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Changes over 5 years in utilization of dental care by a Swedish age cohort

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Abstract – Objective: The purpose of this study was to investigate the temporal development of the utilization of dental care, in relation to socio-economic factors and also considering perceived oral health, attitudes to dental care, dental anxiety, care organisation and changes in the way that dental care is paid for. A conflict model was used as a theoretical framework. *Methods:* In 1992, a mail questionnaire was sent to all 50-year-old persons in two counties in Sweden, Örebro and Östergötland, as part of a cross-sectional study. This study group numbered 8888 persons. In 1997, the same population was sent a new questionnaire. There were 5363 persons who completed the questionnaire in both 1992 and 1997. Changes in utilization of dental care were analysed. *Results:* An increase in personal expenditure for care was obvious, 42% paid more in 1997 compared with 1992. In the study, 7% had prolonged their time since most recent visit and 12% had less frequent visits. In regression models, education, occupation, place of residence, country of birth, marital status, gender, dental anxiety, having poor perceived oral health and poor general health were associated with utilization. Care organisation factors showed there was a greater probability of having higher utilization and higher cost of care when private practitioners provided the care. *Conclusion:* Small changes in the utilization of dental care occurred during this study time. Inequality in utilization existed and socio-economic factors affected utilization as well as health perception and dental anxiety. Changes in the cost of care did not affect utilization appreciably, probably because of a selected population with high price elasticity. Having a private care provider compared with one in the public system affected the probability of having higher utilization and higher cost for care.

Key words: conflict model; inequality in utilization; questionnaire; utilization of dental care

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During the 1990s, two large comprehensive oral health studies were carried out on the same population in Sweden, the first one in 1992 based on all persons born in 1942 in two Swedish counties, Örebro and Östergötland. It was found that there were some social inequalities in dental health. Marital status, foreign birth, education and occupation were all associated with perceived oral health (1). The 1992 study was followed-up after 5 years, in 1997, on the same population, i.e. all persons born in 1942 in the two counties, thus establishing a cohort. In a previous study on this cohort, changes in the perceived oral health were analysed with respect to social and demographic factors (2). The main finding was stability – there had been very moderate changes, and the social gradients in perceived oral health remained. The overarching aim of this paper is to scrutinize the role of utilization of dental care in this context. Can the social gradients be found in care utilization as well? What other factors affect utilization?

Utilization stands for the amount of care received. There are different opinions about the

measurement of utilization of dental care (3). The most common measure is the annual number of dental visits per person, although this is not uncontested (4). There are at least two aspects of utilization to be considered, the quantity and the content of care received. How many care episodes are experienced over time, and what kind of care is performed? The quantity of treatment is rather easy to operationalize by self-reported data in various combinations of questions, such as time since last visit and regularity of visits to care as well as by different visit registrations. However, self-reported data about utilization suffer from bias, as people generally exaggerate the information they give about attending dental care, making point estimates uncertain (5). However, this bias is less important in an analytic perspective and it can be assumed to be constant in a cohort study.

As to the content of utilization, there are complications. What role does the care provider play, that of a dentist, a dental hygienist or a dental assistant? Does the visit contain only acute care or is it a planned treatment? Has the visit involved, e.g. endodontic or prosthetic treatment, prophylaxis or more routine recall check-ups? It is usually difficult to have data about such factors in mass data studies, but the cost for treatment can be regarded as a rough estimate of how much care is performed during the visit. There is an example where utilization is defined and measured as any contact with a dental clinic resulting in a bill during a calendar year (6). Here, the chosen operationalization is twofold: frequency of visits and cost, capturing quantity and to some – unknown – extent also content.

The study of utilization is important because it is generally assumed that a high utilization in a population has a positive effect on oral health (4, 7–9). This is not uncontradicted, however, as iatrogenesis as well as supplier-induced demand can play a role (10). There is also a reciprocal relation, whereby oral health is likely to affect utilization (11). It is, for example, well known that edentulousness is related to non-utilization (12–14).

