four age cohorts were 0.27 DMF teeth per child for 8-year-olds, 0.45 for 10-year-olds, 0.35 for 12-year-olds, and 0.82 for 13-year-olds.

The outcome of public oral health services over the 2 years was not correlated with the education index ($r = -0.063$) or with the number of DMF teeth at 12 years of age ($r = 0.165$). Three districts in which the education indices were worse than the average had the best outcome—that is, the fewest new DMF teeth over the 2 years. On the other hand, of the two districts with the best educational levels, one showed a positive outcome, the other a very negative one.

The outcome over the 2 years was positively related to the treatment mix in 1989 (Figs. 3 and 4). The greater the share of prevention in 1989, the less the increase in caries experience in the selected age cohorts over the 2 years. The more the services consisted of fillings in 1989, the greater the increase in the number of DMF teeth over the 2 years.

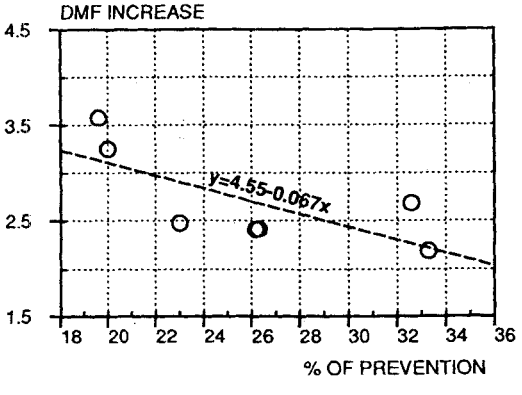

Fig. 3. Mean DMF increases over 2 years by the share of prevention in the treatment mix. Regression line dotted.

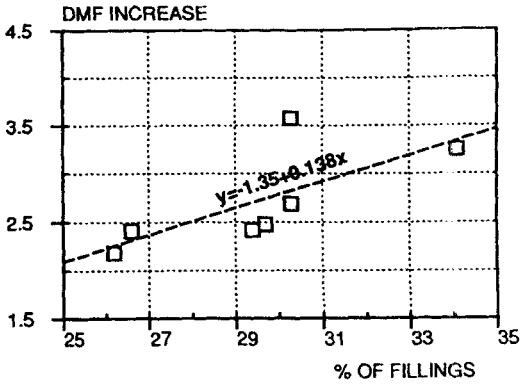

Fig. 4. Mean DMF increases over 2 years by the share of fillings in the treatment mix. Regression line dotted.

The share of prevention and checkups in the treatment mix explained 73.9% of the outcome by district when these two variables were used as independent variables in a regression model (Table 2). Both were negatively related to the increase in the number of DMF teeth. The p values were 0.01 for the share of prevention and 0.10 for the share of checkups.

Discussion

Our study evaluated the overall public oral health services provided by 409 professionals to a total of 98,000 patients in the city of Helsinki in 1989. Provision of the services is administered by the Helsinki City Health Department in accordance with the regulations of the Primary Health Act and supplementary instructions of the National Board of Health. Within these constraints, dental professionals can decide how the goal of the services, which is oral health for all, with priority for children and adolescents, is to be achieved.

Our analysis of all treatment over a 1-year period describes the practices of the public clinics very well, not only for some selected patients but for all of them. The patient population in public oral health services is dominated by young patients, receiving their dental care free of charge. Still, the variation

Table 2. Outcome explained by treatment mix: results of a regression model

Independent variables	Regression coefficient	Standard deviation	β^*	p
Prevention percentage of treatment mix	−0.062	0.024	−0.675	<0.01
Checkups percentage of treatment mix	−0.317	0.176	−0.462	<0.10

Constant = 10.03; $R^2 = 0.739$.
* β = standardized regression coefficient.

in the overall treatment mix was obvious, particularly with regard to preventive treatment. Similar findings have been reported on dentists' decision making for treatment in a population of homogeneous adult patients, the authors concluding that the dentists were more or less preventively oriented (15–17).

The outcome of service provision was defined as the 2-year increase in caries experience in 16,000 patients of school age. Limitation to school age was done because the coverage of services is extremely high during years of attendance at school. A 2-year follow-up period was selected to ensure that the treatment given had time to show its effects on dental health, either arresting caries lesions or 'allowing' them to cavitate. The results are, therefore, a reliable description of differences in outcome and related factors.

The seven independent districts of the city of Helsinki have similar goals for their oral health services. However, they differed greatly with regard to the emphasis placed on different types of dental care, in particular preventive treatment. Great differences were also found in the outcome, since the maximum increase in the number of DMF teeth by district was 63% greater than the minimum. The variation in the outcome was strongly related to the differences in treatment mix. A positive outcome, i.e. smaller increases in numbers of DMF teeth, was seen in the districts in which prevention dominated in the treatment mix. This finding confirms previous statements on the importance of a greater emphasis on preventive dentistry in the decrease of dental caries (6, 18).

The differences in the outcome did not reflect differences in the educational structures of the population between districts. This means that the role of dental professionals was more important than that of background factors relating to the population when differences in the development of dental health among these children were evaluated. Even in the districts in which the socioeconomic situation was below average, the emphasis on prevention led to better than average outcome. Dental professionals should therefore make treatment decisions and work in such a manner as to favor preventive procedures.

The results of our study confirm the importance of preventive treatment in oral health services. Districts placing greatest stress on preventive work achieved better dental health results. Previous reports by us (11, 12) have shown many shortcomings in relation to the focusing of preventive treatment on patients at greatest need. If working methods could be improved to meet the needs of patients, the developments in dental health would be even better.

Most items of preventive treatment can be carried out by oral hygienists and dental assistants. So far, the division of functions between the professionals in the public oral health services in Helsinki has been minimal. In the future, an increase in participation by ancillary personnel in service provision could lead to economies in achieving the goals of the oral health services.

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Received for publication 4 January 1993
Accepted 7 April 1993