Methodology of Capitation Payment to Group Dental Practice and Effects of Such Payment on Care

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THE CONCEPT OF HMOs (Health Maintenance Organizations) is widely espoused today. Several bills on these organizations have been introduced in the U.S. Congress, and the Department of Health, Education, and Welfare has given support to the idea. [See front inside cover—Ed.] Some States, such as California, have been encouraging prepaid health plans as provider mechanisms for Medicaid programs. In California, the staff of the Department of Health Care Services has insisted that prepaid health plans include dental care.

Although the idea of the health maintenance organization is broader than just group practice, that is its major thrust—group practice based on regular periodic payments by each eligible person. Such types of practice, however, are relatively uncommon in dentistry, and a considerable mystique and misinformation surrounds the concept and its methodology. This paper provides a relatively detailed approach to the application of capitation payment to dental group practice.

If fee-for-service considerations with all of their complexities and inequities are ignored, the specific procedure that a dentist performs matters little in terms of economics and resources as long as he and his staff are available to provide service. Most dentistry can be, and is, performed by general dental practitioners. The single major exception is orthodontics. Other specialty services can be referred out, if necessary, without affecting cost-benefit and organizational approaches significantly. A dentist, then, can be considered as just that—a dentist. Since in most States the only other person permitted to perform dental services directly on a patient is a hygienist, this field will also be considered.

Chair Time and Its Cost

The first factor in designing a capitation program is the amount of the dentists' and hygienists' time required to treat the presenting needs of

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each eligible person per year. The term "presenting" is used to designate those needs that can be met. Obviously, if an eligible person refuses to accept care, no time is required to provide service regardless of the existence of a need.

Included also in the determination of this time factor is the level of care that will be provided. A program that includes endodontics, periodontics, and crown and bridge work will require more time than one that limits such services and instead provides extractions and removable prosthetic replacements, as is the case in some Medicaid programs.

The second factor to consider is the cost of the dentists' and hygenists' time, which in turn also indirectly influences the amount of time needed. A dentist's hour is not static. The amount of care that can be provided in an hour is governed by the efficiency of the individual dentist, the type and quantity of the auxiliaries who help him, and the facilities that he uses. The number and type of personnel, as well as other resources, affect the cost of the hour. Included in this cost is the dentist's income, since he is a producer and not a coupon clipper. Only one major item of cost is not distributed relatively evenly, and that is laboratory expenses. Whether the laboratory the dentist uses is part of the practice or a separate entity, its cost is associated with specific items of service. Therefore, in this paper, it is considered separately.

In simplified form, the equation for an annual capitation rate for dental care exclusive of laboratory cost is:

$$R = T_D \times C_D + T_H \times C_H,$$

where:

R = Annual cost per patient
T_D = Annual chair time of dentist
C_D = Cost per dentist hour
T_H = Annual time of hygienist
C_H = Cost per hygienist hour.

Other Cost Factors

Initial versus maintenance care. This formula is inadequate for developing a capitation rate since other factors influence cost and must be included. The difference between initial care and maintenance care is significant. Since most populations have a large backlog of unmet needs, initial care takes more time than maintenance care. Therefore, the time for each has to be considered separately.

Stability of population. The stability of the population also affects time requirements. As an extreme example, if the eligibles in a program change every year, as is the case with Head Start, there never is an annual maintenance care rate for subsequent years. On the other hand, a program for certain industries would have few changes in eligibility, and most persons could be on "maintenance" after the first year.

Utilization. Utilization affects both time and cost. Since under the capitation system, payment is on the basis of eligibility, the percentage of the population receiving service is a critical factor. If use is high and the group is stable, initial costs will be high, but maintenance care, which costs less, will predominate in subsequent years. If use is low, the costs for the initial year will be low, but a maintenance care level is never reached, and in subsequent years costs may not decrease.