Socio-economic factors are known to affect both dental health and utilization. People with lower socio-economic status have poorer oral health and a different pattern of utilization with more infrequent use of dental care (15–17). Availability of care and patient cost are other important issues. If a system of subsidies is introduced, dental utilization will increase (6). During the period of this investigation, the situation was the opposite with large cutbacks in the subsidies, and there is less knowledge what effects this can have. A Finnish study shows that in a period of economic downturn dental utilization was not strongly affected (18).

The care organization is also important for utilization. Availability is an obvious factor, both geographically and financially, also including supply of dental personnel. The care system has different incentives in fee-for-service and capitation systems, also an important issue. These and other factors are put in relation to each other in attempts at constructing explanatory models for utilization of dental care, originating from models of health service utilization (4, 19, 20).

The Andersen–Newman model is an example of a model for health care utilization that is often used, originating from the early 1970s (21). This model declares that utilization of a health service is affected by the person's individual determinants which themselves are affected by social determinants and the health system. In an expanded model, health behaviour factors are included. A similar model is the health field model of Lalonde (22). A more recent sociological comprehensive conflict model for dental care utilization can be found, presented by Petersen (19, 20). This model emphasizes four groups of explanatory factors in order to explain inequalities in dental health:

- Background factors: family, generation, experience of public child dental service.
- Actual socio-economic factors: material work and living condition; social norms and values regarding teeth and dental care.
- Individual factors: actual dental visit habits, attitudes and perceptions regarding teeth and dental care.
- Dental health service system factors: prices and subsidies of dental services, availability and accessibility, behaviour of the dentist.

The aim of this study is to investigate the temporal development of the utilization of dental care, in relation to possible confounders such as gender, residence, socio-economic group and education, but also considering perceived oral health, attitudes to dental care, dental anxiety, care organization provider and changes in the revenue-system, using the cohort population from Örebro and Östergötland. Petersen's 'conflict model for the explanation of actual dental visit habits in adults' is used as a theoretical framework.

Material and methods

Population and response rate

All people born in 1942 (8888 persons) in two Swedish counties, Örebro and Östergötland, received a mail questionnaire in 1992 and in 1997. A cohort comprising the same responders from both 1992 and 1997 was established. During this period, 319 persons had moved into the counties and 443 persons had moved out of the counties or were deceased. Both these groups were excluded from the cohort. The net population with a possibility to respond at both times was 8445 persons. Of those, 5363 persons (63.5%) responded on both occasions and thus constitute the cohort. The response rates were 72.0% in 1992 and 74.9% in 1997, all calculated on the net populations.

A non-response analysis was performed. In a logistic regression model, it was found that both gender and education had a significant influence on the probability of participating in the cohort (gender – OR: 1.14, $P < 0.006$; education – OR: 4.57, $P < 0.0001$). Including oral status, set as number of remaining teeth, in the regression model had the result that the other associations remained, although weaker, and that oral status had a strong influence on the tendency to participate in the cohort (OR: 1.59, $P < 0.0000$) (2).

It was concluded that the non-response was not random. Among those not participating in the cohort there was an overrepresentation of women, of low educated people and of those with fewer teeth. This implies that caution is advisable in interpreting point estimates, which most probably give a too benevolent picture of oral conditions. However, in analysis of associations and differentials, data can be used with greater confidence as long as it cannot be deemed probable that the differentials or covariations are very deviant in the non-response.

Questionnaire

The questionnaire was designed with six different sections:

- Socio-economic conditions: age, gender and occupation, etc.
- General health: physician visits, tobacco habits, and drug consumption, etc.
- Oral conditions: satisfaction with teeth, problems, oral hygiene habits, number of teeth, etc.
- Attitude questions concerning function and appearance of teeth.
- Experiences and use of dental care.
- Questions about most recent visits to a dentist.

All questions analysed in this study were the same in 1992 and 1997. Without changing the design of the overall study a few questions were added at the later time.

