Variations in Utilization of a Multi-State Company Dental Plan

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Abstract: A study was conducted of family records and claim forms of a company-sponsored dental plan to determine the effects of several demographic variables on utilization of the plan and on patterns of expenditure. The plan was non-contributory on the part of the employees. Individual utilization of the plan (at least once during the study year) closely approximated the average for the entire U.S. population. Salaried employees, and families, were more likely to use the plan than hourly-paid employees and families. High income families were more likely than lower income families to use the plan. Most of the independent variables (income, age, hourly versus salaried) correlated with utilization patterns in a predictable manner. A notable exception was when one looked from one division of the corporation to another, with 25 per cent of families in one division using the plan in the study year, compared to 90 per cent at another division. The reasons for these dramatic differences may be related, at least in part, to institutional factors rather than to patient behavior, and further study is indicated. (Am. J. Public Health 67:1173–1178, 1977)

Prepayment for dental care, although a relatively recent phenomenon, is becoming increasingly more important in the purchase of dental care in the United States. Immediately prior to World War II only about 228,000 persons in the United States were covered by some sort of prepaid dental program. During the 1960s the number of covered persons doubled about every two years and during the 1970s the number has been doubling about every three to four years. There were about 30 million persons covered in 1976 and the number is expected to reach over 40 million by 1980.[1]

The relatively late development of prepaid dental care, or "dental insurance", probably can be attributed to the reluctance of commercial carriers to enter the field. According to most rules of insurability, dental care services are not insurable. For instance, the following guidelines of insurability are clearly violated in the case of dental care: 1) unpredictability for the individual; 2) a financial burden of catastrophic size if it falls due all at one time; 3) the event must be infrequent enough to permit reasonable premiums to build up a reasonable reserve fund; 4) existence of insurance should not of itself increase the demand for services.[2]

Despite these obvious violations of the principles of insurance, the cost of dental care can be insured against if the utilization patterns of a group of individuals can be predicted. Recent increases in the number of persons covered by dental insurance are probably due, in part, to the increasing availability of reliable data regarding utilization. Without a doubt, the single most important predictor of dental service utilization is family income, although reduction or elimination of out-of-pocket expenditure does not, of itself, equalize utilization among various income groups,[3, 4]

The studies of the Group Health Dental Insurance Plan of New York City by Nikias[3] are particularly helpful in demonstrating differences in the use of dental care services by various employed social classes within the same prepaid dental care program. Employee members of the plan were predominately in a non-contributory status, although there was a small number of voluntary members who paid the entire premium themselves. There was a clear relationship between occupational status (and presumably income) and dental care utilization, with high white collar persons using the plan at approximately twice the rate of blue collar persons. These utilization patterns prevailed despite the fact that there was little or no out-of-pocket expense for members of the plan. Voluntary members of the plan (subscribers paying the entire premium themselves) exhibited higher utilization rates.[3] Among those who pay their own premiums utilization was consistently higher, even when income was held constant. However, the same differences in utilization by income which were found in the non-contributory groups are still evident in the voluntary groups, with the high white collar workers utilizing the services at a rate approximately 50 per cent higher than blue coilar workers.[3]

The other important recent study looking at utilization in prepaid programs involved the study of a company-sponsored program for dental care in the Astra Pharmaceutical Products Corporation.[5] The Astra plan was administered by

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a commercial insurance company and reported the relatively low utilization rate of about 20 per cent per year among employees and dependents. However, no attempt was made to measure utilization according to socioeconomic status or other possibly relevant demographic variables.

In 1965 the Ritter Corporation, a predecessor of the Sybron Corporation, initiated a dental plan for employees and dependents. In 1974 over 6,000 of 10,000 Sybron employees based in the United States and their families were participating in the plan.*

Unlike other plans reported in the literature, the Sybron plan is paid for and administered by the Corporation, with no contribution from employees. Any dentist may participate in the plan, no prior authorization for dental work is required and dentists are reimbursed on the basis of their usual and customary fees.

The structure of this plan offers a unique opportunity to study demographic effects on utilization of dental services. Although the plan is available at subsidiaries throughout the United States and Canada, all claims are processed in one central office, thereby standardizing definitions and processing and interpretation of data from widespread geographical areas.

