A NEW TYPE OF HOSPITAL INSURANCE:

A PROPOSAL FOR AN EXPERIMENT

Joseph P. Newhouse
Vincent Taylor

October 1970

P-4485

A NEW TYPE OF HOSPITAL INSURANCE: A PROPOSAL FOR AN EXPERIMENT

Joseph P. Newhouse and Vincent Taylor*

The Rand Corporation, Santa Monica, California

Summary of Issues

It has become a cliche that medical care prices, especially hospital prices, are rising. Present hospital insurance arrangements are an important cause of this situation. Typically the purchaser of an insurance policy can go to any hospital without changing his total bill very much (although his choice may change the bill paid by insurance by a great deal). In such a situation the consumer and his physician have no incentive to seek out the most economical hospital; rather each physician and consumer has the incentive to demand the very best. In other words, since the costs of hospitalization are shared among all subscribers to an insurance plan, any given individual incurs little financial penalty by demanding the very best. Hospitals' attempts to meet these demands contribute importantly to rising prices. Moreover, since price is not very important to patients, cost-saving measures receive relatively low priority in management decisions, further exaggerating the effects of rising labor and material prices on hospital costs.

---

*This research was supported by a contract between the Office of the Secretary of the Department of Health, Education, and Welfare, and Professor Lester B. Lave. Any views expressed in this paper are those of the authors. They should not be interpreted as reflecting the views of the Department of Health, Education, and Welfare or The Rand Corporation.

The authors wish to acknowledge helpful comments from Judy and Lester Lave and Richard Zeckhauser on an earlier draft.

The remedy most commonly heard for coping with rapidly rising hospital costs is hospital planning. In practice, however, it is not clear what planning implies. Often its advocates focus upon the duplication of equipment among hospitals, and assume that planning can end gross duplication. Perhaps it can, although even that may not be true. And ending gross duplication would, in all likelihood, do little to stop the rise in hospital costs.

A more specific proposal, put forth by the National Commission on Health, Manpower is to adopt incentive payment plans for hospitals (National Commission on Health Manpower 1967). This proposal has also been put forward by others (Social Security Administration 1968). The essence of this proposal is to give each hospital a target cost and then to reward or penalize it according to whether its costs are above or below the target. This plan would probably be an improvement over the present situation, but is flawed by not incorporating information about consumer preferences. This has two consequences.

First, consumers may be willing to pay extra to go to a particular hospital. It may be near to them, or it may be familiar, or it may be affiliated with their religious denomination. Thus, consumers might willingly pay the costs of using a more expensive hospital. If so, to force a hospital out of business by setting an unrealistically low target cost can make consumers worse off. Nor should this be thought of as merely a hypothetical example. A very similar case actually occurred with St. Francis Hospital and the Hospital Review and Planning Council of Southern New York, supposedly one of the most sophisticated of the hospital planning councils (Somers and Somers 1967, p. 208, n. 5).

Second, without knowledge of preferences, it is impossible to know what the appropriate quality mix should be. If the present system generates "Cadillac-only" care, the target-cost plans are analogous to giving Cadillac producers cost targets -- Cadillacs might be built a little more cheaply, but there still would be no Chevrolets for those who wanted them. Or to take another analogy, giving Soviet plant managers incentives may cause them to run a better managed plant, but there is no guarantee that they will produce that mix of products which consumers most wish to purchase.

A further difficulty with target-cost plans is in setting appropriate "targets." There are numerous chances for error and distortion in the setting of target costs. Since hospitals treat different case mixes, and since case mix influences cost, it is unreasonable to set the same cost target for all hospitals (Feldstein, 1967). But determining the appropriate cost target for each hospital is difficult and costly -- and if the target costs are to provide an appropriate incentive, there cannot be much room for error. Then there is the problem of distortion. What is the nature of the target? Cost per patient day? Then the administrator will perhaps urge longer stays, since that will tend to lower cost per patient day. Or he may encourage the admission of low-cost cases and discourage the admission of high-cost cases. As the Soviets have discovered, it is difficult to find a method for setting targets that does not yield undesirable results. (Nove, 1958).

In the next section we propose an alternative to present hospital insurance arrangements and to target cost plans. We believe this plan will result in less rapidly rising hospital costs for two reasons.

First, it will penalize hospitals with inefficiencies, and second, it will work toward correcting the bias toward Cadillac-only medicine.

