Effects of dental attendance frequency in heavy and low private care-using young adults

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In Finland, adults born in 1961 or later were progressively entitled to subsidies for dental care from private practitioners during 1986–90, while at the same time having access to care in the Public Dental Service. The aim of this study was to compare the effects of attendance frequency of private dental care on treatment costs and treatment spectrum for the heaviest and lowest users over a period. Three separate cohorts of recipients of reimbursements were formed, using the Social Insurance Register. The highest and lowest cost groups in 1986, 1990, and 1994 were followed up to 1997. Initially, the mean numbers of visits were 1.2–1.3 and 5.2–5.6 and cost Euro 48–53 and Euro 358–379 among low users and heavy users, respectively, in all cohorts. Among the heavy users (the high-cost category) infrequent attendance was related to higher and frequent attendance to lower mean annual costs of care. Among the low users (the low-cost category) the opposite was true. Those who initially belonged to the high-cost category received in 1997 significantly more ($P < 0.01$) restorative treatment and, to a lesser extent, more ($P < 0.01$) preventive and periodontal treatment than those belonging to the low-cost category. Frequent dental care seemed to benefit those who received a lot of care. Frequency of attendance was not associated with being a low or a heavy user, indicating rigid check-up routines. The inclusion of simple oral health data would greatly improve the usefulness of the register as an evaluation tool for health-political decisions. □ *Dental insurance; frequency of attendance; longitudinal, private; subsidized dental care*

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To improve the use of dental services and lower the costs of treatment among young adults in Finland, private dental care has been reimbursed through a tax-paid dental insurance scheme since 1986 to those born in 1961 or later. In 1990 subsidized care was expanded to those born in 1956 or later. The same age groups were also entitled to state subsidized treatment in the Public Dental Service (PDS). In private practice the Social Insurance Institution reimbursed payments for examinations, preventive and restorative treatments, endodontics, periodontics, and bite dysfunctions but not prosthetics or orthodontics.

Private sector reimbursements are paid through the sickness insurance scheme, in accordance with the Social Insurance Institution's fee schedule, which is 60%–90% lower than typical private sector fees. The patients' own payment have stayed on the same level during the period 1986–97. Public sector care is supported by national and local taxation. Fees in the PDS are fixed nationally, whereas the fees for care by private dentists are unregulated. For a patient conventional care in the private sector is about 50% more expensive than in the PDS even after the reimbursements. Except for the Social Insurance Institution's annual reports on the numbers of patients in different age groups and the sum of the reimbursements, the follow-up of the utilization of services and benefits to the patients has been scarce. A longitudinal follow-up of all persons having had reimbursements for private dental care during 1986–97 showed a substantial decrease from 10% to 5% of the age group in the demand for private services among the 19- to 25-year olds and stable demand among the 26- to 34-year olds, being about 20%. The different age cohorts had a stable mean number of visits per year and almost constant costs, indicating rigid treatment patterns (1).

The aim of this study was to compare the effects over time of attendance frequency on treatment costs and treatment spectrum between heavy and low users of private dental care. The detailed aims were 1) to compare mean annual treatment costs by number of treatment periods between the heavy and low users after the initial treatment period in 1986, 1990, and 1994 with those for 1997, and 2) to compare mean annual treatment costs and types of treatment received in 1997 between the heavy and low users.

Materials and methods

The data used were gathered from the Reimbursement Register kept by the Social Insurance Institution. Since 1986 the register has included information on dental care costs, reimbursements, and number of visits and, since mid-1995, on basic treatment measures (excluding prosthodontics and orthodontics) provided for persons entitled to subsidized care in the private sector. Their civil registration number is also recorded. All persons aged 19 years or older who had received reimbursements for dental

Table 1. Proportions of persons having had different numbers of treatment periods during the whole study period from 1986 (Cohort 86), 1990 (Cohort 90) or 1994 (Cohort 94) to 1997 among low and heavy users