Family size. Since capitation payments are usually made on a per family rather than per person basis, family size must be included in the formula. Experience has shown that family size may vary considerably. In programs with which I have dealt, the average family size has ranged from around two to six persons.

Age of eligible persons. The age of the eligible persons is a known factor. Empirically, I have noted a sharp distinction between adults and children in dental need, although not much difference between the various age groups within the adult and child categories. Therefore, while age subdivisions can be included in the formula, in this paper only the adult-child difference is considered.

Fluoridation and socioeconomics variables. Other factors that may affect time and cost are fluoridation and general socioeconomic variables. Once more, these are not included in this paper. In practice, I have discovered that socioeconomic status does not affect dental time much. The specific treatment needs may be radically different, but not the treatment time. For example, a group of laborers may have had very limited dental restoration and therefore have many missing teeth and badly neglected mouths. They may require many extractions and removable prosthetic appliances. A group of professionals of the same age distribution would have had much more dental experience, and consequently, more teeth at risk. Those teeth at risk, however, would be

more likely to be salvageable. The professionals would require more restorative dentistry and fixed replacements. Since the time required for both groups may be identical, costs would be the same, inasmuch as laboratory cost has been eliminated as a factor in my estimates. The different populations might have different rates of turnover and utilization, but these factors are included as separate variables.

For a profession accustomed to thinking in terms of fee for service, the concept of time as used in this paper is usually hard to grasp. Members of the profession believe that a different spectrum of services for different population groups (for example, laborers versus professionals) should be economically significant. Nevertheless, although the difference may be significant from the standpoint of the level of oral health that can be achieved (for example, artificial dentition for laborers versus natural dentition for professionals), the difference is not necessarily of significance in program costs.

Basis for Capitation Rate

A more complex and more realistic formula can now be postulated:

$$R_1 = U\,[(T_{AD} \times C_D + T_H \times C_H) + S(T_{AD} \times C_D + T_H \times C_H) + D(T_{DD} \times C_D + T_H \times C_H)]$$

$$R_2 = F \times U \times M\,(T_M \times C_D + T_H \times C_H) + I\,(R_1)$$

$$R_n = \text{Same as } R_2$$

where:

- R_1 = Rate (cost) per family for initial year
- R_2 = Rate per family for a second year
- R_n = Rate per family for any subsequent year
- T_{AD} = Number of dentists' hours required per adult for initial year
- C_D = Cost per dentist hour
- T_H = Number of hygienists' hours per person per year
- C_H = Cost per hygienist hour
- S = Average rate for spouse per employee or subscriber
- D = Average number of dependent children per employee or subscriber
- T_{DD} = Number of dentists' hours per child for initial year
- T_M = Number of dentists' hours per person for subsequent year
- M = Percent of all persons covered for subsequent year
- I = Percent of all persons covered for first time in year
- U = Average annual utilization rate
- F = Average family size.

The formula is based on the following assumptions:

1. Dentists and hygienists are the only team members who use general chair time.
2. The hygienists' time is the same for adults and children in both the initial year and in maintenance years.
3. The dentists' time is the same for adults and children in maintenance years.
4. All population groups require the same number of chair hours except for the effect of family composition.
5. Laboratory expenses are excluded as a factor in program cost. Since they must be paid, it is assumed that the patient pays the cost individually.

If the general concept is accepted, the variables and the assumptions can be changed, eliminated, or added as needed. At best they are oversimplified and would have to be changed with experience. For example, if auxiliary duties are expanded, time and cost factors for other chairside operators may be included as separate variables. If socioeconomic status affects time requirements, this factor can be added. If laboratory cost is included as part of capitation, it too can be added as another term.

Plan 1—All Initially Eligible

The use of the formula can be illustrated by a theoretical example. For simplicity, the following quantities are assumed (not necessarily true to life, although designed to be reasonably accurate):

T_{AD}	= 3	T_{DD}	= 2
C_D	= \$50	T_M	= 1
T_H	= 1	M	= 80 percent
C_H	= \$15	I	= 20 percent
S	= 0.8	U	= 70 percent
D	= 1.2	F	= 3.