Variable Cost Insurance

In its simplest form, our proposal is that consumers be asked to select the hospital they will use, knowing that their insurance premium will depend on the costliness of the hospital they select. If they become sick, they would be expected to go to the hospital they selected; however, provision would be made for the case in which this hospital was full or was not capable of treating the particular illness. Further, if the consumer changed his mind when he became sick, he would always be free to select a different hospital; however, should the new hospital be more expensive than the one covered by his insurance premiums, he would have to pay the difference. If the new hospital were less expensive, some type of credit could be provided. We call this kind of medical insurance Variable Cost Insurance (VCI). (See also Newhouse and Taylor, (1970, 1971)).

An Illustration of VCI

As an example of VCI, suppose there is an area with two hospitals. One specializes in training physicians, pursues extensive research, and utilizes the latest, most sophisticated medical equipment: it costs $100 per day. The other hospital is very cost conscious, does not have any of the elaborate new equipment such as hyperbaric chambers, and consequently costs only $50 per day. To make the example extreme, we suppose that the cheaper hospital is located in a rural neighborhood and the expensive hospital is located in an urban neighborhood; both hospitals have identical lengths of stay for a given type of illness.

Suppose there is a firm with half of its employees living in the rural setting and half living in the urban setting. Each employee pays half of his medical insurance premium, which is calculated on the basis of an average per diem charge of $75, and the firm pays the remainder. It is also reasonable to assume that the rural dwellers choose their neighborhood hospital and the urban dwellers choose their neighborhood hospital.

With current group-rated insurance, the rural are subsidizing the urban, since each use local hospitals. More importantly, neither are motivated to use the cheaper hospital nor is either hospital motivated to worry about cost increases. Under VCI, each employee would be asked to designate the hospital he would choose to use. If the urban continued to select the expensive hospital and the rural continued to select the cheaper hospital, the urban would experience a marked increase in their medical insurance premiums (67%) while the rural would experience a marked decrease in their premiums (67%). (The percentage changes assume the employer maintains his contribution.) More likely, some of the urban would be motivated to seek the services of the cheaper hospital to save money. As the occupancy rate at the expensive hospital fell, the administrator and trustees would become more cost conscious and attempt to be more competitive. As his occupancy rate rose, the administrator of the cheaper hospital would work hard to keep his costs down in order to keep this increase in demand for his hospital.

On the contrary, it is also possible that some of the rural would choose the more expensive hospital because they had not realized that

better quality care was available. As people began to switch to the better hospital, the administrator and trustees of the less good hospital could purchase more modern equipment and generally spend greater sums to improve the quality of medicine in their hospital, since they would have evidence that patients were willing to bear the cost of these improvements. Whichever kind of switching occurred, the point is that the administrators and trustees would be motivated to change their hospitals in response to consumer desires and demands.

Problems of Implementing VCI

This illustration of VCI is extraordinarily simple. Even so, there are a number of problems which arise. What costs should the premium be based upon? What if the hospital of choice is full? What if the hospital of choice cannot treat the particular illness? What if individuals want to select a pediatric hospital for their children, an obstetrics hospital for maternity, and a general hospital for all else? We proceed to explore many of these difficulties.

VCI relates premiums to the cost-level of a hospital. What we desire is a cost index for a hospital that reflects the cost of treating a typical case in that hospital relative to the cost of treating it at other hospitals in the area. It would probably be unwise to relate premiums simply to per diem cost, because the case mix at a hospital will influence per diem cost. If two hospitals are of equal quality and equal management and differ only in case mix, it would be desirable that they have the same cost index. Although we believe there is a preferred way to calculate a cost index, almost any index of cost which is acceptable to participating hospitals will bring about most of the

benefits of the plan. This is because great exactness in the determination of cost is not essential to VCI. After a cost index of the hospitals in an area has been determined, the consumer is asked to choose a hospital (or hospitals), knowing that his premium will be proportional to the costliness of the hospital he selects. The dollar amount of the premium will be set so that the insurer covers its costs, exactly as it is now. Further, the hospital can be reimbursed exactly as it is now (or in any other mutually agreeable fashion) for the cases it treats. Thus, extreme accuracy in the costliness index is not important to the insurer or critical to the hospital.

