

Heavy consumption of dental services among Finnish adults

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Objective: To compare treatment of heavy and low users of dental services among adults in the Public Dental Service (PDS) in one of the biggest cities in Finland and to identify reasons for heavy use and to suggest improvements to care provision. **Method:** All adults who attended the PDS in Espoo (pop. 227,500) in 2004 were allocated to a group (n=3,173) who had made six or more dental visits and a comparison group (n=22,820) who had three or fewer dental visits. The data were obtained from the patient register of the PDS. A sample of 320 patients was randomly selected from each group. Information on age, gender, number and types of visits, oral health status, treatment provided and fees paid was collected from treatment records. **Results:** 10.5% of the adults were found to be heavy users and their treatment made up 31.6% of all adult dental visits. The proportion of men was greater among heavy users and the heavy users were on average 6.6 years older than the low users. The mean total treatment time for heavy users was 5.5 hours and 2.0 hours for low users. Heavy users had more untreated and treated caries and more periodontal pockets than low users. Restorative, endodontic and prosthetic treatment needs characterised the heavy user group, while the low users most often received restorative and periodontal treatment only. **Conclusions:** Our study indicates that complicated treatment needs of heavy users and lack of experience among the caregivers in dealing with them resulted in high numbers of dental visits for individual patients. The PDS should offer appropriate continuing education for its oral health care teams and organize a referral system offering specialist care for difficult endodontic, periodontal and prosthetic treatments.

Key words: Adult and elderly population, complicated treatment needs, heavy users of oral health services.

Introduction

In Finland, dental services are provided both by the Public Dental Services (PDS) and the private sector. For a long period, the public sector catered mainly for children, young adults and some special needs groups. In 2001–2002 the dental care provision system was reformed and previous age limits restricting adults' use of the PDS were abolished (Niiranen *et al.*, 2008). At the same time, all adults who used private dental services, irrespective of age, became entitled to partial reimbursements of the cost of care from the national health insurance. The reform aimed to increase equity by improving adults' access to care and reducing cost barriers. Local municipalities are responsible for arranging the public dental services for their inhabitants and these services are highly subsidized. After the reform, the increased demand and need for care by the increasingly dentate adult and elderly population generated pressures to examine treatment routines in many PDS units, especially in bigger cities where previously little care had been offered to adults (Widström 2006).

Espoo, close to Helsinki and with 227 500 inhabitants in 2004, is the second largest city in Finland. Of the population, 75.7% was over 18 years of age; of these, 19.3% had visited the PDS in 2004. The dental workforce in the PDS of Espoo consisted of 82 general dental practitioners, 13 specialists, 36 dental hygienists, and 139 dental assistants giving a dentist to popula-

tion ratio of 1:2363, which was somewhat higher than the national average (1:2539). Despite relatively high workforce numbers and good supply of private services for adults in the capital region, the PDS was not able to respond to the increased demand for oral health care by the adult population caused by the dental care reform. In this situation, heavy users were found to be an important patient group to study because they absorbed much of the available resources. In order to allocate the existing resources more efficiently and according to population treatment needs, heavy users of dental services needed to be identified and their treatments analysed. Our aim was to identify heavy users of dental care among adults in Espoo and compare their oral health status and treatment provided with those of the low users in order to rationalise care supply in the PDS.

Material and methods

Adults who had made six or more dental visits to the PDS in 2004 were defined as heavy consumers of dental services. Low consumers were those who had had three or fewer visits during that year. In the first stage, we identified all patients over 18 years of age who met the heavy user (n=3,173) and the low user (n=22,820) criteria in the patient register of the PDS in Espoo. After that, a sample of 320 patients (10% of the heavy users and a comparison group of equal size of the low users) was

randomly drawn from each group. The city administration of Espoo, the legal owner of the patient register, granted research permission. In the next step, we collected information on age, gender, self-reported general health status, numbers and types of visits, treatments provided and patient fees for these patients in 2004 from treatment records. The number of dental visits in the previous year (2003) was also recorded. Data on dental status was collected mainly from the 2004 records but also from the 2003 records when dental status had not been recorded in 2004. In addition, information on the duration of each visit and whether or not the treatment course had been completed was extracted from the records. Information on patients' occupational status was also included in the patient register in the city of Espoo. We categorised the occupational status into six classes, using the classification recommended by Statistics Finland (Classification of Occupations, 2001).

