Changes in utilization and cost sharing within the Danish National Health Insurance dental program, 1975–90

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The aims of the analysis were 1) to examine the development in utilization of dental care provided for adults in Denmark under the National Health Insurance during the period 1975–90; 2) to assess the appropriateness of available dental care statistics for studies of oral health trends; and 3) to analyze the price development of dental services during 1975–90 and its impact on patient and Insurance expenses, respectively. Utilization and economic data were retrieved from available registers and analyzed. Three trends were found. First, the utilization has increased more than what could be explained by the population increase; secondly, the panorama of dental services changed from predominantly restorative/extraction services to predominantly diagnostic/preventive services. Thirdly, the price paid by Danish adults for dental care increased disproportionately to other price developments in society. On the basis of traditional health economic theory this development could be expected to affect demand for dental services negatively.
□ *Dental care; dental health surveys; economics, dental; health services research; insurance, dental*

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The improvements in the oral health situation in Danish and other Western child populations during the past two decades are now well documented (1–3). Although this, in itself, is a positive achievement, the final evaluation of the long-term success of the development in children surely must be the outcome of the subsequent dental care of adult generations. However, in spite of the considerable public expenditure for dental care through the National Health Insurance (NHI), only one major representative adult oral health survey has been carried out in Denmark, in 1982–83 (4). With the dearth of adult oral health data, however, it could be considered whether there is a reasonable proxy for a full-fledged epidemiologic survey that would be more easily collected and would still show long-term trends in adult oral health. Spencer et al. (5) suggested that treatment statistics could be a valid and inexpensive source for discerning time trends in oral conditions. A Danish study based on NHI statistics illustrated the pattern of contacts and treatment services at one point in time (6), and relatively similar results were obtained through a dental practice survey comprising a representative sample of dentists reporting their work during a week (7). Studies in Sweden, Norway, Australia, and the USA (8–11) indicate that changes in dental treatment patterns were consistent with certain oral health changes in that increasing proportions of dental services comprised preventive services and decreasing proportions comprised services such as fillings. The first purpose of the analysis presented here was to examine the development in the provision of dental care for adults in Denmark during the period 1975–90, to assess the appropriateness of available dental care statistics for studies of oral health trends and to improve the basis for planning in the adult dental care system.

Additional to the outcome of dental care, cost is usually considered a prominent issue in dentistry (12, 13). Private and public expenditure for dental care in Denmark was studied in a private practice profile survey in 1974 (14), but subsequently, information on NHI costs and dentists' gross earnings have mainly been produced administratively by the NHI and the Danish Dental Association, respectively (15, 16). Only one study has suggested a possible socioeconomic demand model for dental visits on the basis of a sample of Danish workers (17). The study, however, did not collect information on expenses and actual price of dental care, which might be useful to understand choices and behavior of dental service consumers with regard to dental care. Thus, the second aim of the paper was to analyze the price development of dental services during 1975–90 and to investigate its impact on patient and NHI expenses for dental care, respectively.

Materials and methods

As suggested by Grytten (18, 19), this paper considers utilization as the amount of care provided to the population, operationalized by the number of individual dental services covered by the NHI, to analyze the pattern of utilization of dental services over time. The basic information about dental services provided to the adult Danish population was retrieved from the NHI

Table 1. Amount of dental services provided to Danish adults under the National Health Insurance in 1975. For explanation of DSU, see text

1 Dental service	2 No. of services	3 DSU factor	4 No. of. serv. per examin.	5 DSU weight	6 No. of DSU	7 Percentage of services
Examination	3,279,566	1.00	1.00	1.00	3,279,566	27.07%
Roentgenogram	839,588	1.17	0.26	0.30	982,318	6.93%
Scaling	1,745,056	2.17	0.53	1.15	3,786,772	14.41%
Filling						
a	1,890,237	2.08	0.58	1.20	3,931,693	15.60%
b	1,204,856	2.67	0.37	0.98	3,216,966	9.95%
c	509,449	3.50	0.16	0.54	1,783,072	4.21%
d	1,689,703	2.33	0.52	1.20	3,937,008	13.95%
Extraction	743,863	1.80	0.23	0.41	1,338,953	6.14%
Prevention	0	0.00	0.00	0.00	0	0.00%
Periodontal	0	0.00	0.00	0.00	0	0.00%
Endo + surg.	211,363	2.75	0.06	0.18	581,248	1.74%
Total	12,113,681		3.69	6.96	22,837,595	100.00%

dental services register for the years 1975, 1980, 1985, and 1990. The background and operation of this register are summarized below.