The present study was intended to identify and analyze the relationship between the dependent variables—utilization and patterns of expenditure—and the independent demographic variables.

Method

At the time the study was carried out, the Sybron Corporation was made up of 48 divisions in 15 states and two Canadian provinces. The various divisions are involved primarily in the manufacture of medical and dental equipment, chemical research, manufacture of scientific instruments, and dental laboratories. Approximately two-thirds of the employees are white collar or salaried and the remaining one-third are blue collar or hourly workers. The divisions vary in size from fewer than a dozen employees to over 1,200 employees.

All employees of at least one year's duration and their dependents are eligible for the dental program. The study population was selected from among employees who were eligible throughout the entire calendar year 1974. All dependents of study employees were also included in the study sample.

By use of a table of random numbers 10 per cent of the eligible employees of each division of the Corporation were selected. If a division had fewer than 250 employees, a minimum of 25 subjects was selected. If a division had fewer than 25 employees, all were included in the study sample. The final study population comprised 1,896 individuals in 649 families. The files contained 6,312 employees in 26 divisions that had dental plans in 1974.

Data were extracted from dental program folders which were filed according to division and alphabetically by employees' names. Within the folders were: 1) family records, containing demographic information and summaries of claims filed; 2) claim forms for all members of families.

Treatment information related to claims paid from January 1, 1974 through December 31, 1974 was included, without regard to when the services actually were received. On the average, less than one month elapsed between billing by the dentist and payment by the plan.

Demographic information collected for each individual family member was year of birth and sex. In addition, for each family unit the following items were coded: employment status (salaried or hourly), income during 1974, number of years employed, division of Corporation at which employed, and Zip Code, which subsequently was collapsed into eight geographical regions of the United States and Canada.†

The dollar value of services received by the individual members of the family was recorded in terms of treatment categories (see Table 1). The number of dental visits was recorded for each individual, but in many cases was only estimated and cannot be regarded as reliable. Although the claim form had a column labeled "Date Service Performed," it was noted frequently that there was only one date entered for services that obviously required more than one appoint-

TABLE 1—Definition of Treatment Categories

Category	Services Included
Diagnostic	Exams, radiographs, diagnostic and lab tests, biopsies, photographs, models
Primary preventive	Prophylaxis, fluoride, dietary counseling, oral hygiene instructions
Secondary preventive	Space maintenance, habit correction
Restorative, routine	Intracoronal restorations, related pulp capping and pulpotomy, stainless steel crowns, pre-formed crowns
Restorative, crowns	Single, custom-made crowns, metal porcelain or plastic
Endodontics	Root canal therapy, related surgery
Periodontics	Scaling, curettage, surgery, provisional splinting
Prosthetics, removable	Complete and partial dentures, repairs, duplication, relining
Prosthetics, fixed	Bridges, including abutments, pontics, repairs
Oral surgery	Exodontia, various surgical procedures
Orthodontics	Active care, other than preventive (see secondary prevention, above)

*The plan pays 100 per cent of the first $30 per person per year for examination and diagnosis. After a deductable of $25 per person and $75 per family, the plan pays 75 per cent of the cost of all dental treatment, except replacement dentures and orthodontics, which are covered for 50 per cent of cost. There was an annual maximum of $400 per individual and $1,000 per family, except for orthodontics, which had a lifetime maximum of $500 per person.

†New England, Middle East, Southeast, Southwest, Central, Northwest, Far West, and Canada.

ment (e.g. complete dentures, crowns, and bridges). It was felt that other data relating to treatment were quite accurate since the plan paid a fixed per cent of the total fee. Probably the only disincentive to filing complete information on the claim form would be if the patient or family had already reached the annual maximum, a relatively unlikely event. When available, the individual fees charged for several common treatment services were recorded, along with the Zip Code of the providers of the services.

All data were punched on standard 80 column IBM cards and analyzed by SPSS (Statistical Package for the Social Sciences).[6] Where appropriate, chi square, one-way analysis of variance and multiple regression techniques were used to test the statistical significance of the data.

