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before and after subsidisation reform
in Finland**

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DISCUSSION PAPER 149

**DENTAL UTILISATION BY YOUNG ADULTS BEFORE AND AFTER
SUBSIDISATION REFORM IN FINLAND**

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ABSTRACT

Dental care was never fully integrated into the welfare state in Finland, but in 1986 it was decided to improve access to both publicly and privately provided dental care by reducing the price paid by patients. Since this would have been rather expensive to do for the whole population, it was decided to introduce it gradually, starting with the young adult population (those under 21 already had free publicly provided dental care).

The so-called "Subsidisation Reform" (SR) was based on the assumption that the seeking of care would increase, as would the amount of care actually provided, and this increase would be spread across both the public and the private sectors.

This study investigates the short-term effects of this reform. The seeking of care did increase, but the amount of care actually provided, decreased and the changes were not evenly spread between the two sectors. The reasons for these changes are explored, and some of the inherent difficulties in evaluating health care reforms are set out, since they are likely to be of wider significance than this particular reform in Finland.

INTRODUCTION

Supply conditions before the subsidisation reform

Before the subsidisation reform in 1986, publicly funded dental care was organised only for the Finnish population up to the age of 21 in the whole country. It was provided through health centres, which covered almost the whole public sector provision. Dental care had been free for the age groups 0 - 17 since 1972 and the rest had to pay about half of current private prices.

The adult population was able to receive services either from the private or public sector. However, access to and out-of-pocket prices of, dental services were dependent on place of residence due to differences in supply conditions between sectors. There was no direct public funding for the private sector, while the public sector was and still is financed mainly from tax revenue. Hence, patients had 100 % out-of-pocket payment in the private sector, compared with only about half of that in the public sector. In effect, the difference is an estimate, because private practitioners were working on a fee-for-service basis but the health centres itemised things in a much more simplified manner, and dentists there had salaried lifetime posts. Almost the same number of dentists were working in each sector. However, they were not distributed equally all over the country. There had been complete freedom for private practitioners as entrepreneurs to practice in any location, while the personnel for the health centres had been allocated under a strict planning and control system of central government since 1972 in order to improve overall access to dental care in the whole country. As a result private services were concentrated in densely populated areas (mostly cities), where the provision through health centres was restricted only for the population up to the age of 21. Meanwhile the health centres provided dental care to the whole population in remote and rural areas.

Thus, geographically, there was inequity both in access to, and consumer prices of, dental care among the adult population. At that time the policy interest focused on lack of public subsidy for young adults, because they had been free dental care attenders since childhood and were now growing out of the existing subsidy system. Moreover, there was a reluctance to jeopardise the achieved good results in oral health and wide coverage of dental care among them. For example, in 1982, about 80 % of 0-18 year olds had visited a health centre for dental care. In addition, it proved to be politically impossible to concentrate the expansion of dental care provision only on health centres and neglect the whole private sector.

The Subsidisation Reform in 1986

As a result of tedious political negotiations between different interest groups it was eventually decided to implement a policy change called a subsidisation reform (the SR) in the dental care market. The SR was introduced in January 1986. However, implementation started gradually. Firstly, the SR of dental care was introduced for children and young adults who were born after 1960. The oldest eligible age group was 25 year olds in 1986. The eligibility remained permanently, because the criteria was the birth year. There was an implicit promise to lower the critical birth year later on and gradually to cover the whole population. As a consequence of the SR, National Health Insurance was extended to cover dental care, specifically, private dental care. The reimbursement rate became 60 %, excluding orthodontic and prosthodontic services. Dental charges in the public sector were lowered by 40 % for the age group 18-25 years and examination and preventive care were free of charge. The price ratio between the private and public sector remained approximately unchanged at 2 to 1. Overall the availability of dental services improved in the public sector due to the SR. The number of health centre dentists was increased and the privilege of using public sector services was extended to cover the age group of 0-25 years. A more detailed description of the SR can be read elsewhere (Arinen and Sintonen 1994). In brief, the effect of the SR was a decrease in price of roughly 50 %, and an improvement in the availability of dental services in the public sector. It was also the the first trial carried out by the government to coordinate public and private dental care supply, linking the private sector to the Finnish dental care market through national insurance.

