

# Treatment provided in the Public Dental Service in Finland in 2009

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**Objectives:** To analyse treatment measures provided in the Public Dental Service (PDS) and to discuss the therapy given against treatment needs as expressed in the national clinical epidemiological studies. **Methods:** In 2009, the Chief Dentists of the PDS units collected data from their local registers on patients and treatment provided. Data were obtained from 166 PDS units (86%). Treatment patterns were compared between age groups, provider groups and geographical areas using chi-square tests. **Results:** Altogether 8.9 million treatments were provided for 1.7 million patients. Examinations, restorative treatment and anaesthesia accounted for 61.3% of all treatments. Preventive measures (8.4%) and periodontal treatment (6.3%) were small proportions of the total. Prosthetic treatment was uncommon (0.5%). Working age adults received half of all treatments (53.2%), the young a third (36.4%) and the elderly 10.4%. Dental hygienists or dental assistants provided 29.7% of all treatment for children and adolescents, 11.1% for adults and 14.1% for the elderly. **Conclusion:** Relatively healthy children had plenty of examinations and preventive measures, and adults had mostly restorative care when their needs were more periodontal and prosthetic care, indicating that treatment given was not fully in line with needs.

**Key words:** health services research, register study, treatment measures, dentists, dental hygienists, Public Dental Service, Finland

## Introduction

In Finland the Public Dental Service (PDS), financed by taxation and patient fees and run by local municipalities, was established in the early 1970s. Initially, the PDS catered mostly for children and youngsters but, since 1980s, gradually older age groups were given access to PDS subsidised services until in 2001/2002 all remaining age restrictions on access were removed. Private services, partly subsidised through a national health insurance system, have been widely available in densely populated municipalities. In addition, clinical dental technicians (denturists) make full dentures for edentulous people, 44% of those aged over 64.

About 72% of the children and adolescents and 26% of adults have been to the PDS and about 25% of adults have had reimbursed care in the private sector (Kela, 2014; SOTKA, 2014). During a three year period, practically all children and almost half the adults had visited the PDS and about 30% of the adults had attended private dentists (Widström *et al.*, 2013). The difference between annual and longitudinal figures is due to private patients making more frequent visits because they are offered annual or biannual recalls. The PDS does not have the resources to recall adult patients, thus their visiting patterns are more irregular. Private patients typically have higher education and higher incomes than those who use the PDS (Suominen-Taipale *et al.*, 2008).

Information on treatment measures has long been collected in the PDS, to allow the calculation of treatment-based bonuses to supplement dentists' salaries. All municipal PDS units record the various treatments provided using the same codes, originally created by the

Social Insurance Institution and updated by the National Institute for Health and Welfare (THL, 2009). These codes also form the basis for billing adult PDS patients.

In 2008, the two big PDS units of Helsinki and Vantaa conducted a study, where dentists, dental hygienists and dental assistants, for a week, recorded the time taken for each individual treatment and its recording (Tarvonen *et al.*, 2012).

The aim of this study was to analyse treatment measures provided in the PDS on children and adults in two geographical areas of the country and to find out what proportion of and what kind of treatments dental hygienists and dental assistants provided. Furthermore, our aim was to discuss the therapy given against treatment needs in adults as assessed in the latest national clinical epidemiological studies.

## Material and methods

In connection with the special survey on performance of the PDS in 2009, the Chief Dentists of the 193 PDS units were asked in addition to the routine data also collect information on treatment provided from their municipal data bases. Approval to conduct the study was given by one of the Directors of the National R&D Centre of Welfare and Health (STAKES), as was customary when register data without sensitive personal information was used to survey service quality.

Altogether 166 PDS units (86%) returned the requested data. These covered a population of 5,209,954 people (97.3%), of whom 690,462 children and adolescents and 1,013,764 adults had used public dental services in 2009. The PDS units employed 1,992 dentists, 747 dental hygienists, 2,491 dental assistants and 356 others.