For example, the insurer could merely pay the subscriber's hospital bill, whatever it is. The bill, of course, would then be used to determine the hospital's relative cost in the next time period. If the cost index used to measure relative cost is too high for one hospital and too low for another, fewer consumers may use the first hospital and more may use the second, but each hospital will be reimbursed for the cases it treats at whatever charge it makes. Hence, small errors in determining relative cost should not prove serious to the participating hospitals. (Further, since it is relative cost which matters, if the method used to calculate cost over- or underestimates by the same proportion at each hospital, there is no problem.)

There are a number of ways one could determine the relative cost of a hospital. The simplest is to use its per diem costs. Other methods can be used which adjust for the case mix at the hospital. Since the details of alternative methods for determining relative costliness are

somewhat technical, we have placed the discussion of these methods in an appendix.*

Some individuals probably wish to use different hospitals for different medical conditions. In some cities, for example, almost all may use one particular hospital for pediatrics or for obstetrics. If, in fact, there is only one hospital which treats certain types of cases, the simplest method is probably to permit subscribers to use these hospitals without any penalty or credit, regardless of their choice of hospital for general medical and surgical care. The expected cost would, of course, be included in each subscriber's premium. Further, there might be separate choice of hospital for complex conditions, with the insurance premium based on a composite of the expense ratings of the hospitals chosen.

This raises a question about the appropriate degree of disaggregation to allow in the way of hospital selection. At one extreme would be the requirement that a subscriber select only one hospital. At the other, he might be allowed to select a separate hospital for each 4 digit ICDA code. Clearly at this last extreme, the plan would be so complex and cumbersome that neither consumer nor insurance organization would accept it. We leave the question open, but note that choice of hospital for a small number of categories of treatment would seem likely

---

*Our preferred method is to define a price relative for a number of types of cases. The price relative would be the ratio of the average charges (including all charges for laboratory fees, etc.) at a particular hospital for the type of case in question (e.g., uncomplicated birth) to the average costs in the community for that case. The hospital's relative expense rating would then be a weighted average of its price relatives, the weights being the proportion of revenue the hospital derives from each case.

to be desired by a number of consumers and should not add significantly to administrative costs.

Another area where policy choices need to be made by the insurance organization is in those cases where patients go to hospitals other than the ones for which their premiums were calculated. If there is no difference in the relative costs of the hospitals, there is obviously no problem. The insurer could pay the bill, as before. But, what if the patient chooses a more expensive hospital (or a less expensive one)? Again, there are a number of acceptable policy choices, and we suggest that the final choice be made by the insurance organization. The following simply lays out some of these options so that they may be considered:

In the event a subscriber chooses a more expensive hospital without any extenuating circumstances, it would seem reasonable to charge him for the entire extra cost incurred by the insurance company. This could be done simply by making the fraction of the bill paid by insurance equal to the relative costs of the two hospitals. In symbols, the fraction paid would equal E_p/E_u, where E_p is the relative costliness of the hospital paid for in the insurance premium, and E_u is the relative costliness of the hospital actually used.* If acceptable to the insurer, any additional amount due could be paid the hospital by the insurer; the subscriber would then pay the insurer on the installment plan for the debt incurred, with the payments necessary to amortize the debt (including interest) being added to the insurance premium.

---

*If the subscriber had chosen different hospitals for different categories of care, the appropriate indices to use would be relative costs for this category of care.

If the subscriber chooses a less expensive hospital than the one he has paid for in his insurance, the problem is a little more complicated. If the formula described above is used, it could result in making cash payments to the subscriber (when there is no coinsurance) -- a result that is generally considered undesirable by insurers because of the problem of "moral hazard" (making it profitable to get "sick"). An alternative that might reduce this difficulty would be to give the subscriber a credit against future insurance premiums when he used a less expensive hospital. Alternatively, there may be no credit given for using a less expensive hospital. While this is simpler and eliminates the possibility of profiting from being sick, it reduces the incentive to economize on care.

Subscribers may contract diseases that cannot be adequately treated in the hospitals that they have chosen, requiring them to seek care in more expensive facilities. In this case, it would seem undesirable to force them to make extra out-of-pocket payments. One possibility is to provide that a patient may be treated elsewhere at no additional cost to him if certain requirements are met (for example, if the primary physician and a consulting physician chosen by the insurance organization so recommend). The exact nature of the requirements should be left to the insurance organization, since they must balance the costs of abuse of the privilege against the costs of stringent screening requirements. The insuring organization can determine by experience for each hospital how many of those electing a hospital will have to make use of this option and set premiums for each hospital accordingly.