In 1973, a previous privately based, but government supported, sick fund system was replaced by a government enacted National Health Insurance (NHI), which also comprised a dental care component. All Danish citizens were automatically eligible from the age of 16. The specifics of the dental care program have been analyzed in several previous papers (20–22). In brief the program is based on general dental practitioners working within fee-for-service system consisting of an agreement between the NHI and the Danish Dental Association. The agreement, which is renegotiated every 2–3 years, contains a negotiated range of dental services; each service is specified as to its contents and its fee, of which either a certain percentage or a fixed amount is paid by the NHI as determined by the Minister of Health. Patients pay their own share directly to the dentist, whereas the NHI share is reimbursed directly to the dentist on the basis of the dentist's monthly claims, which are subsequently entered into the NHI dental services register. Since affiliation with the NHI is more or less a precondition for running a private dental practice owing to the reimbursements for patients, and since affiliation is only open to members of the Dental Association, which is responsible for the agreement on the dentist side, almost all private dental practitioners in the country are affiliated with both. Thus, monthly, the dental services register, which was also established in 1973, will reflect all NHI-covered dental services that private dental practitioners provide to the population. The dental services that have never been covered by the NHI are complete or partial dentures, gold crowns or bridges, and orthodontic services.

During the 1970s through the 1990s changes were introduced in the NHI dental care program, in response both to professional requests and to political and administrative demands for reductions in government expenditure for dental care to the public. Certain services, such as periodontal and caries-preventive services, were not covered in 1975 but were added to the insurance program after negotiation (23, 24) and were thus covered in 1985 and 1990. The government's wish to cut public expenditure was executed by reducing the reimbursement levels of the NHI and by abolishing a special youth dental care program, which had more favorable reimbursements to specific younger age cohorts (22).

Data analysis

To overcome some of the problems connected with an analysis of the economic impact of not only the reduced reimbursements but also changes in the relativities between individual dental services and the different price levels in 1975 through 1990, I chose to use a standardized measurement of dental services in all calculations. This standardized measurement, termed a Dental Service Unit (DSU), has been used previously in the planning of the Danish Dental Care System (25) and in a comparison of different treatment programs (26). The DSU is defined as the money value of a dental examination, and the dental examination is therefore assigned a factor 1.0. All other dental service items are weighted in relation to this unit in accordance with their monetary value and are hence assigned a conversion factor (DSU factor), as shown in Tables 1 and 2. The underlying values for the calculation of the factors are the prices agreed on by the NHI and the Dental Association and form the monetary basis of adult dental care in the country. During the period of study the monetary values of the DSU (as of 1 April the respective years) were as follows: 1975 = 31.43 DKK (Danish krone); 1980 = 40.33 DKK; 1985 = 55.43 DKK; 1990 = 99.09

Table 2. Amount of dental services provided to Danish adults under the National Health Insurance in 1990. For explanation of DSU, see text