The variables in the questionnaire used here were:

- Gender
- Place of residence: city, town, rural
- Education: primary education, secondary education, high school/grammar school, college education, other
- Marital status: married, cohabiting or single
- Occupation: open-ended question amended with a subquestion about being entrepreneur or not. A categorization of occupation into four categories based on the official standard SEI (Socio Economic Index, Statistics, Sweden) was made (23):

(1) Blue-collar workers,
(2) White-collar workers,
(3) Professionals and white-collar workers in leading positions,
(4) Entrepreneurs and farmers. In some analyses categories (3) and (4) were combined into one, because of too few cases in category (4).

- Perceived oral health. As indicators of perceived oral health, satisfaction with teeth, chewing ability and number of remaining teeth were used.

Dental care utilization

Indicators of dental care utilization were:

- Time since most recent dental visit; less than 1 year, between 1 and 3 years, between 3 and 5 years, more than 5 years.
- Frequency of dental visits; twice or more per year, once a year, every second year, or more seldom.

These indicators were analysed separately but were also pooled into an index.

Persons who stated that they visited a dentist less than 1 year ago and also said that they went to dental care two or more times per year were combined into a group of 'high consumers'. Those with latest dental care visit more than 1 year ago and regular visits every second year or more seldom were combined into a group of 'low consumers'. All others were characterized as 'average consumers'.

Cost of dental care last year was analysed separately. The question was phrased in terms of personal expenditure during the last year: 'How much have you paid yourself for dental care during the last year?' There were five response

alternatives: no cost, cost < SEK* 300, SEK 301–1000, cost,> SEK 1000, or 'do not remember'. In a logistic regression analysis with cost aspects as dependent variables, the response alternatives were dichotomized in two ways. First, no cost including 'do not remember' versus any given cost, second as high cost (>SEK 1000) versus all others including 'do not remember' (1 SEK = 0.11 EUR in November 2004).

Statistical analysis

Data were analysed in contingency tables. Covariations were measured by Spearman's ρ. Logistic regression analysis was performed using the utilization index and cost aspects as binary dependent variables with three groups of independent variables: social attributes, individual attributes and care organization. Each year, 1992 and 1997, was analysed separately. For 1997 two different models, with and without 'utilization 1992' as an independent variable (models A and B), were run. All data analysis was performed in the SPSS version 11.0 (SPSS Inc., Chicago, IL, USA).

Results

First, the frequencies of the components of the utilization measure during the two study years were analysed, and the relative changes were calculated for the net population (Table 1). An increase in cost was obvious. There were 82% fewer respondents paying less than SEK 300 in 1997 compared with 1992 ($P < 0.0001$). Despite that, the two indicators of utilization (time since recent visit and frequency of visit) both showed relative stability. Only minor changes were found.

Cross-tabulations were performed for the panel population concerning the two utilization indicators and for the variable cost for care latest year (Tables 2–4). Forty-two per cent of the panel stated an increased cost for their dental care visits during the latest year, while 15% stated a decreased cost in 1997 compared with 1992. Seven per cent had prolonged their time since recent visit and 12% stated that they had decreased their frequency of visit.

For both interpretations of the dependent variables, two logistic regression models were run for the 1997 data, models A and B. Model B included utilization data from the 1992 study, i.e. the truly longitudinal model. Model A was run for control of serial correlation effects. Inclusion of the 1992 utilization variable did not change the associational patterns (Table 5). Poor general health and poor perceived oral health affected utilization, the latter showing increased probability of having both low and high utilization. Care organization had a strong influence in all models. Care given by a private provider gave higher utilization, independently of all other variables, while public care had higher probability to give low utilization. Occupation also influenced care utilization. Entrepreneurs had a higher probability to be high consumers than

Table 1. Frequencies and changes in per cent of utilization indicators 1992 and 1997