Another difficulty arises when the hospital which the patient has elected is full. This is not a problem if the hospitals with waiting lists are the more expensive ones. Naturally a subscriber could choose an equally or less expensive hospital without penalty (and in fact, might benefit if the premium-credit plan described above were in effect). Again, however, the insurance organization will need to set up procedures for deciding on how much, if any, additional payment will be required by subscribers if they go to a more expensive hospital than is provided for by their insurance.

Pros and Cons of Variable Cost Insurance

Variable Cost Insurance offers a number of significant advantages over existing and other proposed plans. Many of them have been alluded to already. Since each potential user would pay for the quality of care he desired (and in general would receive when sick), the subsidy paid to the users of high cost hospitals by the users of the low cost hospitals would be ended. Thus, the plan would be more equitable.

Efficiency should also be increased. Since consumers would try to get the most value for their money (which they have no incentive to do under present plans), hospitals that did not deliver a quality of care commensurate with their cost would tend to lose patients. Likewise, if some consumers would prefer to pay less and go to a less-high-quality hospital, they would be free to do so.

In discussions with numerous individuals in the insurance industry, some objections have been raised to VCI. Most of these objections do not stand up to close analysis. The most commonly voiced objection

is that for VCI to be beneficial, individuals must have significant freedom of choice of hospitals -- but such freedom does not exist. While we do not deny that consumers' choice of hospitals is circumscribed, we believe that most critics overstate the amount of freedom of choice needed for VCI to have a beneficial impact on hospital costs. If only 10 percent of the patients of a high cost, low quality hospital decide to go elsewhere, the management of the hospital will be under considerable pressure to improve its performance. Even if the change is gradual, with only a few percent of patients going elsewhere each year, the cumulative effect over a five-year period will be very substantial.

It is also argued that the physician, not the patient, chooses the hospital, so that increasing cost awareness of consumers is irrelevant to influencing choice of hospitals. This argument implies that most physicians do not take into account the wishes and desires of their patients, something we do not believe is true. A physician with appropriate staff appointments might very well tailor his recommendations on hospital choice to the income status of his patients. Further, the adoption of VCI might encourage physicians to obtain staff affiliations at hospitals with varying expense classes. Some physicians may move their practices to more efficient hospitals in order to lower the cost of insurance to their patients. Again, only a small percentage of physicians need to make such moves in order to have substantial impact. Even those physicians who do not move seem more likely under VCI to bring pressure to bear upon the hospital management to curtail waste. The cost of such waste will be borne directly by their patients,

perhaps causing them to lose some patients, but in any event making their patients less well off.

Another argument which may be quickly disposed of is that consumers do not have sufficient expertise to choose a hospital. Under VCI a consumer cannot be in a worse position than he is now, when he must rely solely upon the physicians' recommendation. Usually those who make this argument really are worried that VCI will be successful in causing consumers to economize upon their hospital care; that is, they worry that consumers will not be willing to pay the full cost of high quality care. Some will, and some won't -- but that is one of the desirable aspects of VCI. Forcing the consumer to buy a Cadillac when he would prefer a Chevrolet plus some money to buy other goods does not make him better off.

It is true that the administrative costs of VCI would exceed those of conventional insurance plans. How large these costs would be relative to potential savings could be estimated by an experiment to be described below.

Extension of VCI to Comprehensive Care and Physician Care

VCI is straightforwardly applicable to comprehensive care. The consumer would pay whatever the group providing the comprehensive care charged. Thus, those providing prepaid comprehensive care would take over the insurance function and, by setting a premium, determine their relative costliness.

The application of VCI to physician services is harder than to hospital services but not impossible. Because it offers a way of

making the market for physician services significantly more competitive and so slowing down the inflation in physician fees (and perhaps even lowering them), it deserves discussion. The problem in applying VCI to physician services is the difficulty in obtaining a meaningful index of relative cost. If VCI for physician services existed, a physician would face an incentive to assign patients to an overly expensive case type, since this would increase the amount he could charge at any given measure of relative cost.