Based on these assumptions,

$$R_1 = 0.7\,[(3 \times 50 + 1 \times 15) + 0.8\,(3 \times 50 + 1 \times 15) + 1.2\,(2 \times 50 + 1 \times 15)] = \$304.50$$

$$R_2 = 3 \times 0.7 \times 0.8\,(1 \times 50 + 1 \times 15) +$$

	0.2 (304.50)	= 170.10
R_3		= 170.10
	3-year total	= $644.70
	1-year average	= 214.90
	1-month average	= 17.91

The formula may be clearer if expressed in tabular form. A group of 100 families is assumed. Using the same values as before, we would have 100 subscribers, 80 spouses, and 120 children. Table 1 shows the number of dentists' and hygienists' hours required in each of the first 3 program years. For example, at 70 percent use, 70 subscribers would require 210 dentists' hours and 70 hygienists' hours.

The cost of the dentists' time, at $50 per hour, would be as follows for the total families for the 3 years:

Year	*Hours*	*Cost*
First	546	$27,300
Second	277	13,850
Third	277	13,850
Total	1,100	$55,000

The cost of the 210 hygienists' hours required annually would be $3,150, or $9,450 for 630 hours during the 3-year period. The combined costs of the dentists' and hygienists' time would thus be $64,450 for the 3 years—$644.50 per family, or $17.90 per family per month. (The monthly cost differs slightly from that obtained with direct use of the formula because of the rounding of numbers.)

Surcharges and Phasing In

A monthly rate of almost $18, however, may be beyond the reach of the particular population. If the standards of dental care are maintained at the same level, two approaches to this problem can be used: (*a*) surcharges or co-payments to be paid by the patients can be introduced for services in addition to laboratory charges; (*b*) each family can be phased into treatment over a period of time.

Payments by patients have a double effect. First, any out-of-pocket amounts they pay reduce the monthly capitation rate by changing the source of funds. In addition, personal payment by patients reduces utilization of services. I am assuming that the reduction in use is not constant as the surcharges rise. For example, a $1 surcharge per filling for a blue-collar population may have little effect on use, but a $5 charge might. In addition, the same surcharge may affect different socioeconomic groups differently. Surcharges need not be related to a percentage of the average fee.

Table 1. Number of users of dental service in eligible categories and hours required to provide it in initial membership year and subsequent years, plan 1

Membership year and eligibility categories[1]	Users	Dentists' hours	Hygienists' hours
1st Year			
Total eligible (300)	**210**	**546**	**210**
Subscribers (100)	70	210	70
Spouses (80)	56	168	56
Children (120)	84	168	84
Subsequent years			
Total patients (300)	**210**	**277**	**210**
Subscribers (100)	70	98	70
Spouses (80)	56	78	56
Children (120)	84	101	84
New patients only (60)	**42**	**109**	**42**
Subscribers (20)	14	42	14
Spouses (16)	11	33	11
Children (24)	17	34	17
Maintenance patients only (240)	**168**	**168**	**168**
Subscribers (80)	56	56	56
Spouses (64)	45	45	45
Children (96)	67	67	67

[1] The numbers in parentheses are persons eligible in each category.

No surcharge might be imposed for examinations and preventive services, while fairly steep charges could be imposed on extractions.

To return to the example, a 25 percent across-the-board surcharge (based on an average fee schedule) may result in about a 50 percent monthly capitation saving, so that the rate would be reduced to about $9.