In the patient records, the D and DMFT indices were used to describe the caries status and the Community Periodontal Index (CPI) (Ainamo *et al.*, 1982) to describe periodontal status. We noted the sextant with the highest CPI score. The numbers of teeth and prosthetic constructions (crowns, bridges, implants and removable dentures) present were also recorded. Differences between the heavy and low consumers of dental services were evaluated by the chi-square test and the t-test.

Results

According to our definition 10.5% of the adults ($n=3,173$) who had visited the PDS in 2004 were heavy users and 75.6% ($n=22,820$) were low users. The proportion of men was greater in the heavy users group than in the low users group (Table 1). Heavy users were on average 6.5 years older than the low users. Most low users were under 45-years of age (69.1%) and most heavy users (52.3%) were 45 years or older. There were more pensioners (20.3%) and blue-collar workers (27.7%) among the heavy users than the low users (10.5% and 16.9% respectively) (Table 1). Most patients in both groups reported good general health, but 36.0% of heavy users reported having ill health compared with 19.8% of low users ($p<0.001$).

Treatment of heavy users accounted for 31.6% of all adult dental visits and the treatment of low users 46.1% in 2004. Heavy users had had more than five times the number of visits than had the low users (Table 1). The highest number of visits during the study year in the heavy users group was 22. Half of the low users (51.6%) had only one visit.

The mean duration of one dental visit was significantly higher (39.4 min) and the mean total treatment time longer (5 hours, 28.2 min) in the heavy users than in the low users (34.0 min and 58.3 min respectively). The total treatment time was 5-9 hours for 36.6% of the heavy users and more than nine hours for 8.7%, the maximum total treatment time for a person was 14 hours. A significantly greater proportion of the heavy users (44.0%) had also visited a dental hygienist compared with the low users (23.8%). Treatment courses were completed by 52.5% of the heavy users group and by 74.2% in the low users group ($p<0.001$). More than half of the heavy

users (60.3%) had also visited the PDS in Espoo in 2003 compared with 39.3% of the low users ($p<0.001$).

About 63% of the patients in each group had had a full mouth examination and DMFT and CPI indices had been recorded in the patient's records (Table 1). The other patients had mainly had emergency visits and partial examinations. The number of teeth present was about the same in both groups (mean 25.3 for heavy users, 26.9 for low users, $p<0.05$). There were only five edentulous persons in the samples, three in the low users group and two in the heavy users group. Of patients over 65-years of age, 35.0% in both groups had fewer than 20 functional teeth. The number of teeth did not differ significantly in either group according to gender.

In the heavy users group, 20.7% and in the low users group 52.8% had no carious teeth ($p<0.001$) (Table 2). The heavy users had more caries and fillings (mean $D=2.9$, mean DMFT=20.1) than had the low users (mean $D=1.2$, mean DMFT=14.4) ($p\leq0.001$). Almost half of the heavy users (46.8%) had three or more teeth needing restorations compared with 13.3% of low users ($p\leq0.001$). There were no significant differences in the numbers of decayed teeth between the genders. A small proportion in both groups had healthy periodontal conditions (Table 2). Heavy users had significantly more sextants with shallow and deep periodontal pockets than the low users ($p<0.001$).

Heavy users had also more removable dentures, bridges and crowns than low users (Table 2). Implants were rare, only 1% in both groups had one or more implants.

Emergency care, restorative treatments and endodontics dominated the adult dental care provided in Espoo. Emergency visits were usual for both groups and 67.9% of the heavy users and 50.0% of the low users had had such visits in 2004.

About the same proportions of heavy and low users had had an examination (Table 3), but there was a significant difference in radiographs taken, 74.4% of heavy users had had one or more radiographs taken during their treatment course compared with 29.3% of the low users ($p\leq0.001$).

Of the heavy users, 87.0% and of the low users, 49.7% had received fillings (Table 3). The heavy users had on average 1.1 carious lesions filled during one restorative treatment visit and the low users 1.2. Also most of the heavy users (76.3%) who did not have caries ($D=0$) had had restorative treatment, suggesting replacement of existing dental restorations for reasons other than caries.