Such a problem has been faced in a different form by the Physicians Association of Clackamas County (Oregon). They offer prepaid comprehensive care, but reimburse physicians on a fee-for-service basis. Since there is only a fixed sum of money to be divided among the physicians, they must have an internal check against overcharging or overutilization. They solve the problem as follows: the first physician a patient sees for an illness is designated as the primary physician for that patient. All charges subsequently incurred in treating a particular illness episode are charged to that physician's account. If the physician refers to another physician, the first physician's account is charged. Likewise he is charged for any hospitalization or laboratory tests which might be necessary. The average cost per case is then computed for each primary physician. Clackamas County runs its plan so that if a physician's case cost is more than 15 percent above the county average, he is liable to pay back to the plan the excess. Exceptions may be made if the physician can show that he has had some catastrophic cases. The plan has been operating for thirty years. What is important for our purposes is that evidently the case mixes of the primary

physicians in the plan are not sufficiently different to cause great variation in case cost. (To minimize this possibility, the plan uses a twelve month moving average of physician case cost.)

If the average case cost is a meaningful figure and not subject to great variation from variation in case mix (as the Clackamas County experience would make it appear), the principles of VCI can also be applied to physician services. The relative costliness for each physician would simply be his average case cost relative to some standard.

Other Literature

There is little literature relevant to VCI. So far as we can tell, it is a genuinely new direction for medical insurance. Some have suggested to us that it is similar to capitation payment, as suggested by Robert Sigmond and others (Social Security Administration 1968). Under capitation payment each hospital would receive a certain fixed amount for each patient who elected to use it. However, the amount, at least initially, would be the same for all hospitals, and would be set at the average for the area. Thus, this proposal solves none of the problems discussed at the beginning of the paper. The consumer still has an incentive to demand the very best in hospital services. The plan does not allow for quality differences for which consumers might be willing to pay; implicitly it pushes all toward the same quality level. Nor does it allow for cost differences due to differences in case mix. Thus it will unfairly and very seriously penalize some hospitals. For these reasons we find VCI both different from and preferable to capitation.

Mark Pauly has discussed the moral hazard associated with hospital insurance. (Pauly 1968). In effect, VCI attempts to eliminate the moral hazard which attaches to choice of hospital, as well as reduce X - inefficiency in the production of hospital services. (Newhouse and Taylor, 1970). Moral hazard related to length of stay remains.[1] This problem can be attacked by physician insurance of the type outlined above. We note in passing that Pauly feels VCI "deserves a try." (Pauly 1970).

Martin Feldstein (1970) has recently proposed major risk insurance as a possible solution for escalating hospital costs. The essence of this proposal is that consumers would be given an insurance policy with a sizable deductible, the exact size of which would vary with family income. Above the deductible, the insurance could pay everything; alternatively, there might be 50 percent coinsurance for a certain range. This proposal is not mutually exclusive with VCI. In fact, we feel that it could be made even better by incorporating VCI. VCI would improve the information available to the consumer about the relative costliness of hospitals; thus, the consumer could be expected to make a more informed choice of hospital. Further, VCI would strengthen the incentives of the consumer to choose a hospital which delivered a quality of care commensurate with its cost.

---

[1] Some feel that this is the significant problem. For example, a referee of this paper commented that: "The real problem in the financing of hospital care is unnecessary utilization, not the level of unit costs. Many administrators and observers have stated that unit cost probably cannot be reduced more than 15% in most hospitals." We would guess that the potential savings are much larger. For example, the National Health Manpower Commission found that wage-adjusted per diem cost in a "carefully chosen set of 'distinguished' hospitals" which were "essentially equivalent" varied from $46 to $96. (National Commission on Health Manpower, 1967, p. 55).

An Experiment to Test VCI

The experiment we propose is to insure a certain large group or groups of subscribers under the terms of VCI. Hopefully the group would be large enough to contain considerable geographical and socioeconomic diversity, for we believe these two factors are quite significant in influencing hospital choice. Thus, the employees of one or more fairly large plants might be chosen. The attractiveness of VCI to the employees and management will be greater if they are located in an area with several hospitals whose costs are widely dispersed since VCI will then offer potential for substantial savings over present plans. If the employees pay their own insurance premiums, application of VCI is straightforward. Suppose, however, the employer pays the insurance premiums. Then he might agree to pay for insurance at the "average" cost hospital; alternatively, the employer could agree to maintain the same amount of insurance payments as he does at present. If employees elected hospitals under the average, they could receive the difference (the difference could perhaps be an increase in other fringes); conversely, if they elected hospitals with higher than average expenses, they would pay the difference. A hypothetical plan is outlined in Table 1.