The items of treatment provided were classified by the municipal PDS units into 13 main treatment areas according to the Finnish Social Insurance Institution's schedule: (clinical) examinations, complementary examinations (radiology, laboratory tests), anaesthesia (local anaesthesia, sedatives, nitrous oxide), preventive care (oral hygiene instruction, dietary advice, fluoride varnish, fissure sealants etc.), endodontics, periodontics, oral surgery, orthodontics, restorative care (permanent and temporary fillings, crowns), prosthetics, treatment of bite dysfunctions, certificates (most often for insurance companies due to trauma) and other treatment (removal of sutures or orthodontic brackets, local medications, etc. (THL, 2009).

Patients were grouped by age (under 18, 18-64 and over 64 years). Treatment was provided either by dentists (including specialists) or dental hygienists and dental assistants. Geographical areas were classified as Southern (including the Southern and Western parts of the country) and Northern (including Eastern and Northern Finland and Lapland). To control for the possible effect of some

treatments being short and others time consuming, all treatment counts collected were also converted into treatment time (minutes) using the average durations of treatments observed in a recent study (Tarvonen et al., 2012).

Treatment patterns were compared between age groups, provider groups and geographical areas. Data were processed and analysed using SAS v9.3 software. Chi-square tests compared groups with Bonferroni correction for multiple comparisons.

## Results

Altogether 8.9 million treatment measures provided on 1.7 million patients were recorded (Table 1). The most common treatment categories were examinations (including radiography), restorative treatments and anaesthesia, making up 61.3% of all treatment measures. Preventive measures (8.4%) and periodontal treatments (6.3%) were less common. With treatment of bite disorders and prosthetics (each 0.5%) being rare (Table 2).

**Table 1.** Numbers of Finnish Public Dental Service treatment measures in 2009 overall and provided for children and adolescents, working-age adults and the elderly classified according to main treatment disciplines

Main treatment disciplines	Numbers of treatment measures by age group			Total numbers of treatment measures (n=1,700,758)
	<18 years (n=690,462)	18-64 years (n=841,844)	>64 years (n=171,920)	
Anaesthesia	229,965	698,326	82,907	1,011,198
Prevention	547,135	162,453	37,480	747,068
Endodontics	31,281	275,920	33,694	340,895
Periodontics	89,606	382,712	93,615	565,933
Oral surgery	114,347	275,121	71,688	461,156
Other treatment	86,861	117,180	23,552	227,593
Orthodontics	695,533	20,240	68	715,841
Restorative treatment	382,457	1,226,583	268,442	1,877,482
Prosthetics	492	22,882	17,459	40,833
Treatment of bite dysfunctions	8,811	29,924	2,682	41,417
Certificates	96,330	176,666	34,234	307,230
Examinations	873,285	961,759	202,081	2,037,125
Complementary examinations including radiology	92,857	398,163	61,313	552,333
All treatments	3,248,960	4,747,929	929,215	8,926,104

**Table 2.** Percentages of Finnish Public Dental Service treatment measures in 2009 by patient age group for each of the main treatment disciplines with the overall distribution also converted to treatment time using the Helsinki time study (Tarvonen et al., 2012)

Main treatment disciplines	Distribution of treatment measures by age, %			Distribution of all treatment measures, %	Distribution of all treatment measures converted to treatment time, %
	<18yrs	18-64yrs	>64yrs		
Anaesthesia	22.7	69.1	8.2	11.3	4.7
Prevention	73.2	21.7	5.0	8.4	7.7
Endodontics	9.2	80.9	9.9	3.8	8.2
Periodontics	15.8	67.6	16.5	6.3	9.7
Oral surgery	24.8	59.7	15.5	5.2	4.6
Other treatment	38.2	51.5	10.3	2.6	1.5
Orthodontics	97.2	2.8	0.01	8.0	7.3
Restorative treatment	20.4	65.3	14.3	21.0	26.2
Prosthetics	1.2	56.0	42.8	0.5	1.4
Treatment of bite dysfunctions	21.3	72.3	6.5	0.5	0.9
Certificates	31.4	57.5	11.1	3.4	2.2
Examinations	42.9	47.2	9.9	22.8	22.7
Complementary examinations including radiology	16.8	72.1	11.1	6.2	2.9
All treatment disciplines	36.4	53.2	10.4	100	100

Half of all treatment measures (53.2%) were provided on working age adults, a third (36.4%) on the young and 10.4% on the elderly (Table 2). Most preventive treatment (73.2%) and almost all orthodontic treatment (97.2%) were provided for children and adolescents. Most endodontic (80.9%), periodontal (67.6%) and restorative treatment (65.3%) had been provided for working age adults. Half of all examinations (47.2%) were provided for them too, and a slightly lower proportion (42.9%) for the young. A slightly lower proportion of prosthetic treatment (42.8%) had been provided for the elderly than for working age patients (56.0%; Table 2).