Plan 2—Phasing In

For some populations a plan can be designed based on variable eligibility. As an example, only the subscriber is eligible for treatment the first year, the spouse the second, and the children the third. This phasing-in procedure, a variation of incremental care, reduces the average monthly cost by spreading the higher rate for the initial year over a longer period and by decreasing the number of separate persons who are eligible during the first 2 years of a family membership. A further reduction in numbers is achieved because the turnover of families results in fewer persons meeting the eligibility requirements. To avoid overcomplicating the following example, it is assumed that all families achieving spouse eligibility also achieve eligibility for dependent children.

$$R_1 = 0.7\ (3 \times 50 + 1 \times 15)_{\text{Subscriber}} = \$115.50$$

$$R_2 = 0.7 \times 0.8\ (1 \times 50 + 1 \times 15)_{\text{Subscriber}} + 0.2\ (115.50) + 0.7 \times 0.8 \times 0.8\ (3 \times 50 + 1 \times 15)_{\text{Spouse}} = 133.42$$

$$R_3 = 59.50_{\text{Subscriber}} + 0.7 \times 0.8 \times 0.8 \times 0.8\ (1 \times 50 + 1 \times 15)_{\text{Spouse}} + 0.2\ (73.92) + 0.7 \times 0.8 \times 1.2\ (2 \times 50 + 1 \times 15)_{\text{Children}} = 174.86$$

3-year total	= $423.78
1-year average	= 141.26
1-month average	= 11.77

In this case the phasing-in process reduces the original capitation cost to slightly under $12. If $9 is all that is available, a surcharge of about 15 percent might accomplish the almost 25 percent further reduction required.

The hours required to implement such a phasing-in procedure over a 3-year period are shown

Table 2. Number of users of dental service in eligible categories and hours required to provide it, by membership year, plan 2

Membership year and eligibility categories[1]	Users	Dentists' hours	Hygienists' hours
1st year			
Subscribers only (100)	70	210	70
2d year			
New patients (84)	**59**	**177**	**59**
Subscribers (20)	14	42	14
Spouses (64)	45	135	45
Maintenance patients—subscribers only (80)	**56**	**56**	**56**
Total (164)	115	233	115
Subscribers (100)	70	98	70
Spouses (64)	45	135	45
3d year			
New patients (129)	**90**	**203**	**90**
Subscribers (20)	14	42	14
Spouses (13)	9	27	9
Children (96)	67	134	67
Maintenance patients (131)	**92**	**92**	**92**
Subscribers (80)	56	56	56
Spouses (51)	36	36	36
Total (260)	182	295	182
Subscribers (100)	70	98	70
Spouses (64)	45	63	45
Children (96)	67	134	67

[1] The numbers in parentheses are persons eligible in each category.

in table 2, plan 2. As in the use of the tabular format for plan 1, we assume 100 families are eligible. Because of phasing in, no spouse can be a maintenance patient in the second membership year, and in the third year no child can be a maintenance patient. The cost of the dentists' time would be as follows during the first 3 years of membership under plan 2.

Year	*Hours*	*Cost*
First	210	$10,500
Second	233	11,650
Third	295	14,750
Total	738	$36,900

The cost of the hygienists' time would be as follows:

Year	*Hours*	*Cost*
First	70	$1,050
Second	115	1,725
Third	182	2,730
Total	367	$5,505

The total cost of time of dentists and hygienists for the 3-year period would be $42,405, or $424.05 per family and $11.78 per family per month.

Establishment of Treatment Priorities

The potential for success of the capitation group practice approach, both as to oral health and financial solvency, lies in the ability to control the treatment rendered to a given population. While most people may not particularly relish going to the dentist and may be fatalistic about losing their teeth and ending up with dentures, a high percentage of any given population can be stimulated to use dental services if appropriate means are used.

These means may include removal of financial barriers, educational efforts, group pressures, provision of transportation and baby-sitting, convenient dental facilities, and a host of other organizational techniques designed to make going to the dentist easier than not going. These possibilities are not idle speculations. Years ago the Public Health Service was able to reach about 85 percent of the school children in Richmond, Ind., and Woonsocket, R.I., by locating their dental treatment facilities in the schools (*1,2*). More recently Pelton treated more than 70 percent of the eligible students at the University of Alabama who chose a group practice as their source of care (*3*). I have previously reported on several dental programs for different populations, including one for a poverty group, in which annual utilization ranged from about 70 to 90 percent (*4, 5*).