The goal set for the SR was to remove possible financial barriers to seeking dental care from either sector, in order to maintain the good oral health status and wide coverage of dental care that the age group entitled to the SR had achieved earlier. The obvious assumption was that due to the SR, the seeking of care will increase, it will be distributed covering both sectors, and the amount of care consumed will also increase.

Earlier research about dental care reforms

There are few earlier studies on the effect of price changes on the utilisation of dental care. In Sweden Barenthin (1976) compared the utilisation of dental care, measured by the number of people seeking care, before and after the National Dental Health Insurance was introduced in 1974. The results indicated a decrease in that number. However, the results can be questioned, since the data on utilisation before the reform were based on interviews carried out in one municipality only after the reform, whereas data on utilisation after the reform were based on actual statistics.

Parkin and Yule (1988) studied the effect of changes in patient charges on utilisation by using time series data (1962-81) from the NHS in Scotland. Only a weak and negative connection was found between utilisation and charges. The rise of patient charges affected less the seeking of care than the amount of care and type of services provided in a course of treatment.

In the United States a randomized trial in health insurance was made to find out the effect of cost sharing on utilisation of dental services. The follow-up time was five years and coinsurance rates were 0 % (free plan), 25 %, 50 % and 95 %. The utilisation was measured by probability of any use, dental visits and expenses (including copayment). Results (in the middle of the follow-up-time) indicate that utilisation of dental services increased significantly as cost sharing declined. Enrollees in the free plan had 34 % more visits and 46 % higher dental expenses than enrollees in the 95 % coinsurance plan. The impact of cost sharing was concentrated between the free and 25 % plans (Manning et al 1986).

The aim of the study

This work is a part of an evaluation project of the SR. The evaluation was restricted to the utilisation of dental services. The concept of utilisation was defined as a process consisting of three decisions 1) seeking of dental care, 2) choice of dental care sector and 3) amount of dental care including a) the number of visits and b) the service-mix. In this paper we are looking at the seeking of dental care and amount of care (measured by the number of visits). The short-term effects of the SR in 1986 and 1987 were examined. More specifically, we tackle the following questions:

1. Which factors affect the seeking of dental care and the amount of care?
2. Has the relative importance of those factors changed as a result of the SR?
3. Has there been any change in the seeking of care and/or in the amount of care as a consequence of the SR, when the effects of other factors have been controlled?

THEORETICAL BACKGROUND

The theoretical underpinning of this study is based on a model developed for dental care by Sintonen and Maljanen (1995). The starting point of the model is that in order to understand utilisation one has to understand and combine the behaviour of clients and suppliers. For the demand side, elements have been picked from the Grossman-type approaches of Holtman and Olsen (1976), Pedersen and Pedersen (1980), Keeler

et al. (1977) and Cropper (1981). The supply side has its roots in the discussion of supplier inducement and rationing begun by Evans (1974) and Cooper (1975) respectively. Both sides are complemented with factors considered relevant in the Finnish dental market.

The demand side

Due to cross-sectional empirical data, it is assumed that people are one period utility maximisers with $U = U(H,Z)$, where H is the stock of oral health and Z stands for all other commodities. Demand for oral health $D(H)$, according to traditional demand theory, is negatively related to the price of oral health per unit P_h and constraining income Y , and is positively related to the prices of all other commodities P_z and "tastes" ie. the value people place on oral health mainly as a source of consumption benefit V_h . Thus:

$$D(H) = h(P_h, P_z, Y, V_h)$$

P_h is dependent on the prices of the inputs of oral health production. The input of special interest here is dental care C with a shadow price P_c . Other inputs, K , are goods and time devoted to self and oral hygiene with P_k . Since Y presumably affects the opportunity cost of the time inputs:

$$P_h = f(P_c, P_k, Y)$$

On the basis of the model it is assumed that a rise of price will cause a decrease in utilisation. The price of dental care includes money price charged for the care (out-of-pocket payment), monetary travelling costs, the opportunity cost of time required by the care (travelling + waiting + treatment time), the potential loss of earnings due to visiting a dentist during working hours and the disutility that people may derive from dental care in the form of fear and pain.