1 Dental service	2 No. of services	3 DSU factor	4 No. of serv. per examin.	5 DSU weight	6 No. of DSU	7 Percentage of services
Examination	3,857,960	1.00	1.00	1.00	3,857,960	27.49%
Roentgenogram	1,564,966	0.80	0.41	0.33	1,257,943	11.15%
Scaling	3,239,419	1.77	0.84	1.49	5,733,795	23.08%
Filling						
a	728,397	1.41	0.19	0.27	1,027,504	5.19%
b	815,344	1.80	0.21	0.38	1,467,274	5.81%
c	423,481	2.36	0.11	0.26	999,661	3.02%
d	1,440,122	2.58	0.37	0.96	3,718,825	10.26%
Extraction	355,359	1.38	0.09	0.13	489,412	2.53%
Prevention	494,170	1.80	0.13	0.23	889,506	3.52%
Periodontal	591,104	1.80	0.15	0.28	1,063,987	4.21%
Endo + surg.	522,953	2.00	0.14	0.27	1,045,906	3.73%
Total	14,033,275		3.64	5.59	21,551,773	100.00%

DKK. In the calculations the current prices are used, and no deflation has been attempted. As a comparative basis for the price developments, the consumer price index, as calculated for the respective years by the Danish Bureau of Statistics, was used (1975 = 100; 1980 = 164; 1985 = 240; 1990 = 290).

Tables 1 and 2 contain the basic data for the subsequent analysis. For simplicity, only data from 1975 and 1990 are presented in table form, but similar tables were produced for 1980 and 1985. A brief explanation of the contents of the tables is provided here. The dental services listed in column 1 are those covered by the NHI; the actual list contains several additional subgroups, but they have been combined for this analysis for simplicity. Dental examination is the basic service provided at the start of a normal course of treatment. Four different filling types are distinguished: *a* is a one-surface amalgam filling, *b* is a two-surface amalgam filling, *c* is a three-surface amalgam filling, and *d* is a composite filling in the incisors. Although Scaling could be considered part of periodontal therapy, it was included in the schedule long before periodontal treatment was accepted in the program, and thus it has been kept separate here. Prevention covers mainly caries-related diagnostic and preventive activities and was only introduced in 1987, whereas periodontal preventive and curative services are grouped under Periodontal. Extraction is self-explanatory; although the term covers several options, for this analysis it may be considered the number of teeth extracted. Endodontics and surgical treatments are pooled into one group because of their relatively small size; reimbursement of surgical services is done by a fixed amount rather than a percentage. In Column 2, labeled number of services, the total number of services that year is given. Prevention and Periodontal are listed as 0 in Table 1 (1975), because they were introduced later, which is illustrated in Table 2 (1990).

Column 3 lists the DSU factors as previously defined for each dental service. Each factor is calculated as

$$\frac{\textit{Price of the service}}{\textit{Price of the dental examination}}$$

Thus, for example, scaling was 2.17 times as expensive as a dental examination in 1975 (Table 1), whereas in 1990 it was only 1.77 times as expensive as a dental examination (Table 2), owing to relative price corrections. Column 4 calculates the number of each service per dental examination. Since a course of treatment will traditionally comprise an initial dental examination and subsequently various other services, the column total expresses the number of services in an average course of treatment. The DSU weights in column 5 are multiplications of the previous two columns, thus expressing the number of DSUs in an average course of treatment. This factor will be used later for the price calculations. Column 6 indicates the total number of DSUs as a multiplication of number of services and the respective DSU factors. A further multiplication of the number of DSUs by the monetary value of the DSU the respective year would thus give the total amount of money used for adult dental care within the insurance program that year. The last column gives a simple percentage breakdown of the proportion of each service category over total number of services.

It should be emphasized that the number of patients cannot be deduced directly from this type of table, because a patient could have more than one course of treatment during the year. As a final note, demographic changes and an increase in the number of dentists took place during the period under study.