Results

Utilization: Individual

About 49.6 per cent of eligible individuals utilized the dental plan during 1974. Although utilization by children (51.6 per cent) was higher than utilization by employees (49.8 per cent) and by spouses (46.5 per cent), the differences were not statistically significant. Utilization by females was slightly higher than by males (51.9 per cent versus 47.4 per cent) but, again, the difference was not statistically significant.

When utilization was examined by sex and by age, however, differences were noted. These differences are summarized in Figure 1. Female utilization is seen to have a relatively narrow range from 48.2 per cent to 56.0 per cent, with the exception of the small sample (N = 5) over 65 years of age. Those differences were not statistically significant. However, male utilization showed a distinctly bimodal pattern, with peaks at 9–17 and 46–65 years of age. These differences were statistically significant ($P < .001$).

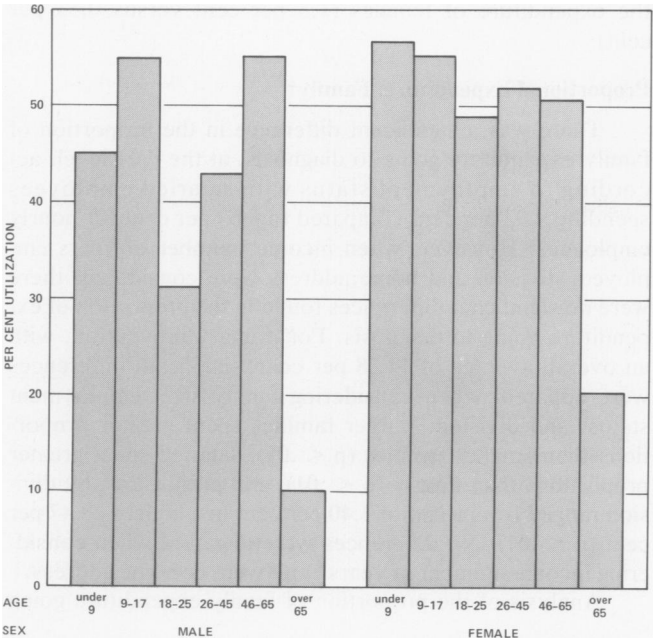

FIGURE 1—Individual Utilization of Dental Plan by Age and Sex, 1974.

Utilization: Family

Nearly 65 per cent of families had one or more members who used the plan during 1974. When this utilization was studied, marked differences became apparent with several of the independent variables. These differences are summarized in Table 2.

TABLE 2—Family Utilization of Plan According to Independent Variables, 1974

Independent Variables	N	% Utilization
Employment Status		
Salaried	362	77.9
Hourly	185	57.3
Income 1974		
under $7,000	39	56.4
7,000-9,999	135	59.3
10,000-12,999	156	69.2
13,000-15,999	74	82.4
16,000-18,999	59	79.7
19,000-21,999	31	93.5
22,000-24,999	15	86.7
25,000-27,999	7	85.7
28,000 and over	22	95.5
Family Size		
1	99	43.4
2	234	62.8
3	102	68.6
4	108	70.4
5	59	81.4
6	24	75.0
7	14	78.6
8 or more	6	66.7

Chi Square $p < .01$ within each category

Family utilization was directly related to employment status (salaried vs. hourly) and income. It came as no surprise that family utilization varied with family size, but it is interesting to note that utilization peaked at a family size of five and, thereafter, began to drop off as families became larger.

From one division of the Corporation to another sharp difference in utilization were noted. Of the 26 divisions studied, the rate of utilization ranged from a low of 25.0 per cent to a high of 90.5 per cent, with the differences significant at the 0.01 level (data not shown).

There were no significant differences in utilization according to geographical area within which the families resided.

Total Expenditure: Individual*

The average individual expenditure for dental care in 1974 (portion paid by Corporation plus portion paid by em-

*Total cost of care, including portion paid by Corporation and portion paid by employee. In looking at total expenditure, for families as well as for individuals, those without expenditures were excluded. Therefore, the means expressed are means only of those who had expenditures of $1 or more.

ployee) was $120.59. Although females spent slightly more than this average and males slightly less, the difference was not significant.

As shown in Table 3, employees had the highest individual expenditure, with spouses at about 87 per cent of employee expenditure and children having only about one-half the average expenditure of employees.