These few examples illustrate that a system based on some form of group practice and which has a clearly identified population can treat most of that population. Since resources are almost always not adequate to perform all needed services in a short time, a rational system of priorities can be applied to treatment. An example of such a system, which Jay W. Friedman (currently clinical professor at the University of Southern California School of Dentistry and dental consultant to several prepaid dental plans) and I formulated, is presented (see box); it would have to be modified for different purposes and as concepts of "urgency" of treatment changed.

Under such a system, patients' conditions are classified on the basis of data obtained from thorough clinical examinations, including X-rays and other diagnostic procedures. Neither health education nor control procedures are included in any of the four classes of priorities because all can be carried out independently of active treatment. Under the system patients can be treated on the basis of urgency of need; some needs can be left untreated until future dates. Completion may be at various levels. A person's work may be completed through priority 2 while priority 3 work is postponed for several years. Some treatment may never be performed. The nature of dental disease and its sequellae are such that management of care in this manner need not result in harm since with few exceptions dental conditions are chronic and change slowly over time. A treatment program can take advantage of this fact if it is sufficiently well organized to control the behavior of the provider. Such control can be easily instituted in capitation group practice.

In a typical open-panel fee-for-service program every dentist performs a service as fast as he can on each patient who presents himself. He does not know the total eligible population, only those who arrange to see him. He follows each patient's work through to completion, from urgent treatment to nonurgent. Once the dentist's appointment book is full, care of new patients is postponed or they are refused service, even though their needs may be more urgent than those of people treated in the office at the time. The result is the lopsided treatment schedule shown in the fee-for-service portion of the chart, which illustrates in oversimplified form the effects of two approaches to dental care.

In a system of capitation group practice, however, in which treatment standards and even costs are the same, resources can be apportioned by priority so that treatment for almost all persons proceeds from the urgent to less urgent. In the chart the amount of care is the same, but its distribution is different. More eligible persons are seen, and secondary prevention is enhanced by reducing untreated urgent needs to a minimum.

This high-utilization priority approach, when combined with flexibility in the spacing of appointments, enables the group practice to work within time and cost projections unless a major error in their estimation has been made. Moreover, it permits the large commitment of chair time for the first year of a patient's treatment to be spread into subsequent years so that the allocation of resources, while not level, does not have the sharp initial peak.

Another aspect of the high-utilization priority approach is that an entire family (if eligible) can be examined at once. With proper control of appointments, long waits can be avoided. The dentist can examine everyone in a family and establish a preliminary treatment plan. This examination is not a screening, since X-rays, charts, and histories are used. Patients with more complex cases are given second appointments that include time for treatment as well as for continued evaluation.

Once everyone in a family has been examined, the program for the entire family is presented to the parents in one discussion. I have found that not only is total examination time thereby reduced but the family invariably accepts the priority concept since some family member is always under treatment and obvious conditions are not neglected. A sensible approach makes sense to dental care recipients if it is presented properly.

Of course, as previously stated, this system can work only if no major error of underestimation has been made. If time and cost estimates are much too low, members of a group practice who wish to avoid losses will have to proceed so slowly with treatment that nonurgent needs will become urgent. This occurrence would defeat the purposes of the entire concept.