Evaluation of such an experiment, as Pauly notes, is difficult. (Pauly 1970.) That is because the incentives VCI brings to bear are upon the choices of the hospital management, and those choices affect all patients at the hospital. However, if VCI were restricted to one area, and if the consumers with VCI were a significant fraction of the population of the area, we would expect hospitals in that area to show

Table 1

HYPOTHETICAL PLAN

Relative Costliness of Hospital Chosen	Insurance Cost ($ per mo.)	Employer Contribution ($ per mo.)	Employee Contribution ($ per mo.)
.75	$15	$20	receives $5
.9	$18	$20	receives $2
1.0 (average)	$20	$20	0
1.25	$25	$20	pays $5
1.5	$30	$20	pays $10

a lower rate of increase in costs than a control group of hospitals. Conceivably the group of hospitals operating under a VCI plan might even show a decrease in costs.

Even if the trial group is a negligible fraction of the total market, one can observe the trial group's choice of hospitals. We would like to know how implementation of VCI changes their choices. We expect that there will be more usage of lower cost hospitals. To test this it will be necessary to gather data on which hospitals members of the plant utilized before the plan took effect, for example, by collecting data for six months prior to implementation of VCI. (Hence, we would use the group in the sample as its own control.) This prior choice of hospital can then be compared with the actual choice after the plan takes effect. This provides an estimate of how much reallocation of hospital patients among hospitals takes place after the implementation of VCI. We would expect that the reallocation will continue to occur for a number of years, so that any initial gains from reallocation should be treated as a lower bound.

Even more importantly, the gains from reallocation are a lower bound because under VCI high-cost hospital should be motivated to improve efficiency. If this happens, gains accrue to all users of the hospital. In practice, such gains could be expected to overwhelm the gains to those patients who actually do change their choice of hospital.

BIBLIOGRAPHY

Feldstein, Martin S., Economic Analysis for Health Service Efficiency, Amsterdam: North Holland Publishing Company, 1967.

_____, "National Health Insurance: A New Approach," mimeo 1970.

National Commission on Health Manpower, Report; Washington: GPO, 1967.

Newhouse, Joseph P. and Vincent D. Taylor, "The Subsidy Problem in Hospital Insurance," Journal of Business, October 1970, pp. 452-456.

_____, "How Shall We Pay For Hospital Care?", forthcoming in The Public Interest, Spring 1971.

Nove, Alec, "The Problem of 'Success Indicators' in Soviet Industry," Economica, 25, February 1958, pp. 1-13.

Pauly, Mark V., "The Economics of Moral Hazard: Comment," American Economic Review, 58, June 1968, pp. 531-537.

_____, "Efficiency, Incentives, and Reimbursement for Health Care," Inquiry, 7, March 1970, pp. 114-131.

Social Security Administration, "Reimbursement Incentives for Hospital and Medical Care," Washington: GPO, 1968 (Office of Research and Statistics Research Report No. 26).

Somers, Herman M. and Anne R. Somers, Medicare and the Hospitals, Washington: The Brookings Institution, 1967.

Technical Appendix

THE FORMULA TO COMPUTE EXPENSE RATINGS

In this appendix we consider alternative methods for determining the relative costliness of hospitals. We call an index which measures relative costliness an index of expense ratings. There are at least five desiderata for a formula to compute hospital expense ratings:

1) If the only reason for cost differences between two hospitals is case mix, the formula should give the hospitals the same expense ratings;

2) The formula should give the administrator an incentive to produce hospital care efficiently (including producing at the optimal scale);

3) A hospital whose costs are $\underline{x}$ times those of another because of inefficiency should have an expense rating which is $\underline{x}$ times the other;

4) The formula should lead to a price structure for hospital services which approximates the structure of marginal cost;

5) The formula should offer the administrator an incentive to expand those parts of his operation which are relatively efficient and contract those which are not.

Assume for now that the consumer elects one hospital for all his care and that his premiums are proportional to the expense rating for that hospital. At the end we will consider the consequences of allowing the consumer to select a different hospital for various diseases. Since any disease group for which a consumer elects one hospital will of necessity be heterogeneous, the following analysis will in that case apply within disease groups.