Results

During the period 1975 through 1990 the number of

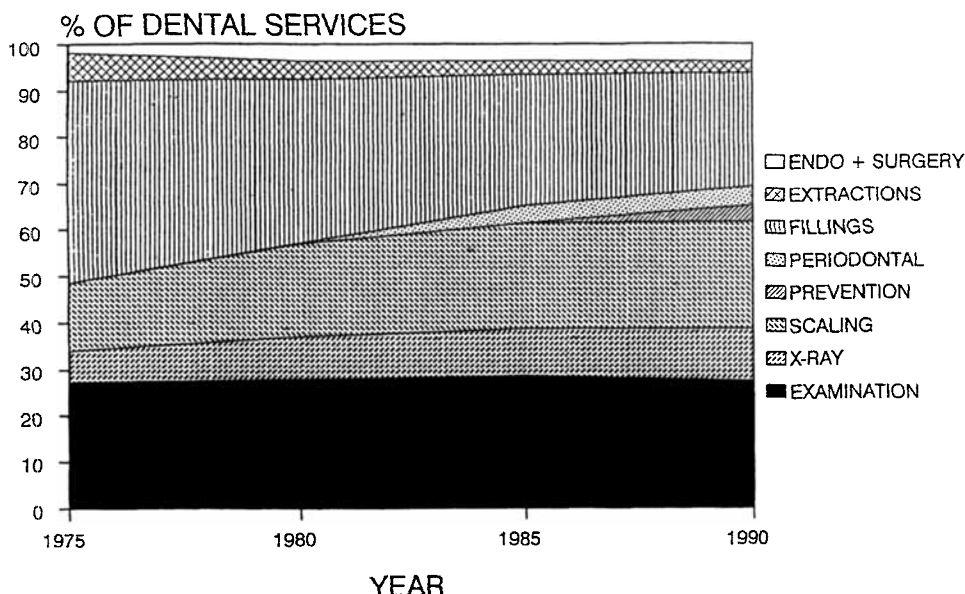

Fig. 1. Distribution of selected types of dental services provided under the National Health Insurance to adult Danes during 1975 through 1990.

dental services provided to Danish adults under the National Health Insurance dental program increased by 15.8%, from about 12 to about 14 million services (Tables 1 and 2). The population covered by the health insurance increased 7.9%, from 3.8 million in 1975 to 4.1 million in 1990. During this period the character and the mix of the dental services to adult Danish patients changed considerably, as illustrated in Fig. 1, which also covers the two intermediate years, 1980 and 1985. Overall, patients received more preventive-oriented services (that is, examinations, roentgenograms, scaling, prevention, and periodontics), less fillings, less tooth extractions and more endodontic/surgical treatments. At the beginning of the period the diagnostic and preventive-oriented services accounted for less than 50% of the total number of services, whereas at the end of the period they had reached almost 70%. The considerable reductions in the number of fillings and extractions (from about 50% to about 27%) were not equally distributed, the main reductions coming from one- and two-surface amalgam fillings, whereas the tooth-colored fillings decreased less (Tables 1 and 2). The number of endodontics and surgical services more than doubled, accounting for 1.7% of all services in 1975 and for 3.7% in 1990. Although the character of the dental services changed, the total number of services per dental examination changed very little (3.69 in 1975 to 3.64 in 1980; column 4 in Tables 1 and 2). Thus, the average course of treatment seemed to comprise almost the identical number of services, but with different contents.

Table 3. Danish National Health Insurance reimbursement percentages for dental services to adults, 1975–90

Year	Dental care program: Youth Dental Care Program	Dental care program: General Adult Dental Program
1975	75% Examination: 100%	66%
1980	75% Examination: 100%	66%
1985	60% Examination: 100%	50%
1990	Program discontinued	45% Certain preventive services: 65%

Table 3 illustrates the different NHI reimbursement levels for the general and the youth dental care programs during the relevant years. Thus, in 1975 young adults were offered free dental examinations and an NHI reimbursement of 75% of the price of most dental services (on the basis of the above-mentioned negotiated, fixed price), whereas adults in the general program received an NHI reimbursement of 66% of the price of most dental services (excluding those already mentioned). Gradual deterioration of the dental program then took place. In 1990 the youth dental care program had been abolished, and the whole population above 18 years of age was under the same NHI provisions of 45%

Table 4. Economic variables determining health insurance and patient costs for dental treatment in Denmark, 1975–90