Due to the SR, the out-of-pocket price decreased for the group covered by the reform. So we hypothesize, that the utilisation of dental care will increase.

It is also assumed that a loss of oral health stock and an increase in income or/and the value of oral health will increase utilisation. The value of oral health is related to characteristics of individuals and actions of the providers. Generally, women and the well-educated usually appreciate oral health more than men and the low-educated. This should increase the use of dental services and the use of dental care. However, the net effect of these factors is theoretically uncertain, because they also have an opposite effect on utilisation through better knowledge, selfcare and oral hygiene.

The supply side

It is assumed that the suppliers maximise their utility which is dependent on income, Y, and leisure, L:

$$U = U(Y, L)$$

Firstly in considering the private dentists, they worked (up to 1992) on an almost fixed fee-for-service basis. Their gross income per period can be written as:

$$Y = t \times N \times p \times v \times s \times f,$$

where t is working time, N the number of potential clients (the population of the catchment area), p the probability of a visit per dentist's working hour, v the average number of visits per client, s the average set of services and f the average fee.

The fixed fees and given stock of dentists means that at any moment there is only one aggregate level of care that realises the desired income-leisure optimum. (The Finnish private practitioners used to follow a fixed fee-schedule up to 1992.). Apart from fees and the population of the catchment area, private dentists can affect all the other variables in choosing their level of supply. Inducement is about affecting them to increase income from the level generated by autonomous demand. Personal recalls to raise p and/or increasing v and/or s would be such actions. Actions aimed at a certain individual are referred to as personal inducement. In the Finnish dental market one can speak also of general inducement, which is an indirect way for providers to influence on the probability of a visit per dentist's working hour. It takes place through the continuing, strong and systematic efforts of dental authorities, the Finnish Dental Association and individual providers to make people adopt a regular pattern of visiting a dentist.

Rationing is about affecting the variables in the above equation to reduce autonomous demand. Reducing t , decreasing p by increased waiting or queuing and/or reducing s should have that effect.

The health centre dentists work on a salary basis. Hence, it is assumed that in choosing the supply of care consistent with their income-leisure optimum, they can primarily affect the amount of extra time worked, and also p , v and s in the above equation (Sintonen and Maljanen 1995).

MATERIAL AND METHODS

The study design

The original study design was intended to be quasi-experimental, because you cannot have full control over an intervention like the SR, which is organised by the government. It can be called a natural experiment. Separate randomly equivalent subgroups from the target group of the SR were compared before and after the intervention. One sample was measured prior to the SR in 1985, an equivalent one subsequent to the SR in 1987. These subgroups are called study groups. The study group consisted of 19 - 25 year olds, that is, the oldest age groups who were entitled to the SR in 1986. For control (as a substitute for control group) a comparison group was included consisting of the youngest age group left outside the reform. It was not possible to segregate an age equivalent subgroup, because the whole population under 26 years of age was covered by the SR.

Sampling took place in two stages. Firstly four municipalities with different supply conditions before the SR for the study group were chosen nonrandomly. The municipalities were Jyväskylä, Kuusamo, Vantaa and Turku. Only 19-24 year old Vantaa citizens got free public dental care before and even after the SR. No private dental care was available in Kuusamo. Only acute public dental care was available in Turku to those aged over 21 years before the SR.

In the second stage a random sample was drawn from the population of young adults of each municipality. Following the equivalence of subgroups, the study group was aged 19 - 25 years before and after the SR (each 1875 observations). The comparison group was aged 26 years in 1985 and aged 27 years in 1987 (each 375 observations), because the SR already covered those aged 26 years in 1987.

The data were gathered through mail questionnaires in November - December 1985 and 1987. The questionnaires were virtually identical on both occasions. The final response rates were 80% (1985) and 75% (1987) for study groups and respectively 81% (1985) and 80% (1987) for comparison groups.

Dependent variables

The analysis focuses on the number of dental visits during a 10 months period before the data collection as a measure of utilisation. The indicators were for a) the seeking of care: the dichotomy of visits: 0 if no visit and 1 otherwise, and b) the amount of care: the number of visits given that it was positive. The frequency distributions of visits are given in table 3 in connection with the results.