Indicator	1992 (%)	1997 (%)	Change per cent units	% change
Cost				
No cost	5.6	6.1	0.5	9
SEK <300	25.6	4.7	−20.9	−82
SEK 301–1000	45.6	59.0	13.4	29
SEK >1000	20.3	27.6	7.3	36
Do not remember	2.9	2.6	−0.3	−10
n	6292	6383		
Time since recent visit				
<1 year ago	87.5	87.4	−0.1	0
1–3 years ago	8.8	8.5	−0.3	0
3–5 years ago	1.2	1.6	0.4	33
>5 years ago	2.5	2.4	−0.1	−4
n	6310	6454		
Frequency of visit				
Twice or more per year	25.8	26.3	0.5	2
Once a year	64.2	64.8	0.6	1
Every second year	4.9	3.9	1.0	20
More seldom	5.1	5.0	−0.1	−2
n	6296	6389		

Table 2. Cross-tabulation of costs for care, latest year

	1997				
1992	No cost	SEK <300	SEK 301–1000	SEK >1000	Sum total
No cost					
Row	40	6	42	13	
Total	**2**	**0**	**2**	**1**	4.6
SEK <300					
Row	4	11	68	17	
Total	**1**	**3**	**19**	**5**	27.1
SEK 301–1000					
Row	2	2	65	30	
Total	**1**	**2**	**31**	**15**	48.2
SEK >1000					
Row	5	2	51	43	
Total	**1**	**0**	**10**	**9**	20
Sum total	4.8	4.8	62.0	28.4	100.0

Panel data, $n = 5023$. Row and total (in bold) per cent.
Shaded areas increase of cost.
Spearman's $\rho = 0.25$.

Table 3. Cross-tabulation of time since most recent visit

	1997				
1992	<1 year	1–3 years	3–5 years	>5 years	Sum total
<1 year					
Row	92	7	1	0	
Total	**82**	**6**	**1**	**0**	89.4
1–3 years					
Row	76	15	4	5	
Total	**6**	**1**	**0**	**0**	7.8
3–5 years					
Row	48	25	4	23	
Total	**1**	**0**	**0**	**0**	1.0
>5 years					
Row	32	10	8	51	
Total	**1**	**0**	**0**	**1**	1.8
Sum total	89.1	7.9	1.3	1.7	100.0

Panel data, $n = 5304$. Row and total (in bold) per cent. Shaded areas increase of time since most recent visit. Spearman's $\rho = 0.27$.

Table 4. Cross-tabulation of frequency of visit

	1997				
1992	≥2 per year	Once a year	Every second year	More seldom	Sum total
≥2 per year					
Row	62	36	1	1	
Total	**16**	**9**	**0**	**0**	26.0
Once a year					
Row	14	81	3	2	
Total	**9**	**54**	**2**	**1**	65.9
Every second year					
Row	9	60	24	7	
Total	**0**	**3**	**1**	**0**	5
More seldom					
Row	9	25	7	59	
Total	**0**	**1**	**0**	**2**	3.7
Sum total	26.4	66.5	3.4	3.7	100.0

Panel data, $n = 5248$. Row and total (in bold) per cent. Shaded areas decrease of frequency of visit. Spearman's $\rho = 0.51$.

blue-collar workers. Feelings of anxiety at most recent visit strongly affected the probability of low utilization. Having low utilization in 1992 strongly affected the probability of having both high and low utilization in 1997, albeit in different directions.

In the models with cost of dental care as a dependent variable, two different contrasts were used (Table 6). One set of models had any cost versus no cost, while another had high cost versus any cost. For perceived oral health, two distinctly different patterns were discerned. When no cost versus any cost was used, poor oral health gave lower probability of having cost. For the contrast between high and other cost, the pattern was reversed, so that poor oral health gave higher probability for high cost. Attending public care gave lower probability of having cost, high or not. For gender, being a woman gave lower probability of having no cost; the same held for married couples, while being born outside Sweden gave higher probability of having no cost. Having felt anxiety at most recent visit affected the possibility to have no cost strongly.

A cross-tabulation showed that 7% of the panel population had changed care provider organization during the last 5 years: 5% had gone from private care to public dental care and 2% the other way around.