	Cohort 86		Cohort 90		Cohort 94	
No. of treatment periods	Low users (n = 17,816)	Heavy users (n = 17,795)	Low users (n = 50,837)	Heavy users (n = 50,944)	Low users (n = 66,077)	Heavy users (n = 66,156)
1	19%	15%	16%	16%	22%	21%
2	14%	15%	13%	15%	21%	22%
3–6	36%	38%	44%	46%		
7–10	22%	23%				
Every year minus one	5%	5%	13%	11%	25%	26%
Every year	4%	5%	15%	12%	31%	32%
Total	100%	100%	100%	100%	100%	100%

care in 1986, 1990, or 1994 were initially included in the study. Research permission was granted by the Social Insurance Institution after receipt of the researchers' commitment to use the data only in present study. Three separate cohorts were formed. The composition of the cohort (number and age of included individuals) and the duration of the observation times varied between the cohorts owing to the expansion of the subsidy scheme. Cohort 86 was made up of all persons who had sought care in 1986 (n = 53,347), when the subsidy scheme was introduced, and persons born in 1961 or later were entitled to subsidized care. The year 1990 was chosen for Cohort 90 (n = 152,777) because that year the scheme was extended to persons born in 1956 or later. Cohort 94 (n = 198,481) was a further group of persons who had first sought care 4 years later. Individuals were followed up by using their civil registration numbers from the first contact with a dentist in 1986, 1990, or 1994 to the year 1997, which was the last year when data were available.

Three cost categories were formed by dividing subjects into three equal-sized groups in accordance with the amounts paid for private dental care in the baseline years of 1986, 1990, and 1994. Those belonging to the highest category were defined as heavy users, and those in the lowest category as low users, and these two thirds were analyzed further. A calendar year was defined as one treatment period, and all costs in a year were considered to be part of the same treatment period. Persons who had attended a private dentist at least once every calendar year or every calendar year but one were considered as frequent attenders, and those who had received care only in one or two calendar years as infrequent attenders. Variation in annual costs paralleled with the number of annual visits (1). In 1986, 95% of the inexpensive users had one or two visits, compared with 25% of expensive users. Corresponding figures in 1990 were 98% and 7%, and in 1994, 98% and 8%.

Valid data about items of treatment provided were available only for the year 1997 and were classified into main treatment areas on the basis of the Finnish Social Insurance Institution's schedule. All costs presented in the results include both the reimbursements and the patients' own share of basic dental care (excluding prosthetics and orthodontics) and were converted into 1997 values by using the cost-of-living index with the 1997 coefficient set to 1.0 and presented in Euro (EUR1.00 = USD0.95 = FIM5.96). Backwards from 1997 the coefficient increased annually, being 1.030 in 1994 and 1.390 in 1986.

A Pearson chi-square test was used to analyze differences between low- and high-cost categories by age, sex, and treatment received, and 95% confidence intervals were calculated for mean annual costs and number of visits.

A multiple logistic regression model was used to identify predictors for having received restorative treatment in 1997 in each cohort. 'Having had one or more restorations' was the dichotomous outcome variable, and the explanatory variables analyzed were cost category, age, sex, geographic area, number of treatment periods, and number of annual visits. For this purpose the number of treatment periods and annual visits were grouped as shown in Table 5. Dummy variables were formed for each category for categorical variables. The relationship between the variables intended to be used in the models were first examined by calculating correlation matrixes (Pearson correlation for the continuous and Spearman for the discontinuous variables). Number of annual visits was excluded from the model because high correlation (r = 0.7) between this variable and having had restorative treatment was detected. Chi-square tests were performed to analyze the associations between the response and the explanatory variables. In these analyses age was grouped. All the tested associations were significant ($P > 0.01$), and the listed variables were entered in the model. Odds ratios (OR) and 95% confidence intervals (CI) were also calculated.

Results

Being a low or heavy user—that is, belonging to a low- or high-cost category in 1986, 1990, or 1994—was not associated with the number of treatment periods: the proportion of frequent or infrequent attenders was almost equal in the two cost categories in every cohort (Table 1). Among the heavy users (the high-cost category) infrequent attendance was related to high and frequent to lower mean annual costs of care. Among the low users (the low-cost category) the case was just the opposite (Table 2).

Table 2. Annual mean costs (Euro) in private care by number of treatment periods among low and heavy users (95% confidence intervals in parentheses). Cost categories were formed by dividing the 19 to 41-year-old subjects initially into thirds and comparing the highest and lowest thirds on the basis of the costs paid for private dental care in 1986, 1990, or 1994