TABLE 3—Total Individual Expenditure (Excluding Those without Expenditure), 1974

Independent Variables	N	Expenditure
Status in Family*		
Employee	328	$156.47
Spouse	250	135.54
Child	381	79.94
Age**		
Under 9	91	45.42
9-17	256	92.48
18-25	66	101.14
26-45	292	130.03
46-65	250	168.67
Over 65	2	193.00

* $p < .01$
** $p < .05$

Expenditure according to age, also shown in Table 3, reflects the same difference in expenditure between children and adults.

When both status in family and sex were considered together (Table 4), it was found that both male and female employees had about the same expenditure. However, female spouses and female children were inclined to have considerably higher expenditure than their male counterparts.

TABLE 4—Mean Total Individual Expenditures by Status in Family and Sex, 1974

Status in Family	Sex: Male (N)	Sex: Female (N)
Employee	$157.28 (256)	$153.57 (72)
Spouse	80.80 (20)	140.30 (230)
Child	68.85 (189)	90.96 (191)

($p < .01$)

Total Expenditure: Family**

Total expenditure for the average family in this study was $276.13. Significant differences in family expenditure were not found when the data were analyzed according to number of years employed, division, home address, or employment status (salaried or hourly).

Family expenditure according to income (Table 5) showed a statistically significant positive relationship, with families earning over $25,000 a year spending three to five times as much as families earning under $7,000.

TABLE 5—Total Family Expenditures (Excluding Those without Expenditures), 1974

Income 1974 ($p < .01$)	N	Expenditures
under $7,000	22	$103.27
7,000-9,999	80	189.92
10,000-12,999	108	266.76
13,000-15,999	63	349.05
16,000-18,999	47	247.96
19,000-21,999	30	365.07
22,000-24,999	13	282.69
25,000-27,999	6	335.00
28,000 and over	21	585.81

Proportional Expenditure: Individual†

Of total expenditure for individuals and families the proportions that were spent on various categories of dental care were analyzed.

With 8.03 per cent of the cost of individual dental care going to diagnosis, the percentage according to age ranged from a low of 2.20 per cent in patients over 65 years of age to a high of 10.40 per cent in children under age nine. Primary prevention, averaging 16.88 per cent, showed its peak at under nine years of age (26.11 per cent) and a steady decrease with increasing age, to 4.67 per cent for patients over 65 years of age. With regard to routine restorative dentistry (mean: 13.23 per cent) the pattern was slightly different with peaks in the 9–17 and 26–45 year age groups.

The only other noteworthy difference was with endodontics, where males proportionately showed three times the expenditure of females (1.5 per cent versus 0.53 per cent).

Proportional Expenditure: Family†

There was a significant difference in the proportion of family expenditure going to diagnosis, at the 0.01 level, according to employment status with salaried employees spending 9.92 per cent compared to 6.63 per cent for hourly employees. However, when income, number of years employed, division and home address were considered, there were no significant differences found in the proportion of expenditure going to diagnosis. For primary prevention, with an overall average of 14.28 per cent, significant differences were apparent when considering family size, employment status, and division: Larger families spent greater proportions than smaller families ($p < .05$), salaried spent greater proportions than hourly ($p < .01$), and proportions by division ranged from a low of 3.40 per cent to a high of 28.47 per cent ($p < .01$). No differences were apparent when considering income, number of years employed, or home address.

Analysis of the proportion of family expenditure going

**Total cost of care, including portion paid by Corporation and portion paid by employee.

†Tables not shown.

to routine restorative care presents essentially the same pattern as previously described for primary prevention ($p < .01$).

When looking further at the independent variable, employment status, similar differences were found with crown restorations and orthodontics, i.e., salaried employees spent proportionately more than hourly employees on both services ($p < .01$). However, it should be noted that the proportions were reversed in the case of removable prosthetics, with hourly employees spending proportionately nearly twice the amount of salaried employees ($p < .05$). This same juxtaposition was apparent in the case of oral surgery, although the difference fell slightly short of statistical significance.

Finally, there was a positive correlation between proportional family expenditures on orthodontics and family size, with larger families spending a greater proportion than smaller families ($p < .01$).