Discussion

Because of a severe economic crisis during the 1990s, Sweden experienced turmoil in its welfare system, with consequences also for the dental care system through austerity policies. The public expenditures for adult dental care were cut in half from SEK 4 to 2 billion in fixed prices between 1992 and 1997. There was also a precipitous increase in patient charges. For annual examination, the patient's fee in 1992 was at most SEK 102. The corresponding sum was SEK 229 for 1997, more than double. For other treatments the cost could be almost threefold. In comparison during the time 1987–96 patient cost for dental care in the US rose by 7%, albeit from a higher cost level (24).

Despite this drastic alteration in the subsidy system and although 42% of the panel population stated that they had an increased cost, very small changes in utilization of dental care were found during this period. It might appear as if cost of dental care does not affect utilization. There is, although, a very strong association between utilization habits in 1992 and 1997, indicating that persons in this cohort have a strong tendency to maintain their utilization habits. One explanation for the small changes could be that the increase in patient cost has not had the time to take effect during the study period. Another explanation is that it can be assumed that rather many people at the age of 50–55 are well established in society and in working life, and not so sensitive to changes in cost as a younger age cohort may be. In 1992 only 4% stated that they did not work at all, while the corresponding figure for 1997 was 8%.

Table 5. Logistic regression models of dental care utilization 1992 and 1997. Low utilization contrasted to normal and high utilization and high utilization contrasted to low and normal utilization ($4050 \leq n \leq 5265$)

	Dependent variables: utilization aspects (OR)					
	Low (1)/Normal–high utilization (0)			High (1)/Low–normal utilization (0)		
Independent variables	1992	1997: Model A	1997: Model B	1992	1997: Model A	1997: Model B
Social attributes						
Rural residence ref. cat.	–	–	–	–	–	–
Town residence	1.12	1.15	1.09	1.02	1.12	1.12
City residence	0.99	1.01	0.98	1.24 *	1.22	1.22
Blue-collar worker ref. cat.	–	–	–	–	–	–
White collar	0.87	0.98	1.01	1.23 **	1.13	1.10
Higher white collar	1.05	0.81	0.82	1.14	1.37*	1.37*
Entrepreneurs	0.89	0.81	0.83	1.79 ***	1.90***	1.87***
Primary education ref. cat.	–	–	–	–	–	–
High school	0.99	0.72	0.68 *	1.10	1.06	1.09
College	1.12	0.97	0.95	1.14	1.12	1.13
Individual attributes						
Gender: Men ref. cat.	–	–	–	–	–	–
Gender: Woman	0.73***	0.83	0.85	1.26 ***	1.15	1.14
Single ref. cat.	–	–	–	–	–	–
Married	0.74**	0.60 ***	0.61 ***	1.01	0.98	0.96
Born in Sweden ref. cat.	–	–	–	–	–	–
Not born in Sweden	1.56**	1.33	1.18	0.97	1.06	1.15
Good general health 1992 ref. cat.	–	–	–	–	–	–
Poor general health 1992	1.52***	1.46 *	1.34	1.02	1.06	1.10
Poor oral health 1992 (range 1–13)	1.11***	1.06	1.02	1.21 ***	1.18***	1.21***
Dental anxiety	2.67***	2.20***	2.02***	0.85	1.09	1.17
Attitude: Appearance	0.99	1.00	1.00	1.03*	1.02	1.03
Attitude: Function	1.04*	1.03	1.03	0.96**	0.95***	0.94***
Care organisation						
Private care ref. cat.	–	–	–	–	–	–
Public care	2.68***	1.96 ***	1.56 ***	0.49 ***	0.66***	0.73***
Normal–high utilization ref. cat.	–	–	–	–	–	–
Low utilization 1992	–	–	4.03 ***	–	–	0.36***
Model χ^2/d.f.	293.6***/16	118.5***/16	236.9***/17	201.2***/16	104.4***/16	164.9***/17
Correctly classified cases %	86.8	88.9	89.2	74.2	74.0	73.9

Significance: *$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$. Reference category (ref. cat.)

There is a goal of equality in dental health and dental utilization in Sweden. Since the introduction of a National Dental Health Insurance in 1974 there have been expectations that the existing inequality would decrease. Despite the goal, inequality still exists (1, 6, 15). In this cohort, factors such as level of education, occupation, place of residence, gender, marital status and country of birth were associated with dental care utilization.