When treatment measures were converted into time, the share of anaesthesia and complementary examinations halved and the share of prosthetics tripled but remained low. The share of endodontics doubled and also the shares of periodontics and fillings increased slightly (Table 2). Overall, the pattern of treatment did not change much.

Regarding treatment profiles, on average, more than one examination or orthodontic treatment measure per patient was provided for children and adolescents. The next most common treatments in this age group were prevention and anaesthesia (Table 3). Among working age adults, restorative treatment, examinations and anaesthesia were the most frequently provided treatment measures. Periodontics and oral surgery were less frequent and prosthetics and treatment of bite dysfunctions were rare. Restorative treatment was the most usual treatment in the oldest age group, for whom the number of examinations was on the same level and the number of periodontal treatment measures somewhat higher than in the working aged. Prosthetics and treatment of bite dysfunctions were also rare in this age group (Table 3).

Comparing the geographical regions, most (77.9%) of the treatments provided for the young were carried out in the more populous Southern Finland: a national average of 4.7 treatment measures per child. Similarly for adults 78.3% of treatments were provided in Southern Finland. The treatment profiles were similar in both regions studied (Table 3). On average, almost the same number of treatment measures was provided for the elderly (5.3 per patient) as for

the working aged (5.6). Among the elderly, fewer restorative treatment measures, anaesthesia and complementary examinations were provided in the North than the national average for the age group.

Turning to treatment providers, a fifth (18.2%) of all treatment were provided by dental hygienists or dental assistants: a third (29.7%) of all on children and adolescents, 11.1% on working aged and 14.1% on the elderly. Dental hygienists and dental assistants had provided most of the preventive (77.3%) and periodontal (63.4%) treatment and 19.6% of the examinations. They had also provided orthodontic (13.6%), surgical (9.7%) and restorative treatments (1.2%). Southern and Northern regions were similar in all the above respects. Treatment provided by dental assistants was 2.0% of all treatment measures provided by the auxiliaries: for children and adolescents, 5.0%, working aged 0.3% and for the elderly, 0.5%.

## Discussion

The volume of data in this register study is huge and due to the high response rate can be considered to be representative for the PDS in Finland caters for practically all the young and about half the adult population (Widström *et al.*, 2013). No similar studies at the national level have been reported. Dentists' remuneration and billing of patients in the PDS have long been based on treatment provided and dentists can therefore be expected to have recorded their treatment carefully. In some local municipalities, dental hygienists also have additional productivity-based payments but this is the exception. Dental hygienists offer fewer treatments and dental assistants fewer still making recording their work easier. Codes of treatment items can, however, be interpreted differently. Therefore, it is usual to have repeated discussions on the codes and recordings in the local PDS units to achieve consensus, because over-recording means extra costs for the PDS. Thus, the overall assumption is that the data analysed can be considered reliable.

**Table 3.** Numbers of Finnish Public Dental Service treatment measures in 2009 per 1,000 treated patients by age: children and adolescents, working-age adults and elderly and by geographical region (Southern and Northern Finland) overall and for each class of treatment