	No. of treatment periods						
	Infrequent visitors		Frequent visitors				
	1	2	3–6	7–10	Every year minus one	Every year	Total
Cohort 86							
Low users (n = 17,816)							
Mean annual costs (Euro)	46 (45–47)	100 (96–104)	125 (123–127)	123 (122–125)	111 (109–113)	110 (108–113)	105 (104–106)
Heavy users (n = 17,795)							
Mean annual costs (Euro)	357 (350–363)	284 (279–290)	247 (245–249)	212 (210–214)	195 (192–199)	192 (189–196)	258 (256–260)
Cohort 90							
Low users (n = 50,837)							
Mean annual costs (Euro)	48 (48–49)	105 (103–108)	121 (121–122)		116 (115–117)	112 (111–113)	106 (105–106)
Heavy users (n = 50,944)							
Mean annual costs (Euro)	365 (360–369)	304 (300–308)	254 (253–256)		229 (227–231)	227 (225–229)	275 (274–276)
Cohort 94							
Low users (n = 66,077)							
Mean annual costs (Euro)	51 (50.8–51.4)	105 (103–106)			112 (111–113)	107 (106–108)	95 (95–96)
Heavy users (n = 66,156)							
Mean annual costs (Euro)	388 (383–392)	312 (309–314)			278 (276–279)	262 (260–263)	302 (301–304)

Table 3. Mean costs (Euro) and mean number of visits among low and heavy users in baseline years (1986, 1990, or 1994) and at the end of the follow-up in 1997. (95% confidence intervals in parentheses)

	In 1986 (Cohort 86)		In 1990 (Cohort 90)		In 1994 (Cohort 94)	
	Low, n = 17,815	Heavy, n = 17,795	Low, n = 50,835	Heavy, n = 50,944	Low, n = 66,075	Heavy, n = 66,156
Mean costs (EURO)	48.1 (47.8–48.4)	363 (360–366)	50.0 (49.8–50.2)	359 (358–361)	53.1 (53.0–53.2)	380 (379–382)
Mean no. of visits	1.33 (1.32–1.34)	5.24 (5.19–5.29)	1.29 (1.28–1.29)	5.61 (5.58–5.64)	1.24 (1.24–1.25)	5.44 (5.42–5.47)
	In 1997					
	n = 6007	n = 6216	n = 23,939	n = 22,350	n = 35,707	n = 35,930
Mean costs (EURO)						
Only twice	209 (181–238)	248 (219–277)	212 (198–225)	281 (264–298)	183 (177–188)	268 (261–275)
Every year	134 (124–144)	191 (179–203)	131 (128–134)	214 (209–219)	125 (124–127)	216 (213–218)
All	162 (158–167)	217 (212–222)	151 (149–152)	229 (226–231)	139 (138–141)	228 (226–230)
Mean no. of visits						
Only twice	2.93 (2.59–3.27)	3.56 (3.18–3.97)	2.98 (2.82–3.14)	3.71 (3.51–3.90)	2.70 (2.66–2.81)	3.64 (3.55–3.72)
Every year	2.31 (2.16–2.45)	2.99 (2.82–3.16)	2.24 (2.20–2.28)	3.27 (3.21–3.34)	2.13 (2.11–2.16)	3.23 (3.20–3.27)
All	2.50 (2.45–2.55)	3.20 (3.14–3.27)	2.43 (2.40–2.45)	3.33 (3.29–3.36)	2.29 (2.27–2.31)	3.33 (3.30–3.36)

Only twice = first period of treatment in 1986, 1990, or 1994 and second in 1997; Every year = visited every year during the study period.

Table 4. Proportion of persons having had different types of treatment measures in 1997 among low and heavy users in the baseline years (1986, 1990, or 1994). *P* values refer to the Pearson chi-square test performed to analyze differences between low and heavy users in every cohort

Type of treatment received	Cohort 86, cost category		Cohort 90, cost category		Cohort 94, cost category	
	Low, $n = 6007$	High, $n = 6216$	Low, $n = 23{,}939$	High, $n = 22{,}350$	Low, $n = 35{,}713$	High, $n = 35{,}934$
Examinations						
Only twice	66	68^{NS}	74	72^{NS}	77	78^{NS}
Every year	86	87^{NS}	87	87^{NS}	86	83**
All	81	80^{NS}	83	80**	83	83**
Prevention						
Only twice	32	28^{NS}	28	28^{NS}	29	35^{NS}
Every year	37	44**	34	45**	30	43^{NS}
All	34	37**	32	40**	30	41**
Periodontics						
Only twice	17	21^{NS}	22	22^{NS}	22	26^{NS}
Every year	18	21^{NS}	22	27**	22	29^{NS}
All	20	23**	22	26**	22	28**
Restorative†						
Only twice	76	83 $P = 0.07$	75	83**	70	85**
Every year	52	71**	53	73**	53	74**
All	62	76**	60	78**	57	78**
Surgery						
Only twice	15	18^{NS}	20	23 $P = 0.07$	14	17**
Every year	5	6^{NS}	5	7**	5	8**
All	9	10^{NS}	7	10**	7	10**
Bite dysfunctions						
Only twice	3	3^{NS}	2	3*	3	2^{NS}
Every year	2	3^{NS}	2	3**	2	4**
All	3	3^{NS}	2	3**	2	3**