Independent variables

The empirical counterparts of theoretical variables and their hypothesized effects on seeking care are given in table 1. Upwards arrows refer to positive associations and vice versa.

Table 1 also gives definitions of the independent variables. However, some definitions need extra clarification. The money price (SPRICE) includes elements about an objective price charged by a supplier and elements about a potential client's opinion about that charge. Firstly, the respondents were asked to estimate what the charge could be in the public sector for a treatment costing 100 Fmk in the private sector. Secondly, if the respondent reported choosing the public sector should he visit a dentist at the moment, the SPRICE variable got a value of the above-mentioned estimate. If the choice would be the private sector, it got a value of 100. In the study group in 1987 the value of the SPRICE variable was still multiplied by 0.4 for finding out the effect of the SR. This multiplier reflects an objective change in price. All values were then divided by 100. The other measures of price were: time price (VISTIME), indirect price (INCLOSS) and psychological price (FEAR). The loss of health stock was measured by acute ache during 10 months.

The variable measuring the influence of general inducement (GENINUC) was constructed as Sintonen and Maljanen (1994) proposed. First, a logit model for the reported pattern of regular dental care attendance was estimated with factors presumably affecting tastes as independent variables (many of which are also related to the utilisation itself). The residual of the model measures the extent to which an individual values oral health and has therefore adopted a regular pattern of care over and above what one would expect on the basis of the variables in the model, i.e. for

other omitted reasons. It is argued that the most important omitted variable, whose effect emerges here is the unobservable variable of general inducement (plus of course measurement errors). Therefore a rough measure of general inducement for each individual was defined as follows: $GENINUC = (1-\hat{u}) \cdot (\text{regular dental attendance})$, where \hat{u} is the predicted individual probability of a regular pattern. $GENINUC$ takes a value of 0 for the individual without a regular pattern, otherwise $1-\hat{u}$. By inserting $GENINUC$ into models for utilisation it is possible to find out first, how general inducement affects utilisation through regular attendance pattern and second, the total effect of other regressors (direct + through regular attendance effect).

The $DENSITY$ variable is assumed to reflect primarily the local incentive to personal inducement. $DENTINIT$ variable can be seen as a direct act of personal inducement.

The SPRICE and DENSITY variables have a special position in this study. As a consequence of the SR they changed. In essence, the SR was changes in values of these variables - the out-of-pocket price decreased in both sectors and the supply increased in the public sector. Hence, the SR can be operationalised by measuring these changes. Therefore these variables were named the SR-variables. The others are just control variables. Table 2 sets out descriptive statistics for independent variables in study and comparison groups.

Table 2. Descriptive statistics for independent variables: means and SDs for continuous ones and percentages of 1 to all for dummy variables

Variable	Study group		Comparison group	
	in 1985	in 1987	in 1985	in 1987
FEMSEX*	50%	43%	51%	45%
ACUTNEED*	21%	21%	25%	27%
INCOME	3.09 (2.38)	3.62 (2.58)	4.24 (2.21)	5.00 (2.21)
HIGHEDUC*	28%	29%	34%	35%
LOWEDUC*	18%	14%	25%	22%
GENINUC	0.19 (0.22)	0.20 (0.21)	0.23 (0.26)	0.22 (0.25)
DENTINIT*	15%	14%	8%	9%
INCLOSS*	31%	31%	38%	44%
VISTIME	0.80 (0.43)	0.77 (0.42)	0.85 (0.49)	0.78 (0.34)
SPRICE	0.54 (0.32)	0.20 (0.14)	0.68 (0.31)	0.77 (0.33)
FEAR*	41%	41%	38	41%
DENSITY	1.15 (0.49)	1.18 (0.44)	1.12 (0.49)	1.17 (0.50)
Observations (N)	1502	1414	305	301

*Dummy variables

Statistical Models

A frequency distribution of dental visits is not normal. It is typical that a large proportion of observations have no visit, a majority some visits and only few more than ten visits. In addition, all values are non-negative integers. These salient features of the dependent variable have often been neglected. In earlier analyses normal linear regression modelling was applied (e.g. Holtman and Olsen 1976). A further step was the tobit model, which deals with zero-observations (Manning and Phelps 1979). In the two-part model, the first dependent variable is set equal to 1 for those visiting a dentist and equal to 0 for non-visitors and second non-visitors have been dropped out and this zero-truncated data is regressed. This method allows separate investigation about the decision to seek care and the number of visits. Manning and others (1981) used zero-truncated normal regression. Fitting all these models (and some of their variants) into the same data has shown that the parameter estimates and even their signs differed considerably (Mueller and Monheit 1988, Sintonen and Maljanen 1994).