Main treatment disciplines	Number of treatment measures per 1,000 treated patients by age group									All treatments per 1,000 treated patients (sd)
	under 18 years			18 - 64 years			over 64 years			
	South	North	All (sd)	South	North	All (sd)	South	North	All (sd)	
Anaesthesia	326	357	333 (130)	833	817	830 (221)	500	417	482 (202)	595 (170)
Prevention	778	844	792 (376)	189	206	193 (230)	216	225	218 (168)	439 (210)
Endodontics	45	47	45 (27)	329	322	328 (114)	206	160	196 (82)	200 (70)
Periodontics	135	112	130 (75)	459	440	455 (135)	563	478	545 (155)	333 (102)
Oral surgery	154	209	166 (74)	324	338	308 (118)	425	386	417 (184)	271 (86)
Other treatment	125	128	126 (273)	141	133	139 (180)	142	117	137 (222)	134 (208)
Orthodontics	995	1,053	1,007 (378)	23	27	24 (23)	0.4	0.5	0.4 (3)	421 (170)
Restorative treatment	548	574	554 (508)	1,437	1,529	1,457 (339)	<b>1,611</b>	<b>1,379</b>	1,561 (345)	1,104 (306)
Prosthetics	0.6	1.0	0.7 (1.9)	29	22	27 (23)	107	81	102 (80)	24 (24)
Treatment of bite dysfunctions	14	9	13 (79)	35	39	36 (26)	16	14	16 (21)	24 (34)
Certificates	147	112	140 (155)	220	173	210 (155)	<b>214</b>	<b>143</b>	199 (149)	181 (150)
Examinations	1,272	1,237	1,265 (268)	1,150	1,117	1,142 (349)	1,194	1,108	1,175 (403)	1,198 (302)
Complementary examinations including radiology	138	123	134 (82)	486	426	473 (212)	<b>383</b>	<b>260</b>	357 (167)	325 (143)
All treatments	4,677	4,804	4,705 (800)	5,625	5,569	5,613 (948)	5,469	4,687	5,303 (929)	5,224 (800)

Differences considered significant at the  $p < 0.05$  level following multiple test correction are marked in bold

Because some treatment items can be implemented quickly and others may take much more time, we wanted to check whether converting treatment items to treatment time would change the overall pattern of care provided. The recent time study (Tarvonen *et al.*, 2012) made it possible, although it was a local study and there were some newer codes that had to be adjusted to fit this material. The comparison showed that when measured as time, the proportions of prosthetics, endodontics, restorative care and periodontics increased and the share of anaesthesia and complementary treatment (radiographs) decreased. Overall, the differences were as could be expected, based on clinical experience indicating that treatment items provided can give a reasonable picture of the clinical activities in the dental service.

The great majority of treatment measures were provided in the south of Finland, where the majority of the population lives. Compared with a smaller study in nine PDS units some ten years earlier, it was obvious that a greater proportion of treatment measures in our study were provided on adults. This is natural, as adults' access to care has since been widened. The content of the treatment, mostly examinations and orthodontics, remained unchanged (Läärä *et al.*, 2006). This study also showed that those under 18 years of age were most often examined. Their oral health is good (Suominen-Taipale *et al.*, 2009; Widström and Järvinen, 2011) and especially good compared with adults and thus the need for so many examinations can be questioned. Children and youngsters have been prioritised in the PDS since the 1970s. This age group also received most (73%) preventive treatment measures – often provided by auxiliaries to make care more cost-effective. In 2009, it was still customary that non-specialised dentists undertook much orthodontic care, which explains the high numbers of orthodontic items provided. In past times, when the PDS mainly treated young people, orthodontic treatment was popular as it provided dentists with variety in their work. Today more of this work is provided by specialists and dental hygienists.

A nationwide clinical epidemiological study of adults in 2000 showed that periodontal diseases were common among them. The other significant and frequent finding was the absence of one or more teeth without prosthetic replacement, even in highly visible areas in the mouth. These findings indicated great treatment needs for both periodontics and prosthetics (Suominen-Taipale *et al.*, 2008). The more recent epidemiological study limited to the southernmost and northernmost areas in 2011 (Suominen *et al.*, 2012) showed some improvement in adults' oral health mainly slightly higher mean numbers of remaining teeth. Partial or full removable dentures were still common: 27% of those between 55–64 years, 50% of those between 65–74 years and 70% of those aged over 74 had removable dentures. Periodontal disease was diagnosed among 56% of women and 70% of men. Furthermore, 14% of the women and 28% of men had carious lesions. Most women (76%) and fewer than half of the men (45%) reported brushing their teeth more than once a day (Suominen-Taipale *et al.*, 2008). Those with low education and income had more treatment needs, worse oral health habits and used public dental services to a greater extent than persons with high education and income (Suominen-Taipale *et al.*, 2008; Suominen *et al.*, 2012).