There are, as previously pointed out, different approaches in explanatory models of dental care utilization, originating from different conceptual approaches. In this paper an effort is made to apply the 'Conflict model for the explanation of actual dental visit habit in adults', by Petersen (19, 20). This sociological model is based on interaction models and conflict sociology. It stresses both the primary effects of structural factors and the secondary importance of normative factors. As primary effects, background factors such as family, generation, material work and living conditions can be seen, as well as dental health service system factors. Social norms are regarded as the result of behaviour, therefore the influence of norms in the model is considered only as a secondary effect. There is not a one-way connection in the model; rather it consists of paths going in diverse directions between the different explanatory factors. This means that the model should be attacked with simultaneous equation models allowing also for indirect causal paths. However, such models require a beginning using ordinary regression techniques, which is the aim of this paper, thus setting a foundation for deeper analytic work.

Table 6. Logistic regression models of cost for dental care 1992 and 1997. No cost contrasted to all other alternatives and high cost contrasted to all other alternatives ($3972 \leq n \leq 5265$)

	Dependent variables: cost aspects (OR)					
	No cost (1)/Cost (0)			High cost (1)/Other–no cost (0)		
Independent variables	1992	1997: Model A	1997: Model B	1992	1997: Model A	1997: Model B
Social attributes						
Rural residence ref. cat.	–	–	–	–	–	–
Town residence	1.06	2.05*	1.88*	1.13	1.08	1.08
City residence	1.00	2.14*	2.07*	1.11	1.17	1.12
Blue-collar worker ref. cat.	–	–	–	–	–	–
Lower white collar	1.01	0.92	1.00	1.04	0.89	0.88
Higher white collar	1.33	1.18	1.26	1.04	0.94	0.94
Entrepreneurs	0.84	1.18	1.15	1.76***	0.95	0.93
Primary education ref. cat.	–	–	–	–	–	–
High school	0.64	0.47	0.36*	1.09	0.99	1.01
College	1.42	1.20	1.12	1.09	1.27*	1.27*
Individual attributes						
Gender: Men ref. cat.	–	–	–	–	–	–
Gender: Woman	0.72*	0.80	0.80	1.27***	0.85*	0.86*
Single ref. cat.	–	–	–	–	–	–
Married	0.63**	0.65*	0.69	0.77**	1.03	1.03
Born in Sweden ref. cat.	–	–	–	–	–	–
Not born in Sweden	1.34	1.37	1.23	1.12	1.15	1.17
Good general health 1992 ref. cat.						
Poor general health 1992	1.23	1.25	1.17	1.24	0.10	1.08
Poor oral health 1992 (range 1–13)	1.13**	1.18**	1.11*	1.43***	1.23***	1.24***
Dental anxiety	3.33***	3.31***	3.03***	1.29	1.63**	1.67***
Attitude: Appearance	0.99	1.00	0.99	1.03*	1.01	1.01
Attitude: Function	1.00	0.96	0.96	0.97	0.97	0.97
Care organisation						
Private care ref. cat.	–	–	–	–	–	–
Public care	2.38***	1.85***	1.34	0.64***	0.79**	0.81*
Normal–high utilization ref. cat.	–	–	–	–	–	–
Low utilization 1992	–	–	0.19***	–	–	0.81
Model χ^2/d.f.	113.9***/16	72.5***/16	137.7***/17	328.3***/16	114.1***/16	118.8***/14
Correctly classified cases %	95.9	96.5	96.6	80.2	72.1	71.5

Significance: *$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$. Reference category (ref. cat.)