Interrelationship of Independent Variables

Multiple regressions were carried out on the data, defining the criterion (dependent) variables as total expenditure, proportional expenditure, and utilization during 1974. The independent variables were employee's age, spouse's age, employee's sex, number of parents in family, employment status (salaried or hourly), employee's income, number of years employed, and division of Corporation. An F value of 4.0 was accepted as statistically significant at the 0.05 level.

Table 6 shows the more important results of the multiple regression procedures.

TABLE 6—Multiple Regressions

Criterion Variable	Independent Variables	Multiple R	Beta
Family utilization	Employment status	0.23	0.14
	Division No. 17	0.29	0.17
	Division No. 18	0.34	0.18
Total family expenditure	Employee's income	0.29	0.33
	Number of children	0.36	0.23
	Employee's sex	0.38	0.16
Spouse's Utilization	Employee's income	0.29	0.20
	Employee's sex	0.31	0.16
	Employment status	0.33	0.12

The most important independent variable proved to be employee's income, followed by employment status and employee's age, in that order. The highest multiple R's were of the magnitude of 0.35–0.40. Employment status (salaried or hourly) seemed to have a separate effect on some of the dependent variables, in spite of the fact that it was highly correlated with employee's income ($R = 0.40$). Generally, division of Corporation, as a separate variable, had little effect on the criterion variables. However, Divisions No. 17 and 18 did seem to have an effect on family utilization which wasn't explained by the other variables in the regression equation (Table 6).

Discussion

The overall utilization of the Sybron Dental Plan of 49.6 per cent in 1974 is virtually the same as utilization shown in National Health Survey (NHS) data for 1973,[7] which indicates 48.9 per cent utilization for a probability sample of the entire population of the United States. Although the utilization of the study population prior to eligibility for the plan is not known, it seems reasonable to assume a rate at or above the national average, since employees probably have incomes above that of the NHS data (which includes the unemployed). This finding is disappointing, but not surprising. Some investigators, these authors included, feel that the primary effect of third-party participation in the payment of dental care is to increase the amount that previous users spend on dental care, rather than to increase the proportion of the eligible population seeking care.

This is not to say, however, that there are no noticeable differences in utilization patterns. The most dramatic differences, referred to in the section on "Utilization: Family", occur when one looks from one division of the Corporation to another. Multiple regression tended to wash out these divisional differences because of strong correlations between division and other independent variables such as employee income and employment status. However, Division No. 17, which showed the lowest family utilization rate (25 per cent) and Division No. 18, which was among the lowest (42 per cent), seemed to have an effect on family utilization which could not be explained by the other independent variables in the regression equation. Division No. 19, the effect of which approached statistical significance, had the highest utilization rate in the study (90 per cent). It is not known what caused these divisional differences, but it is possible that other factors were at work within those divisions which altered the predictability of utilization patterns of the eligible employees and their families. Further study of available dental services and the attitudes of the employees and management toward the dental plan in those divisions would be warranted.

There were differences in utilization and in total family expenditures according to income in the expected direction, but these differences did not hold up when one considered proportional expenditure. Contrary to expectations, higher income families did not spend greater proportions of their dental dollars on diagnosis, prevention, fixed bridges, or orthodontics. The difference, as far as income was concerned, appeared to be that higher income families purchased more dental care but not necessarily more sophisticated dental care.

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The Struggle against Air Pollution—1880

"But independently of any question of saving, many of us would, I believe, be ready to make an effort to diminish smoke, were it only for the beauty and comfort and cleanliness, and for the life of the flowers we might then preserve around us." **Octavia Hill, 1880.**

"The case for smoke abatement was and is unanswerable, yet London and all our great cities remain extravagently dirty and the citizens still endure fogs which deprive them and their children of the health-giving sun. Octavia gave the first impulse to the movement, at the moment she lacked the strength to pursue it, and later other and older claims recalled her. It was forty years before another smoke abatement exhibition was made. We still await someone with Octavia's force to carry out the reforms she so wisely foresaw and so greatly desired."

Octavia Hill: A Biography. by E. Moberly Bell. Constable and Co. Ltd. London, 1942. p. 171.

(Octavia Hill, 1838–1912 was a pioneer in housing reform, to which she devoted her major efforts. Her interest in improving the environment led to her work for smoke abatement, and to arouse public opinion she organized an exhibition showing what was needed and what should be done.)