Prosthetic treatment was uncommon. One explanation is that the PDS, until 2002 mainly catered for patients younger than 47 years and edentulous people were used to visiting

denturists. This means that the skills of PDS dentists for doing removable prosthetics may have been a bit “rusty”. Another recent study showed that the PDS did not provide crowns and bridges (Nihtilä, 2014). It has been shown that female dentists (77% of the dentists in the PDS in 2009) are not as keen on prosthetic treatment as are male dentists (Kronström *et al.*, 1977). Nor was periodontal treatment common and slightly more than half of it was provided by dental hygienists. A recent study showed that dentists considered their knowledge and skills in periodontology poor (Rantahakala *et al.*, 2012). Unfortunately, dental hygienists in Finland also have poor education in treating more advanced periodontal diseases and there are “millimetre limits” of how deep they are allowed to scale. Professional protectionism can lead to strange consequences and it seems obvious that both dentists and dental hygienists are in need of continuing education in periodontics. Few PDS units have specialists.

The main emphasis in adult dental care in the PDS was on restorative care and examinations indicating that treatment given did not correspond with the treatment needed. Provision and replacement of composite fillings has been shown to keep dentists busy (Forss and Widström, 2004; Palotie and Vehkalahti, 2002). This was also a finding of this study. Since 1994, when concerns about environmental pollution led to a recommendation to choose other filling materials than amalgam when possible, composite restorations have been placed with wide indications and crowns made of composite filling material are usual. Frequent semi-urgent replacement of lost and broken fillings by new fillings instead of more durable solutions has been shown to lead to heavy consumption of services and poor quality. Reasons given were lack of skills to do prosthetic crowns, lack of specialists locally, and lack of resources for specialist care (Nihtilä, 2014). Another explanation may be the high cost of prosthetic treatment, especially crowns and bridges, for patients (Widström and Seppälä, 2012). It should be noted that doing fillings was an easy and effective way of increasing the salary bonus of dentists in the PDS.

In adults, the numbers of examinations and periodontal treatment measures were lower and the numbers of restorative treatment items much higher, compared with the same year in Denmark (Holt, 2013).

Preventive treatment in adults has been shown to be unusual (Suominen-Taipale *et al.*, 2008) as in this study. Another rare treatment area was bite dysfunctions, probably indicating poor knowledge and skills in this discipline and, again, a lack of specialists. The differences in treatment between Southern and Northern Finland can be related to history, poorer economy and access to care and fewer teeth in the North (Widström *et al.*, 2010).

Task delegation has long been highlighted in Finnish dental care, on grounds of cost-effectiveness. In this study the high proportion of dental hygienists in the PDS could have been expected to have provided more treatment. Team working has not yet been widely adopted in dental care and more purposeful leadership both nationally and locally is required to achieve this. The highly decentralised PDS in Finland has weak local governance. Most chief dentists in the PDS have not sought their leading positions but have rather been persuaded into them. Except in large units, leadership is a part time job in addition to clinical work and most chief dentists do not feel they have the authority as leaders to change old routines (Alestalo and Widström, 2011; 2013).

Brennan and Spencer (2005) showed that dental service activity is influenced by a large number of small effects from a wide range of patient, dentist and practice factors and they called for more research into the outcomes of dental practice. Too little emphasis has been put into the content and quality of dental care provided in Finland. Although electronic patient information systems have become widespread in the PDS, their usability from the management perspective is poor. Every PDS unit is an independent register keeper and, according to current legislation, gathering data, even for benchmarking purposes, requires extensive authorisations. In addition, processing these data is arduous and requires special skills.

Our study gives a worrying picture of the extent to which the clinical efforts in dental care concentrate on restorative care. Sheiham (2005) recommended fewer dentists, intervening less often and reorientating their efforts to improving effectiveness and quality. This study supports his case.

The results also raise the question of the appropriateness of educating high numbers of dentists (four dental schools for 5.4 million inhabitants) and suggest that there rather is a need to start an educational program for dental therapists in Finland.

### Conclusions

Treatment provided in the Finnish PDS did not match the treatment needs of the population. Relatively healthy children had plenty of examinations and preventive treatment measures and adults had mostly restorative care when their needs were for more periodontal and prosthetic care.

### Acknowledgement

The study was supported by Kela, the National Insurance Institution of Finland.

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