In effect, none of the above models are suitable, since the question is about discrete count data (Gurmu and Trivedi 1992, Winkelmann and Zimmerman 1992). When modelling count data, considerably more attention must be paid to model specification (Cameron and Trivedi 1986). A model that exploits the characteristics of the distribution can provide more precise estimates. The first applications of count data modelling to dental visits were made by Manning et al (1986). The model finally chosen was a standard negative binomial regression.

In this study count data modelling was also applied. All models were estimated with maximum likelihood methods (Hausman et al 1984, Greene 1989, Rosenqvist and Strandvik 1989). The model specification will be presented in results.

A test for comparing estimates in separate models

Pooled data from 1985 and 1987 were analysed for the equality of parameters of the estimated models for 1985 and 1987 by using a LR-test resembling CHOW-test (Kennedy 1993). The formula of the test statistic is $-2 \ln[L_1 : L_2]$. $\ln L_1$ is log-likelihood function of a logit model of the $Y = f(X)$, where X is a vector of independent variables. The other log-likelihood function ($\ln L_2$) is for the same data by using a model of the form $Y = f(X, DX, D)$, where D is a dummy taking a value of 1 for 1987 and 0 for 1985 and D stands for the vector of original independent variables multiplied by the dummy variable. The test statistics is chi-square distributed and gets a significant value, if the original models (for 1985 and 1987) are different as a whole. If any of the coefficients of DX variables is

significant, it implies that the coefficients of the corresponding original variable differ significantly.

Prediction of net effects by models

As a consequence of the SR, the reform variables changed as mentioned above. However, changes not due to the SR might occur also in control variables. Hence, the picture of the changes in utilisation obtained from frequencies and means of dependent variables is incorrect. For controlling these other effects the net effect due to the SR was predicted by estimated models. To get the predicted probability of seeking care in 1985 (A), the means of all the variables in 1985 were placed into the estimated model for 1987. Apart from reform variables, the means of the control variables in 1987 were then replaced into the model to get a prediction of the probability of seeking care in 1987 without the SR (B). The difference B-A indicates the change in the probability brought about the changes in the values of the other variables. Finally, the means of reform variables in 1987 were inserted into the model together with the 1987 means of the other variables to get a prediction of the probability of seeking care after the SR (C). The difference C-B is expected to reflect the net effect of the SR on the probability (Δp). The net effect of the SR on the average number of visits given positive (among visitors) was worked out in the same fashion as above. The average number of visits at the level of the whole sample was obtained by multiplying the probability of seeking care by the expected number of visits.

RESULTS

Table 3. *Frequency distributions (%) of dental visits and their means and variances in research and comparison group in 1985 and 1987.*

<i>Year</i>	Number of visits									mean	var.
	0	1	2	3	4	5	6-10	>10	(N)		
Research											
<i>1985</i>	53	13	10	8	5	4	6	1	1502	1.6	6.9
<i>1987</i>	51	16	12	7	5	3	6	1	1414	1.5	6.0
Comparison											
<i>1985</i>	48	11	11	8	6	5	10	1	305	1.9	7.4
<i>1987</i>	55	7	9	9	6	5	7	2	301	1.8	8.8

Table 3 presents the frequency distribution of dental visits (%) in the study and comparison groups in 1985 and 1987. The frequency distributions in both groups resemble each other. Typical of the data is a large number of zero-observations. The

distributions are very skewed - the variances exceed the means. The statistical properties of the distributions do not satisfy those of the Poisson distribution.

Nevertheless a natural starting point for count data modelling is the Poisson distribution (Cameron and Trivedi 1986). Mullahy (1986) has pointed out that appropriate treatment of zero counts is of relevance because it provides a natural alternative or complement to common procedures for dealing with over- or underdispersion. According to Rosenqvist and Strandvik (1989) the inclusion of explanatory variables can also decrease overdispersion. The high log-likelihood value indicates better fit. More statistical information about the modelling process is given elsewhere (Mullahy 1986, Rosenqvist & al 1995).