Only twice = visited first time in 1986, 1990 or 1994 and second time in 1997; Every year = visited every year during the study period.
† Including endodontics.
NS = $P \geq 0.05$; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Both the annual mean number of visits and the costs in the baseline year were about the same in each cohort. After the initial treatment period in 1986, 1990, or 1994, differences between the baseline cost categories decreased. However, in 1997 there was still a clear difference between the high (217 Euro) and low (162 Euro) category among those who visited a private dentist that year. In Cohort 86, 34% of those in the low-cost and 35% of those in the high-cost category had visited a private dentist in 1997. Corresponding figures for Cohort 90 were 47% and 44%, and in Cohort 94, 54% and 54%. Compared with frequent visitors (in this case annual) mean costs and numbers of visits in 1997 were higher among those who visited a dentist for the first time after the baseline in 1997 in both cost categories (Table 3).

Examinations and restorations were the most usual treatment measures in all groups. Persons in every cohort who initially had belonged to the high-cost category had in 1997 received significantly more restorative and, to a lesser extent, more preventive and periodontal treatment (Pearson chi-square, $P < 0.01$) (Table 4). Even though the treatment received was associated with frequency of attendance, being a heavy user at baseline remained an independent risk indicator for having received restorative treatment in 1997 (analyzed by logistic regression and adjusted for sex, age, residence, and number of treatment periods in 1997) (Table 5). Generally, those who had visited a dentist only in the baseline year and at the end of the follow up period had received more surgical and restorative measures than the annual visitors.

Discussion

Discrepancies between reported and actual attendance of dental care have been shown to exist (2, 3). Register data avoid the pitfalls of self-reported data, which rely on subjects' memory (4). Nevertheless, register-based data also have limitations. Because not all treatment is reimbursed in Finland, information on these types of treatment (such as orthodontics and prosthodontics) is missing. Neither information on dental status nor the original reason for attendance at baseline was collected by the Social Insurance Institution. The reimbursement register can be considered reliable with regard to information on costs, number of visits, and treatment measures provided in the private sector because the payments are made against detailed claim forms. Since the incidence and prevalence of dental caries has been reduced during the past 25 years also in Finland, this probably has an effect on the cohorts with regard to dental attendance. Three separate cohorts instead of one were chosen, to increase the reliability of the results and to discern trends. Of necessity, the length of observation

Table 5. Determinants of receipt of restorative treatment (including endodontics) in 1997 in Cohort 86, Cohort 90, and Cohort 94. Odds ratios and 95% confidence intervals based on logistic regression. Having had one or more classified treatment was the dichotomous outcome variable, which was coded for 0 if the treatment was performed and 1 if at least one procedure was provided

Independent variables	Cohort 86	Cohort 90	Cohort 94
At least one treatment provided	*n* = 12,704	*n* = 48,772	*n* = 74,119
Treatment not provided	*n* = 5,700	*n* = 21,714	*n* = 35,149
Cost category			
Low	1.0	1.0	1.0
Medium	1.3 (1.2–1.4)	1.5 (1.5–1.6)	1.6 (1.6–1.7)
High	2.0 (1.8–2.1)	2.3 (2.2–2.4)	2.6 (2.5–2.7)
Sex			
Male	1.0	1.0	1.0
Female	1.0 (0.9–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.0)
Age (unit, 1 year)	1.0 (1.0–1.1)	1.0 (1.0–1.1)	1.0 (1.0–1.0)
Residence			
South	1.0	1.0	1.0
Southwest	0.9 (0.9–1.0)	0.9 (0.9–1.0)	1.0 (0.9–1.0)
East	0.9 (0.8–1.0)	1.0 (0.9–1.0)	1.0 (1.0–1.0)
West	0.9 (0.8–1.0)	1.0 (0.9–1.0)	1.0 (0.9–1.0)
North	1.0 (0.9–1.2)	1.1 (1.0–1.1)	1.1 (1.0–1.1)
No. of periods of treatment			
Every year	1.0	1.0	1.0
Every year minus 1	1.2 (1.1–1.4)	1.2 (1.1–1.2)	1.5 (1.5–1.5)
7 – 10	1.5 (1.3–1.6)		
3 – 6	1.9 (1.7–2.1)	1.6 (1.5–1.7)	
2	2.3 (1.9–2.8)	2.2 (2.0–2.4)	2.2 (2.1–2.3)

times varied between the cohorts. Cohorts were not matched by age, since effects of regular care was shown not to be associated with age in this group of adults (1).