Background factors

The background in the model emphasizes the following explanatory factors: 'family' and 'generation' as primary effects and 'experience of public child dental service' as a secondary effect. Available family factors considered relevant in this study were marital status, which clearly affected utilization. Those who were unmarried had a higher probability of being low utilizers, while marital status was unrelated to high utilization. Other (not available in this study) imaginable family factors could be the strong effect of family traditions. There is a tendency to take over family utilization habits. The explanatory factor 'generation' affects social norms and values regarding teeth and dental care. Edentulousness, for example, was socially accepted in Swedish society a couple of generations ago, but not today. Almost 60% in this cohort considered that edentulousness is something to be ashamed of. Another explanatory background factor is experience of child dental service, ranked as a secondary effect. In this study there were a question about having had any really unpleasant or frightening incident of dental care during childhood/youth. As many as 62% of the responders stated that they had one or several occasions of such incidences. Adding it as an independent variable in the logistic regression model, with utilization as dependent variable, did not give any significant association, nor did it change any other associations in the model, and hence the variable was excluded.

Actual socio-economic factors

The model states as the primary explanatory variable 'material work and living conditions'

presented together with 'social norms and values regarding teeth and dental care' regarded as a secondary effective factor.

In this study, the information about material work and living conditions was education, occupation and place of residence. No information was available on income but level of education and occupation can, to some extent, mirror income information. There are associations with utilization in both education and occupation. Entrepreneurs, e.g. have almost twice as high probability as blue-collar workers of having a high utilization. In a Finnish study during the period 1978–97, it was shown that utilization increased and that difference in utilization associated with education and occupation declined during that time (25). It has also been shown by others that persons with lower income have lower expenditures for dental care and less frequent visits to dental care (13, 26, 27).

Another variable concerning living conditions, also associated with utilization, is living in a city, with a 22–24% higher prospect of having high utilization compared with rural residence. The same association was found in a study from Finland (28). Furthermore a person's general health can affect his or her living conditions. It was seen from this study that having worse general health was related to utilization habits, with up to 52% greater probability of having a low utilization for those with poor general health. This was not the case for high utilization, which was unrelated to general health.

The social norm in Sweden is to have a proper dental appearance and to visit a dentist regularly. This is an issue where great cultural differences exist (29). Sometimes it can contribute to difficulties adapting to society for people with immigrant backgrounds, having another social norm in these respects. In this study approximately 6% stated being born outside Sweden. This affected utilization, with up to 56% greater prospect of having low utilization. Ethnic differences in utilization of dental care have been showed by others (30, 31).

Individual factors

Under this heading in the model we find aspects such as 'actual dental habits' and 'attitudes and perceptions regarding teeth and dental care'. Persons in this cohort showed stability not only in their regular attendance to dental care during the study time but also to whom they went. Changes in choice of care provider, private or public dental health, were small. Of the 7% who stated changes, 71% had changed from private care to public. This is in the same direction as was shown in a study from Finland, although in a younger population (32).

There was a very strong association between utilization habits in 1992 and in 1997, having low utilization in 1992 gave an OR of 4.03 for having it in 1997 as well.

One may wonder whether there is anything that could be called 'normal utilization'. Frequency of utilization differs widely from one country to another, due of course to many factors. In this study, over 90% stated that their regular attendance to dental care was at least once a year. This must be considered relatively high utilization, especially as the perceived oral health in general is rather good. A question to be raised is whether people who consider themselves as being in a state of a good oral health actually need to visit a dentist once or even twice a year. Or is it for that reason they perceive good oral health? In another Swedish study it was reported that in an age cohort 45–64 years, 75% had visited a dentist in the past year. The corresponding figure for this cohort was 87% (13). A study from the UK showed in 1998 that 59% of dentate adults reported attending dental care regularly (33).

Dental fear is an aspect of attitudes and perceptions regarding dental care, affecting utilization. There was no direct question in this study about feelings of dental fear. However, there were questions about whether the respondents felt unpleasantness and anxiety at their last visit. Less than 5% stated having these feelings at their last visit. This showed a strong independent effect in the models, as an explanatory factor behind no cost/low utilization, while it was unrelated to high utilization and only moderately related to high cost.

Available questions about 'attitudes and perception regarding teeth' showed only minor association with utilization in this study. An item phrased 'It doesn't matter what your dental appearance is like as long as you can chew' was regarded as a functional attitude and another item, 'having beautiful and perfect teeth is very important for how you are treated by other people', as an appearance variable.