The following models were tested:

- (I) *standard Poisson regression*
- (II) *standard negative binomial regression* (NBDX)
- (III) a two-part model consisting of
a binomial logit model plus zero-truncated Poisson regression
- (IV) a two-part model consisting of
a binomial logit plus a zero-truncated NBDX - model.

In the two-part models the log-likelihood values consists of two parts, one for the logit and one for the zero-truncated model, which are maximised separately. In the logit model the dependent variable indicates the decision to seek care and zero-truncated analysis indicates the number of visits among visitors.

Models were estimated separately for the study group and the comparison group before and after the SR. As an example, log-likelihood values are given in figure 1 for the study group after the SR.

Figure 1. *Count data modelling process and log-likelihood values for the study group in 1987*

(I) Poisson -2835	(II) NBDX -2256
(III) Logit+ truncated Poisson -2263	(IV) Logit+truncated NBDX -2126

Clearly, the Poisson and NBDX models do not fit the data as such. It is concluded that the zeroes are generated by a different process than the rest of the data, which confirms a tentative experience about processes. Further, for the positive observations the truncated-NBDX fits significantly better than truncated Poisson. Similar results were obtained for all subsets of the data.

Factors related to seeking of care and amount of care

The parameter estimates and their standard errors of the logit models for seeking of care are presented for the study group in table 4 and comparison group in table 5. In the study group a positive association was found as expected with ACUTNEED, DENSITY and GENINUC variables and a negative one with SPRICE, VISTIME and FEAR variables. Only the parameter estimate of SPRICE in 1987 was not statistically significant. Also in the comparison group the parameter signs of these variables were as expected, but some without statistical significance. An exception was DENSITY-variable, whose effect was negative and statistically insignificant in 1987. The reason for this may be the inaccuracy of this variable in the comparison group. The coefficient of the DENTINIT-variable seems to vary in sign and statistical significance - maybe due to its small variance, that is, there was very little personal inducement in this respect. The probability of seeking care appears to be higher among women than men. Other hypotheses do not seem to verify.

The parameter estimates of the NBDX-models for the number of visits are also given in tables 4 and 5. There seems to be very few statistically significant coefficients. In the study groups only the ACUTNEED-variable behaved as expected. The signs of the rest of the statistically significant coefficients were against expectations and were found only either in the model of 1985 or 1987. In the comparison groups the coefficients were, with one exception, statistically insignificant. The low values of the log-likelihood functions indicate the same result - these values can be regarded as weighted sums of t-tests.

The relative importance of the factors changed as a result of the SR

The effect of the SR on the parameter estimates was studied by comparing statistically the 1985 and 1987 models. H_0 restricts the parameters to be the same before and after the SR. The results of the log-likelihood ratio tests for stability of models are in table 6. It is concluded that the SR has mainly affected the process generating the number of visits to the dentists, given that there is a positive number, whereas the process governing the binary outcome of seeking dental care has not significantly changed.

Table 6. Likelihood ratio tests comparing models before and after the SR.

	Chi-square	d.f.	p-values
Study group			
<i>logit</i>	16.1	13	>0.1
<i>truncated NBDX</i>	42.6	13	<0.001
<i>two-part model¹⁾</i>	59.2	26	<0.001
Comparison group			
<i>logit</i>	18.1	13	>0.1
<i>truncated NBDX</i>	8.5	13	>0.5
<i>two-part model¹⁾</i>	59.2	26	>0.1

¹⁾*two-part model consists logit + truncated NBDX*

The net effects

The net effects (Δp) were predicted only for the study group. It was not possible to do it for the comparison group, since the estimated coefficients of its NBDX-models were not significant and the change in DENSITY does not represent a change for the comparison group.

The net effect of the SR by using both the logit model for 1985 and 1987 suggest that the probability of seeking dental care had risen because of the SR by 5.5 %-points, in other words 13%. The mean number of visits among those who had gone to a dentist had fallen by 0.58 or by 17%. This prediction is based on the 1987 NBDX-model, because the 1985 model appeared different and the data fit better the 1987 model. The mean number of visits for all cases fell by 0.08 or by 6%.