Significantly more heavy users had received endodontic treatment compared with the low users (Table 3). Most of the heavy users (69.2%), whose mean total treatment time was longer than nine hours, had had endodontic treatment. For all of the 6.6% of patients in the low users group who received endodontic treatment, this was successfully completed in 2004. Endodontic treatment was not completed in 2004 for 24.0% of the heavy users who received it. The most usual reasons for not completing endodontic treatment was long treatment duration (in 53.2% of these cases, more than six months), extraction of the tooth (34.4% of cases) or that the patient did not wish to complete the treatment (12.4% of cases).

Table 1. Demographic and service utilisation characteristics of the PDS of Espoo in 2004.

	Heavy users n=300	Low users n=314
Gender: Women %*	55.0	65.0
Men %*	45.0	35.0
Mean age (years)***	47.9 (SD 18.9)	41.4 (SD 16.5)
18–29-years ^{NS}	19.7 %	23.6 %
30–44-years***	28.0 %	45.5 %
45–64-years*	31.7 %	19.8 %
65+ years*	20.6 %	11.1 %
Upper-level white-collar workers ***	9.4 %	18.6 %
Lower-level white-collar workers*	25.7 %	33.2 %
Blue-collar workers*	27.7 %	16.9 %
Students ^{NS}	9.3 %	12.8 %
Pensioners ***	20.3 %	10.5 %
Others ^{NS}	7.7 %	8.0 %
Mean number of all visits***	8.2 (SD 2.9)	1.6 (SD 0.8)
Average time of one visit (minutes)***	39.4 (SD 8.4)	34.0 (SD 8.5)
Mean total treatment time (minutes)***	328.2	58.3
Mean number of visits to dentist***	7.3 (SD 2.9)	1.3 (SD 0.7)
Mean number of visits to dental hygienist*	0.9 (SD 1.2)	0.3 (SD 0.5)
Number of treating dentists***	2.2 (SD 1.1)	1.1 (SD 0.5)
Proportion examined (complete oral health status) % ^{NS}	63.3	62.7
Proportion having visited a dental hygienist %***	44.0	23.8

***p<0.001; *p<0.05; NS=p≥0.05

Table 2. Distribution (%) of the heavy and low adult users of dental services in the PDS of Espoo (whose complete dental status was recorded) according to number of carious teeth (DT), maximum CPI scores, number of functional teeth, removable dentures, fixed prosthesis and implants, in 2004.

Indicator	Heavy users (n=188) %	Low users (n=195) %
DT=0***	20.7	52.8
DT=1-2 ^{NS}	32.5	33.9
DT=3-5***	31.9	10.3
DT=6-14***	14.9	3.0
Healthy periodontal conditions (CPI=0) ^{NS}	7.2	8.6
Gingival bleeding (CPI=1)*	9.3	17.3
Gingival bleeding and calculus (CPI=2) *	52.6	63.5
Shallow periodontal pockets(CPI=3)***	21.1	9.1
Deep periodontal pockets (CPI=4) ***	9.8	1.5
More than 20 functional teeth ^{NS}	89.8	94.8
Removable dentures*	11.2	3.4
Bridges*	4.3	1.3
Crowns*	7.3	4.3
Implants ^{NS}	1.0	1.0

***p<0.001; *p<0.05; NS=p≥0.05

Periodontal treatment (usually scaling and root planing) was provided for 73.9% of all heavy users who had had an examination and whose highest value of CPI index was 2 or more. Most heavy users (88.1%) with periodontal pockets (CPI≥3) had received periodontal treatment and 60.0% of them had been treated by dental hygienists. Of the low users, 57.9% of those with CPI ≥2 had received periodontal treatment but only 45.0% of those with highest scores (CPI≥3).

Oral hygiene education was the most common preventive measure provided in 2004; 45.8% of the heavy users and 27.4% of the low users had received counselling on tooth brushing. Oral hygiene education was provided for

71.7% of the heavy users and for 25.0% of the low users with periodontal pockets. Fluoride varnish had been applied to 43.2% of the heavy users and 22.6% of the low users. Patients were seldom given dietary advice (4.3% of heavy users and 0.6% of low users).