Dental health service system

In the model we here find factors like 'prices and subsidies of dental services', 'availability/accessibility' and 'behaviour of the dentist' emphasized, all considered as primary effects. It is well known

that subsidies affect utilization (6). The introduction of subsidy systems normally increases utilization. Prices of dental service are likely to affect utilization as well, especially for underprivileged groups. There was no information available from this cohort about family income. Still, assumptions can be made that blue-collar workers and persons with only primary education in general have less income. In this cohort, higher occupational categories had a tendency to have high utilization. Even though prices for dental care were doubled, or even sometimes tripled, no evidence could be found that this affected utilization, although 42% stated having increased costs for dental care. This may partly be because of the selected material in this population, where the responders consisting of people who in general have rather high price elasticity.

One striking result was that care organization influenced both utilization and cost of care, with higher cost and more frequent utilization for those attending private care. In the group of patients with care provided by private practitioners 20% paid a sum higher than SEK 1000. The corresponding percentage for care given by public dental health was 8%. Marketization and cost awareness have increased in the public system, but it seems that the direct economic incentive for the private practitioners still has effect, giving more cost for the patient. This is remarkable, as both care providers had a fee-for-service remuneration during the study period and prices were fixed, set by the government.

Another factor affecting utilization of dental care is the accessibility of dental clinics and dentists/dental hygienists. High access to care usually increases utilization of care. During the period between 1992 and 1997 the access to dentists and dental care in Sweden was very good. There were even considered to be too many dentists. The public dental service made dental personnel redundant. Thus, variations in utilization in this study can hardly be ascribed to availability.

Assessment of the model

The Petersen model as a whole was in our opinion useful as a theoretical framework for understanding care utilization in this cohort. At least one factor from each of the explanatory variable blocks had effects in our results. However, a striking result cannot readily be accounted for in the model, the relations between perceived oral health and utilization, a seemingly contradictory relation. To recall the results, there was an association between poor oral health and both low and high utilization. It is not surprising that poor oral health leads to high utilization and high cost for care. The seeming contradiction lies in the results for the low-attenders and those with no cost. They also have poor oral health, and the association is substantive, considering that the health variable contains 13 scale steps. We interpret this as meaning that this small group – only approximately 5% of the cohort – represents an unmet treatment need. This is a case where modelling techniques allowing indirect effects should be used. There should be an indirect effect of the socio-economic factors on this point. Another explanation is that it is a question of the causal directionality. Low utilization can obviously lead to worse oral health. This is however outside the scope of the present study, which is limited to the study of utilization as a dependent variable.

There are weaknesses in the present results as they are based on self-assessments. People probably exaggerate their utilization of dental care (5), while this is of less importance in a cohort as it can be expected to level out in the comparison. Another weakness is that, according to the non-response analysis, there is an under-representation of lower social echelons. This will probably not affect the result as the situation was about the same on both study occasions. The selective material is also a weakness as regards general applicability to the whole population. This cohort consists of people at the age of 50–55. At that age most people are well established both in society and in working life, and thus not so sensitive to, e.g. changes in the remuneration system because of higher price elasticity.

Further investigations need to be performed to follow the temporal development of utilization of dental care. The follow-up time may be too short, especially in terms of effects of the drastic changes in the remuneration system. There is probably a certain time lag in such relations. New material is collected and will later be analysed which will allow a closer monitoring of these connections. The present paper forms a starting point for this forthcoming analysis.

In conclusion, small changes in utilization of dental care occurred during this study time. Inequality in utilization exists in this cohort. Socio-economic factors such as education, occupation, place of residence, country of birth, marital status and gender affected utilization. So did perceived oral health as well as general health and feelings of dental anxiety. Drastic changes in the cost of care did not affect utilization appreciably, probably because

of a selected population with high price elasticity. A striking result was that having care provided by a private practitioner gave both a greater probability of having high utilization and a high cost for care. The Petersen conflict model for utilization of dental care proved to be useful as a theoretical framework analysing explanatory factors.

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