DISCUSSION

The importance of an evaluative study about health care reforms is generally accepted (WHO 1993), but implementation is often quite problematic. In essence, the aim of these studies is to tease out whether the special intervention has an effect or not and how large the possible effect is. Therefore, a clearly defined intervention and a controlled experimental study design would be important prerequisites for sound results. Specifically, threats to internal validity (e.g. history and maturation effects) could thus be minimised (Campbell and Stanley 1966). Unfortunately, in practice, a social reform as a

study object does not allow that. Usually, any social reform is not under a researcher's control but constantly changing in content, and choosing equivalent subgroups randomly for control has often proved to be difficult. Consequently, the reliability of results inevitable decreases. Thus a researcher has been set between Scyllia and Charybdis. In order to implement an evaluative study s/he must compromise these issues.

During the process of this study we have faced these problems frequently. When planning the project a panel design was rejected due to the expected high loss of respondents ("experimental mortality") in consequence of great migration in the age groups under study. A comparison group was introduced into the design with the same purpose as a control group is used in controlled clinical trials, that is, to estimate the effect of the intervention by controlling. However, this did not work very well, since it turned out that the SR also affected the utilisation of dental services in the comparison group. There was a clear difference in the utilisation of dental care between the groups before the SR and this gap became even wider after the reform as a result of an increase in utilisation of the study group and a decrease in the comparison group. This happened, because health centres probably restricted access to dental care for the comparison group i.e., they were rationing. Therefore, we had to accept that our final study design was something between quasi-experimental and pre-experimental one with two separate cross-sectional samples, before and after the SR.

Another concern related to the chosen study design is the external validity of the results. The study municipalities were not sampled randomly, but were chosen to represent different supply conditions of dental care. Due to the first-stage nonprobability sampling the external validity of our results (generalisability to the whole country) is not quite clear. However, the different supply conditions are reflected in many of our independent variables and thus the confounding by municipality can be allowed.

Uncertainties involved changes in the content of the original reform. The financing of the reform changed in the second year. First in 1986, the municipalities financed, as before the SR, the expenditure of the public sector dentistry only. In 1987 the Government decided that the municipalities would also have to finance the reimbursements for care in the private sector via payments to the National Health Insurance. It is therefore possible, although not very likely that in order to avoid extra expenses from private sector care in 1987, the municipalities might have taken some action to advocate care in the public sector in that year for the study group and fee-schedule was also under a constant change, specifically in the private sector. Private fees were raised quicker than the actual subsidy fees. Consequently, copayment increased gradually. However, another change compensated partly for this bias. The copayment for check-ups and preventive care decreased to 10 % in the third year. In this study, where each follow-up time was only ten

months, these changes were under better control than when examining the choice of the sector (Arinen and Sintonen 1994) and long-term effects on utilisation (Arinen and Sintonen 1995).

The only way to tackle these problems in validity and reliability is to place more emphasis on measurement and methodology e.g. statistical models replace partly missing control groups. However, the results do not indicate causality. In essence, the aim of these studies is to tease out whether an intervention has any effect and if yes how much.

In the most recent utilisation studies of dental services, seeking of care and the amount of care have been analysed separately. The amount of care has often been measured both by dental expenses and visits, since it has been difficult to find a suitable method for analysing visits, and, on the other hand, the amount of care during a visit varies (Manning et al. 1986, Parkin and Yule 1988, Mueller and Monheit 1988, Sintonen and Maljanen 1994). In this study the number of visits was the only possible measure of the amount, because in the Finnish dental market for young adults dental expenses would reflect the amount of care differently in the public and private sector for two reasons. First, the fee schedule of the private sector includes more items than that in the health centres. Second, in the health centres the rate of subsidisation varies between items. In order to form a comparable expense variable, one should know the number of different items for each individual. That type of information cannot be acquired in a postal survey.

A major problem also in this study was to find a suitable method for analysis and estimation. It was expected to satisfy two requirements. First, its underlying assumption about the distribution of the dependent variable should be as compatible as possible with the observed distribution. Second, it should allow for the possibility that the effect of the independent variables is quite different when explaining the decision of seeking care or not, and the amount of care after seeking. A two-part model consisting of a binomial logit model and zero-truncated negative binomial regression model proved to be the best choice.