A third of the heavy users had had at least one tooth extraction compared with 7.9% of the low users (Table 3). The heavy users needing extractions had on average 1.9 teeth extracted, the maximum number of extractions for a person was 12 and 24.9% of these heavy users had prosthetic treatment measures. The low users needing extractions had on an average 1.4 teeth extracted.

Table 3. Proportion (%) of adult patients in the PDS of Espoo who received different treatment procedures and distribution (%) of treatment procedures for heavy and low users according to the classification of the Finnish Social Insurance Institution, in 2004.

<i>Treatment provided</i>	<i>Proportion of patients having had one or more treatment</i>		<i>Distribution of the treatments provided</i>	
	<i>Heavy users % n=300</i>	<i>Low users % n=314</i>	<i>Heavy users % n=300</i>	<i>Low users % n=314</i>
Examination	63.3 ^{NS}	62.7	5.3***	15.4
Restorative treatment	87.0***	49.7	35.8*	30.6
Endodontic treatment	44.5***	6.6	16.4***	3.8
Periodontal treatment	54.0***	38.1	11.2 ^{NS}	15.8
Extractions	33.6***	7.9	7.1*	4.7
Prosthetic treatment	15.0***	2.8	7.1***	1.7
Preventive treatment	45.8***	27.4	13.8***	23.2

***p<0.001; *p<0.05; NS=p≥0.05

Table 4. Reasons for heavy consumption of dental services among adults in the PDS in Espoo in 2004 and suggestions for strategies to improve the supply and quality of care.

<i>Reasons for heavy consumption of dental services</i>	<i>Strategies for improvement</i>
Dental emergencies	Proper dental examinations and long term treatment plans to reduce the need for repetitive emergency visits Defining a responsible dentist for each patient Organizing semi-urgent appointments for patients with lost and broken fillings and deep caries lesions
Frequent restorative treatments	Better planning of treatments – longer appointments to allow more treatment measures during one visit More careful choice of restorative materials and therapy (fillings/ prosthetic crowns) Better targeted preventive care
Unsuccessful endodontic treatments	More consideration about treatment indications and prognosis Improvement of the quality of treatment Referral of the most difficult cases to a specialist
Avoidance of prosthetic treatments	Fixed prosthetic treatment (crowns and bridges) should be offered more often instead of repeated restorations with composite materials or fibre reinforced bridges Referral of the most difficult prosthetic cases to a specialist
Imprecise periodontal treatment process	Improved diagnosis and treatment Organized maintenance care and better use of dental hygienists Complicated periodontal patients should be referred to a specialist

Prosthetic treatment was rare in low users but 15.0% of the heavy users had at least one prosthetic treatment measure (Table 3). In the heavy users, prosthetic treatment courses were often prolonged as 76.2% of these patients had already started their treatment in 2003 and only 53.5% completed their prosthetic treatment in 2004. The prosthetic treatment measures for heavy users were most often removable dentures (47.4%), denture repairs (36.4%) and, in 18.2% of cases, fixed prosthetics. For low users, all prosthetic treatment measures were repairs to existing dentures. Most of the fixed prosthetic work for heavy users was fibre reinforced composite bridges and only one porcelain crown was made.

Reasons for heavy consumption

Table 4 lists the main reasons for heavy consumption of care as found in this study and gives suggestions for

rationalising adult dental care. In order to improve the quality of oral health care and reduce the number of emergency visits, the dentist or dental hygienist should undertake more careful examination and prepare a more specific treatment plan, including preventive measures. Unexpectedly, only 63% of patients in both groups had had a dental examination in which DMFT and CPI indices and a treatment plan were recorded in the patient's file. When possible, one single dentist should be responsible for each patient's treatment; this was seldom the case for heavy users, who had on average seen 2.2 different dentists (Table 1). Complicated endodontic treatments caused a large number of visits and, for too many heavy users, endodontic treatment was unsuccessful. The quality of endodontic treatment could be improved if dentists followed quality guidelines (European Society of Endodontology, 2006). There were also shortcomings

in the periodontal treatment provided, as in both groups there were patients with periodontal pockets who did not receive any periodontal treatment.