Economic variable	Year of investigation				Period change, 1975–90
	1975	1980	1985	1990	
Dental Service Unit (DSU) value (DKK)	31.43	40.33	55.43	99.09	215%
Percentage change	–	*28%*	*37%*	*79%*	
Dental Service Unit (DSU) weight	6.96	6.91	7.09	5.59	–20%
Cost of course of treatment (DKK)	219	279	393	554	153%
Percentage change	–	*27%*	*41%*	*41%*	
Insurance share of cost (DKK)	153	192	189	233	52%
Percentage change	–	*26%*	*–2%*	*23%*	
Patient share of cost (DKK)	66	87	204	321	390%
Percentage change	–	*33%*	*134%*	*57%*	
Consumer price index	100	164	240	290	190%
Percentage change	–	*64%*	*46%*	*21%*	

reimbursement for most services, but 65% for certain preventive services.

In Table 4 some economic variables determining the cost of dental care both for the NHI and for the patients are summarized. All calculations are given in current Danish kroner (DKK) the respective year. The percentages indicate the change in the variable during the previous 5 years. From 1975 to 1980 the monetary value of all variables in the table—that is, the DSU in DKK, the cost of an average course of dental treatment, the NHI share of a course of treatment, and the patient share of a cost of treatment—increased more or less evenly, 26–33%, which was considerably less than the consumer prices, which grew 64% during these 5 years. From 1980 to 1985 the monetary value of the DSU and the cost of an average course of treatment and the consumer price index increased by 37–46%. However, the cost sharing between the NHI and the patient changed dramatically. The NHI cost decreased by 2% and the patient cost increased by 134%, partly as a consequence of the reduction in reimbursement rates, as shown in Table 3. From 1985 to 1990 the monetary value of the DSU increased considerably more than consumer prices, whereas the NHI cost followed the consumer price index quite closely. The relative increase in the cost of a course of treatment was less than the increase in the cost of a DSU. This was due mainly to the considerably lower DSU weight (6.96 in 1975 (Table 1, column 5 total) against 5.59 in 1990 (Table 2, column 5 total)), which was the result of the combined changes in number of dental services (3.69 in 1975 (Table 1, column 4 total) against 3.64 in 1990 (Table 2, column 4 total)) and reductions of the DSU factors of most services, as illustrated by comparing column 3 in Tables 1 and 2.

For the whole period under investigation the cost of an average course of dental treatment increased more slowly than consumer prices in general (153% against 190%). However, in 1975 the NHI covered 70% of this cost and the patient 30%, whereas in 1990 the coverage was 42% for the NHI and 58% for the patient (Table 4); thus a patient's out-of-pocket expenditure for an average course of treatment was considerably higher.

Discussion

There is no doubt that the pattern of dental services is a valid expression of actual dental care in the adult Danish population within the NHI-covered spectrum of dental services. The major weakness of the data is that they do not reflect the dental services provided outside the NHI—that is, mainly fixed and removable prosthetic work. In a previous analysis it was found that both in 1980 and 1983, these services constituted approximately one-third of the dental services provided to the adult population (25); that is, the services illustrated in Tables 1 and 2 constitute around two-thirds of all services provided. The proportion seems to be quite stable, and these services have always been paid 100% by the patients themselves without any other price limitations than those defined by the general price laws. Thus, they could be considered an additional constant price factor on top of the dental service cost involving the NHI, and they will not be considered further in this analysis.

The trends in utilization among adult Danes are similar to trends presented from Sweden (8), Norway (9), the United Kingdom (27, 28), Australia (10), and USA (29, 30). Whether the dental service pattern illustrated also reflects the oral health development in the population is an intriguing question. The decrease in fillings and tooth extractions and the increase in endodontic services might, however, be an indication of such changes. During the period 1974–91 the DMFT of 15-year-olds in Denmark decreased from around 9 to around 3 DMFT, the proportion of caries-free individuals increased from around 3% to around 25%,