Another essential problem was to choose the best possible variables for explaining the utilisation. Most of the variables derived from the theoretical framework were correlated, as expected, quite well with the dichotomy of visiting a dentist or not. That was not true while explaining the amount of care: only few significant correlations were found and in addition the effects of many variables changed quite a lot, even changed the sign, after the reform. This suggests that the theoretical framework chosen may not be particularly suitable when explaining the amount of care for those who have decided to seek care.

Age was not entered as an explanatory variable due to its small range in the sample. This narrow age distribution consisting of many students may also explain the unexpected, though insignificant effect of income on the seeking of care.

A simple way to estimate the effect of the SR is to compare the distribution or means of the utilisation variables before and after the reform. However, the conclusion would have been erroneous, since there were significant changes also in the values of other variables affecting the utilisation variables in addition to the variables changed by the reform. One could eliminate these effects very simply by choosing a controlled experimental study design. That was not possible in this study as we discussed above. Therefore, a more correct estimate of the effect was obtained, when the change in the utilisation was predicted with a logit regression and truncated negative binomial regression models. Thus it was possible to eliminate the effect of the changes in other variables from that of the reform.

The probability of seeking care proved to be, as expected, the higher, the lower was the perceived price and the higher the dentist density. As a consequence of the reform the probability of seeking care increased by 5.5 %-points (13%). On the contrary, the effects of these variables on the number of visits among those who had visited a dentist were mainly against ex ante expectations. The coefficient of price was positive already before the reform and with the reform it became significant, whereas the expected positive effect of dentist density turned into negative. This suggests a conclusion that after the reform, the higher the price and the lower the density, the higher the number of visits, *ceteris paribus*.

There is, however, a logical explanation to this seemingly surprising result. To start with, a majority of the study group sought care from the public sector already before the SR. An earlier study indicated that the increase in seeking care due to the SR has channelled even more to the public sector (Arinen and Sintonen 1994). Evidently apart from Kuusamo, the increase in supply in this sector due to the SR has not been enough to meet the increased demand and this has resulted in overdemand. In accordance with the demand theory, the response has been a rationing of the demand, reflected in this case as a reduced number of visits per patient. When in municipalities where this has happened, the dentist density is high mainly due to private supply and it is quite logical that the sign of the coefficient of density in the 1987 model has turned into negative.

On the other hand a high price before and after the SR indicates indirectly that the sector chosen by an individual is private -the relative price difference remained unchanged even after the SR. Thus the positive correlation of price with the number of visits tells that already before the SR there was a tendency that those using the private sector had more

visits than those using the public one and with the reform this tendency has strengthened. When one takes into account a reduction in the seeking of care in the private sector, the result is again fully in accordance with our theoretical framework: a response to a decreased demand has been supplier-inducement, reflected as an increased number of visits per patient. In this way the private dentists have obviously at least partly compensated the loss of income that would have occurred otherwise due to a reduced demand. Such an inducement is relatively easy, since owing to the SR, the total out-of-pocket expenses of the patients may still remain even lower than they would have been with a smaller amount of care before the reform.

CONCLUSION

It can be concluded that

1. Doing evaluative research is difficult but possible. A researcher of social reforms must be aware of the need to choose an appropriate methodology for avoiding the problems created by the changing policy environment.
2. The model for predicting whether or not people seek care remained stable between 1985 and 1987, unlike the one for predicting the number of visits made by those who did seek care.
3. The changes in utilisation due to the SR remained fairly insignificant. In addition, the short-term effects proved to be greater than the long-term effects, when the follow-up time was extended up to six years (Arinen and Sintonen 1995). As expected the introduction of the SR led to increased numbers of people visiting.
4. The number of visits among visitors decreased against expectation. This result can be interpreted as indirect evidence about the effect of the supply side on utilisation. The number of visits did increase in the private sector suggesting the existence of the supply induced demand, but the major change in utilisation happened in the fully-booked public sector, where rationing occurred. However, these data do not provide conclusive scientific evidence for the existence of supplier induced (or suppressed) demand.

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