The cost of treatment rather than the number of visits was chosen to describe treatment need because it has previously been shown to reflect best the quantity–quality combination of dental services provided in Finland (5). However, the cost of care is only a proxy measure of need and is unsatisfactory because it cannot identify the reasons for attendance—in particular, it cannot distinguish between regular asymptomatic use of dental care and infrequent, symptomatic users. In this study low users most likely were those with good oral health having had only an examination and some preventive measure, but there might have been individuals with poor oral health attending only for lost fillings or occasional pain relief. However, questionnaire studies show that private dental services have during the past 20 years been used predominantly by well-educated and relatively well-off citizens in Finland, and the less well off use public services (6).

In the present study, frequent attendance was associated with substantially lower annual costs among the heavy users. This could indicate that regular dental care is beneficial. A similar result was reported in Sweden (7), where the effects of regular dental visits in 15- to 29-year-olds were studied over a 17-year period. Among individuals who reported problems with teeth, regular visits reduced the number of visits when older. Among persons with good dental health, the effects were not all positive, as shown in our study too when frequent dental care increased the annual costs among the low users. In Norway frequent dental care was found to have a negative effect on caries and periodontal health among 25-year-olds (8). The authors suspected that frequent false-positive diagnoses led to over-treatment. In our study, however, the costs and the number of visits were higher when there were long intervals between treatment periods both among low and heavy users. Differences in treatment measures between low and heavy users in 1997 were, however, smaller than we expected.

The higher costs among frequent attenders in low users is difficult to explain. Health data from the PDS, which treats most young adults in Finland, show continuous improvement in dental health and falling DMFT values. Supplier-induced demand cannot be excluded, but another explanation might be the use of new filling materials in Finnish dentistry. In 1992, 29% of restorations in adults were amalgams; in 1997 the corresponding figure was 5%. Recent data indicate that the longevity of composite fillings is shorter than expected (9). In Finland young adults' treatment consists primarily of examinations and fillings; more than 70% of the heavy users and more than 50% of the low users who had been annual visitors received restorations in 1997. Whereas regular users of dental care have less active disease and fewer extracted teeth (10–12), they also have the disadvantage of more treated teeth, requiring ongoing maintenance (13, 14), and the repeated replacement of dental restorations (15–17). In Finland general practitioners are known to spend half of their clinical working hours doing restorations (18).

As our results showed, individuals who received less treatment in the baseline year visited a dentist as often as those with more treatment. Frequency of attendance was not associated with amount of costs and, thus, treatment received at baseline. This may indicate rigid check-up routines among the dentists and patients and suggests that

intervals for dental check-ups were not based on need. According to a recent thesis, intervals between check-ups differed only slightly between high-caries patients and cavity-free subjects in children and adolescents treated in the PDS in Helsinki (19). This is consistent with both the personnel and the dental service applying a recall system more appropriate to the disease levels of 15–20 years ago and also to patients' expectations of regular and relatively frequent recall visits. Today's 30- to 40-year-olds were taught to make annual visits (20), but some younger adults may already have experimented with less regular or more symptomatic follow-up patterns.

In spite of the moderately lower costs among frequent heavy users, differences between initial cost categories did not vanish, and the subjects remained in their baseline categories. This reflects the rather palliative nature of conservative dental treatment, as stated by Sheiham (21). In a study of adolescents in the Helsinki PDS, the effectiveness of care was reported to be related to the service mix. Greater emphasis on preventive work was associated with a smaller DMF increase (22). To be of value, regular care should achieve changes in health behavior or provide very effective or long-lasting preventive or restorative measures. According to Kay & Locker (23), one of the most effective ways of ensuring healthy oral habits is to receive simple but individualized advice from dental staff on a regular and repetitive basis. At the time of the study examinations and preventive care were reimbursed at a higher rate than other basic treatments in the Finnish subsidy scheme in an attempt to achieve this. However, the preventive measures provided by dentists in the early 1990s in Finland bore little relation to the patients' actual needs (24). This was also apparent in the present study, as differences between the preventive care provided to low and heavy users were small.

Frequent dental attendance seemed thus to benefit most those who needed a lot of care. Any health benefits as a consequence of the reimbursement system could not easily be measured because the available information was incomplete and inadequate, and a comparable age-matched control group did not exist. Information on the patients' dental status and different background factors would be needed.

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