Classification of dental needs by degree of urgency

Class 1: Very urgent—functional and social disability conditions requiring rapid attention

pain and acute infections
suspected neoplasms
dental caries into or near the pulp
teeth obviously requiring extraction
disfiguring conditions, such as missing or badly decayed anterior teeth

Class 2: Moderately urgent—conditions requiring care within 6 months

chronic or subacute periodontal conditions and heavy calcareous deposits
extensive penetration of caries into dentin
sufficient missing posterior teeth to require replacement (less than eight opposing posterior teeth)
space maintenance for children
replacement of ill-fitting removable appliances

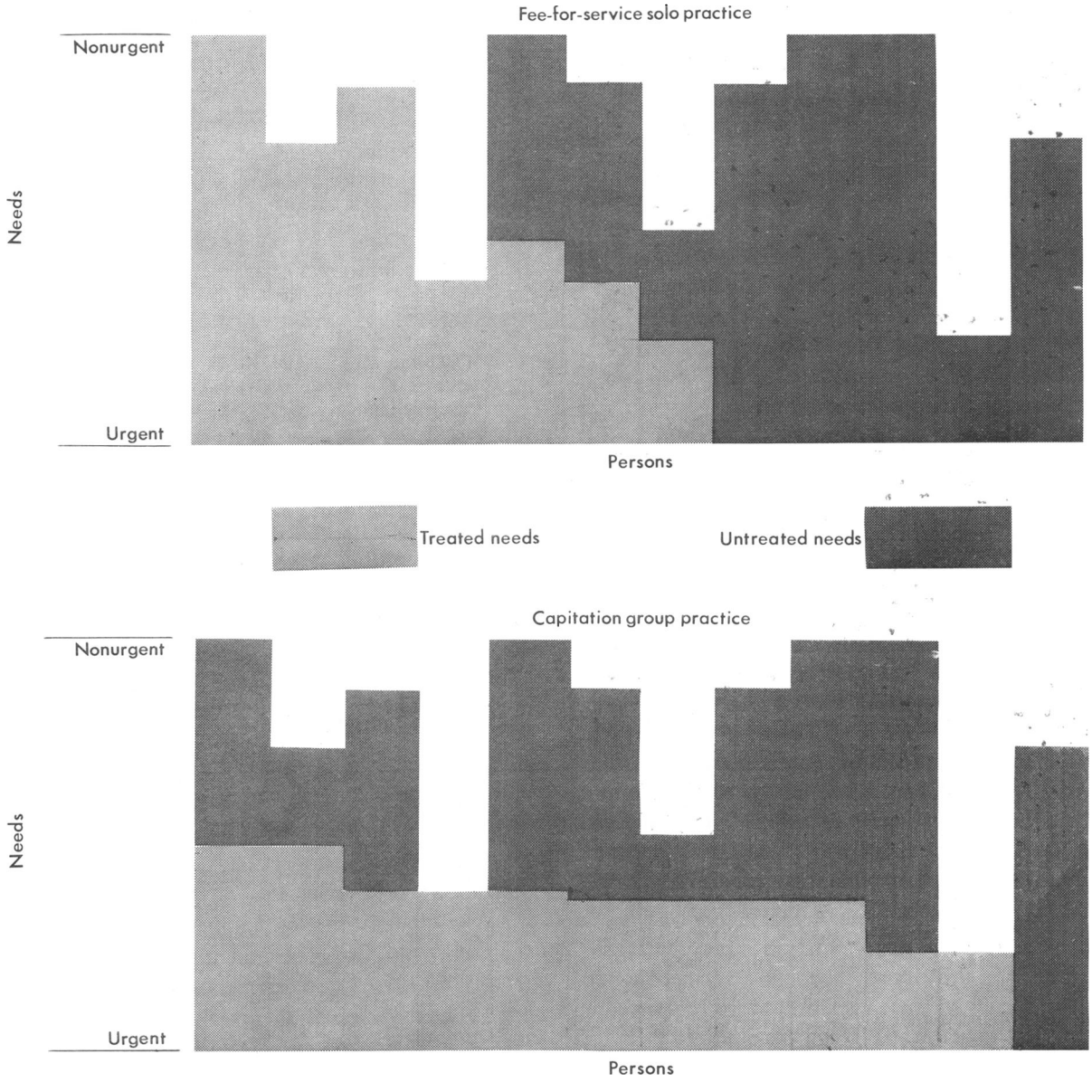
Class 3: Nonurgent—conditions requiring care that is postponable for a time

peridontal surgery
incipient caries
elective third-molar extraction
replacement of missing teeth when fewer than the requirements of class 1 and class 2 conditions
certain inlays or crowns on teeth previously restored with large amalgams, silicates, or stainless steel crowns