Discussion

The mean number of adult visits in the Espoo PDS in 2004 was 2.7. We set the criterion for heavy consumption to at least six visits during a year, so as to include only patients that had consumed substantial PDS resources. In the literature, there is no consensus definition for heavy use of dental services. In studies of heavy consumption of primary health care, the classification of heavy users varied from five or more visits (Andersson *et al.*, 1995) to eight or more visits (Jyväsjarvi *et al.*, 1998) to a medical GP in a year. In a Danish study, the authors defined heavy users of primary health care patients the decile of patients who had made the highest number of visits during a year (Vedsted *et al.*, 2004). The heavy users in our study fulfilled this criterion; they were 10.5% of PDS patients in 2004.

Due to the random sampling method used, our material can be considered representative of heavy and low users of dental services in the city of Espoo. We used routine register data in this study. As dentists' remuneration in the PDS is partly based on these data, information on service utilisation and treatment provided can be considered reliable.

It was obvious from our study that adults using the dental services in Espoo had retained high numbers of teeth. Only 0.6% of the high and 0.9% of the low users in this study were edentulous. In a national study, 6% of the working age population (30-64- years of age) and 44% of those 65 years or older were edentulous in Finland in 2000 (Suominen-Taipale *et al.*, 2004). Espoo residents, in terms of education and personal income (average taxable income EUR 29,900 compared with the 2005 national average EUR 21,020), are of high socio-educational status which is consistent with having better oral health and higher numbers of teeth (Hobdell *et al.*, 2003).

Restorative treatment dominated in both groups. Surprisingly, restorative treatment was common also for heavy users free of active caries. This confirms that heavy users, who had high numbers of treated teeth, needed continuing maintenance and replacement of restorations. This is in accordance with a previous study in Finland, which reported that 65% of the adult restorative treatment was replacement of previous restorations (Fors and Widström, 2004). The PDS seldom offered fixed prosthetic treatment because of a lack of skill (the clinical background of many staff members was treatment of children and adolescents) and also due to insufficient resources. However, by offering longer lasting fixed prosthetics instead of shorter-lasting restorations or fibre reinforced temporary bridges, the PDS could reduce the heavy use of services and, in the long term, free resources.

Although the heavy and low users had both high numbers of teeth, the heavy users were older, had lower social status and more self-reported general health problems. They also had more caries in need of restoration and more shallow and deep periodontal pockets than low users. In the future, the combination of greater numbers of older people with more retained teeth adds up to more

and more complex work for the oral health care team (Joshi *et al.*, 1996, BDA, 2003). This should be considered by PDS planners in Espoo; complex treatment is already the cause of a high number of visits.

Our study reveals shortcomings in periodontal treatment provided, which is a matter of concern because, according to a recent national study, periodontal disease is a major oral health problem in Finland (Suominen-Taipale *et al.*, 2004). Periodontal treatment guidelines should be clearly defined in the PDS: dentists or periodontologists should be responsible for the care of difficult cases and dental hygienists should provide most uncomplicated maintenance care. The preventive measures that aimed to emphasise patients' responsibility and improve their daily oral hygiene habits and nutrition were largely insufficient for heavy and low users in our study as oral diseases cannot be cured by the interventions by dental personnel alone (Sheiman A, 1997, Kressin NR *et al.*, 2003, Lang *et al.*, 1994).

The recent oral health care legislative reform that opened the PDS for the adult population has increased demand for oral health care and changed the working conditions for the PDS dentists. Different guidelines and work processes ought to be developed, but, in 2004, a large proportion (50%) of dentists' and hygienists' time was still being used on relatively healthy children (Nihtilä and Widström, 2009). The quite complicated treatment needs of the adult population and a lack of experience of difficult treatment among the clinicians has resulted in a large number of dental visits for some individual patients. Reducing heavy use by improving the quality of dental treatment in accordance with the changing needs and demands of adult and elderly patients of the PDS is a challenge and provides an opportunity for oral health care personnel to develop and broaden their expertise. Care should be provided by the most appropriate member in the oral health care team. The PDS should encourage such a change and offer appropriate continuing education for the oral health care team, supported by a referral system offering specialist care for difficult endodontic, periodontal and prosthetic treatments.

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