and the proportion with only occlusal caries experience increased from around 20% to around 45% (1). These are the age cohorts that have successively entered the adult dental care program during 1975–90. In spite of such trends, discrepancies between epidemiologic findings in a study population and subsequent dental treatment pattern have been pointed out (31, 32). With reductions in tooth extractions, some increase in endodontic treatments might be expected as an alternative to extraction. Indeed, this development is reflected in the data, with almost 400,000 fewer extractions and around 300,000 more endodontic/surgical treatments. The impact on the need for or the provision of dentures cannot be extrapolated from these data, but overall, the percentage of denture wearers in the adult population has decreased from 38% in 1975 (33) to 27% in 1990 (in press), with the major changes taking place in the younger cohorts. With more remaining teeth, increased need for periodontal treatment should be expected (34). Before the inclusion of periodontal services in the NHI dental care program, information was available showing a considerable need for periodontal services in adults (4, 34), although doubt was expressed as to the effectiveness of the treatment. It is noteworthy that the acceptance of the periodontal treatments during the pilot phase of the introduction of the periodontal program was very slow and very uneven among dental practitioners (24) and that the periodontal treatments, apart from scaling, still only constituted around 4% of all treatments in 1990 (Fig. 1), similar to findings in the USA (30) but higher than rates reported from Australia (35). More recent data, however, indicate that periodontal services have continued to increase after 1990 (36).

Overall, the number of dental services provided by the general dental practitioners to the adult population increased by 2 million, or 17%, whereas the insured population only increased by 0.3 million, or 8%. This could indicate one of two underlying developments: either an increase in utilization—that is, an increase in the number of dental services holding the population constant—or an increase in demand—that is, an increase in the proportion of the population who took up dental care, holding the dental services constant, or a combination of the two. According to Table 1 and Table 2, column 4, the number of dental services per dental examination decreased from 1975 (3.69 services) to 1990 (3.64 services), and each patient who actually went to a dentist during these years received an average of 1.5 dental examinations (Sygesikringens Forhandlingsudvalg, personal communication) (36). This might indicate an increasing demand by the population. Supply of dental manpower could have an impact on these results as well, both from the point of view of supplier inducement, as suggested by Grytten (18, 19), which would probably mainly influence utilization, and from the point of view of improved accessibility to dental services, which might influence both utilization and demand. In fact, the number of dentists enlisted in the NHI increased from around 3000 in 1975 to around 3700 in 1990 (Sygesikringens Forhandlingsudvalg, personal communication), which implies that the average number of DSUs per dentist decreased from 7610 DSUs in 1975 to 5825 DSUs in 1990, possibly indicating an increased competition among dentists. They might have compensated for this development by providing greater utilization of services not covered by the NHI. The present data cannot elucidate this problem. However, an analysis of dentists' total earnings compared with earnings from the NHI during 1980 to 1983 showed that the gross income from dental services covered by the NHI was relatively stable (25), although this could have changed when the NHI changed the reimbursement rates. An additional restraint on dentists was the growing interest in the dental care market by the governmental price-controlling agency (37).

Price changes in the dental services were mainly due to reductions in the government reimbursements and were part of larger financial political initiatives intended to revise the cost sharing between the government and users of public services. Public expenditure for dentistry through the NHI is constantly monitored, and if utilization exceeds the budget, dentists will be 'punished' in subsequent negotiations with the NHI by, for example, having to accept a reduction in the relative price of a particular dental service item. It is similar to, but not identical with, the UK system of the General Dental Service with the Dental Estimates Board and the Doctors' and Dentists' Review Body.

In conclusion, three trends have been demonstrated in the provision of dental services to Danish adults insured under the NHI system during the period 1975–90. First, the utilization has increased more than what could be explained by the population increase; secondly, the panorama of dental services changed from a predominantly restorative/extraction-dominated pattern to one characterized by predominantly diagnostic/preventive dental services, but still with a considerable restoration element. Thirdly, the price paid by Danish adults for dental care increased disproportionately to other price developments in society, mainly due to manipulations with the NHI reimbursement rates. On the basis of traditional health economic theory this development could be expected to affect demand for dental services negatively. These aspects will be studied in a subsequent report.

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