Class 4: Maintenance—no presenting requirements except routine care

no apparent pathological condition
patients scheduled for routine prophylaxis

Treatment of urgent and nonurgent needs of a given population in fee-for-service solo practice and in capitation group practice



Orthodontics and the Time Concept

The same concept of time that has been applied to other dental needs can be applied to an orthodontic benefit. Surprisingly, the monthly costs are minimal since this service generally has to be provided only once in a lifetime to a portion of the population. The expensive single case is distributed over both time and persons.

For simplicity let us assume that the child population in our example is evenly distributed over all age groups from birth to the 19th birthday and that there is no turnover of the eligible persons. A general formula for annual orthodontic cost would be:

$$R_{OR} = \frac{D}{19} \times N \times U \times T_{OR} \times C_{OR},$$

where:

R_{OR} = Annual cost per family for orthodontic treatment

D = Number of dependent children per family

N = Percent of children needing orthodontic treatment

U = Utilization rate

T_{OR} = Orthodontists' chair time required to complete an average case

C_{OR} = Cost per orthodontist chair-hour.

Further assumptions are that all orthodontic cases will be completed in 1 year. The end results would be the same if 2 years were used, since the hours per year would decrease, but the number of cases would increase. For example, if an orthodontist can start 100 cases per year and takes 2 years to complete them, he has 200 persons under treatment at all times after the first year.

An example of the use of this formula follows.

Assume:

D = 1.2

N = 50 percent

U = 50 percent

T_{OR} = 15 hours

C_{OR} = \$70;

then:

$$R_{OR} = \frac{1.2}{19} \times 0.5 \times 0.50 \times 15 \times 70 = \$16.58$$

(or \$1.38 per month).

If a surcharge or co-payment were included, the capitation cost would drop accordingly. As with general dentistry, a system of priorities and the pacing of appointments would assure a relatively even flow of patients, and these procedures would help conserve resources and assure treatment of major conditions first. (The term "major" includes those for which postponement of service would result in more extreme need.) For other than major conditions, postponement has little effect on treatment need. Since somewhat less than 15 minutes of dentists' time would be needed per family per year, 6,000 families would provide enough patients for one orthodontist working 1,500 chair hours per year.

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Since dentistry deals primarily with chronic disease, the dental treatment of a target population covered by a third-party payment program can be paced so as to maximize the use of resources and minimize the deleterious effects of oral ill health. Capitation group practice lends itself to such control.

First, however, a capitation rate for the population has to be established, based on its need for dental resources and the cost of supplying them. Factors requiring consideration are the amount of dentists' and hygienists' time required, which is affected by the need for initial care, as opposed to maintenance care, stability of the population, utilization of services, family size, age of eligible persons, fluoridation, and socioeconomic variables. Provider time and cost are also affected by the type, quantity, and use of facilities and of auxiliary personnel.

A method has been devised that takes account of these various cost factors and provides a realistic basis for arriving at a capitation rate per person or family for a given population. This method is appropriate for populations with differing dental requirements and financial capabilities since the pertinent formulas and priorities include numerous variations. For example, to lower the capitation rate, members of families may be phased into treatment. Also, surcharges or co-payments can be placed on patients for all services or only for specific ones. If this method is used to provide care under a rational system of priorities, capitation group practice of dentistry can achieve results not obtainable under the fee-for-service solo practice system. In prepaid group practice there are incentives for using expanded duty auxiliaries, containing costs, and improving the level of dental health of the eligible population through both treatment and prevention.