To use simply per diem cost does not satisfy the first desideratum. Therefore, we consider three alternatives to per diem cost for computing

the expense rating. All of these methods try to adjust for differences in case mix. The first method sets the premium to use any hospital as the sum over all case types of the subscriber-group probability of contracting case type j times the costliness of the hospital for case type j (plus any normal profit to the insurer).* Thus, the expense factor E for the ith hospital would equal

$$E_i = \sum_j p_j AR_{ij},$$

where p_j is the probability of contracting case type j ($=f_j/f$, where f_j is the frequency of case type j and f is the total number of cases) and AR_{ij} is the average charge for case type j in hospital i. The AR_{ij}'s could be derived from a sample of bills submitted to the insurer and should be all-inclusive (that is, they should include laboratory charges, etc.). How disaggregated case types should be is left to the insurer; while extreme accuracy is not essential, some disaggregation will improve accuracy and is desirable.

The second plan is to introduce hospital-specific weights for each case rather than subscriber-group weights and also to normalize each charge by the average charge in the community. This plan would make the expense factor for the ith hospital

$$E_i = \sum_j \frac{f_{ij}}{f_i} \cdot \frac{AR_{ij}}{\overline{AR}_j},$$

where f_{ij} is the number of cases of type j in hospital i, f_i is the

*By case type, we mean type of procedure performed, e.g., uncomplicated birth.

total number of cases in hospital i, and $\overline{AR}_j$ is the average charge for case type j for all hospitals in the community

$$\left(= \sum_{i=j}^{n} AR_{ij}/n\right).$$

Normalization by $\overline{AR}_j$ means the hospital with an expensive case mix is not penalized, as it otherwise would be with hospital-specific weights.

The third plan is similar to the second except that instead of using frequency weights, it uses hospital-specific revenue weights. Thus,

$$E_i = \sum_j \frac{TR_{ij}}{TR_i} \cdot \frac{AR_{ij}}{\overline{AR}_j},$$

where TR_{ij} is the total revenue in the ith hospital from case type j and TR_i is the total revenue in hospital i. The third plan is our preferred alternative.

We assume that, insofar as possible, the administrator will seek to minimize E. Since the number of patients who elect to use his hospital will presumably be affected by the size of E, this seems like a reasonable assumption. Given this assumption, it is clear that all three expense rating formulas offer the administrator an incentive for least cost production. If he can reduce expenses, he will be able to reduce charges and, then, reduce his expense rating. It also follows that the administrator will seek to produce at the optimal scale.

All three formulas are linear in AR_{ij}. This means that a hospital whose costs are x times those of another because of inefficiency for all

j will have an expense rating x times another. (Although AR_{ij} enters as the square in the numerator of the third scheme, it also enters the denominator; thus, E is still homogeneous of degree one with respect to AR_{ij}.)

The fourth desideratum -- that the resulting price structure approximate marginal cost -- is not fulfilled by any of the three formulas, though in some sense the third formula comes closest. How important marginal cost pricing is depends upon how many noninsureds use the hospital and to what extent the charges affect physician decisions. It is also relevant in giving the administrator the appropriate incentives to expand. We discuss that below. We derive the price structure across case types on the assumption that the administrator minimizes E subject to a loss (profit) constraint. Further, we assume that $f_{ij} = g_i(E) \cdot h_{ij}$, where g(E) is the responsiveness of demand to the hospital's expense rating and h_{ij} is an exogenous parameter which depends only upon the hospital and the disease. g' is negative. Under these conditions the administrator minimizes E in the first formula by setting AR_{ij} equal to zero for all j except that j associated with min f_j/f. He sets AR_{ij} on that disease so as to satisfy the constraint. (If this appears implausible, consider the following: many of the cases at a hospital are routine, but it does maintain an intensive care unit. The hospital has a higher proportion of its cases in the intensive care unit than the average hospital with an intensive care unit. In that case the administrator can set charges for the intensive care unit very high, lower his charges for the routine case, and thereby lower E.) Such a structure

appears undesirable. Formula two leads to an indeterminate price structure; there are an infinite number of combinations of prices which satisfy the constraint and which minimize E. Under the third plan we have:

$$\frac{2P_{ij} - E}{(g + g'_{ij}\,(\frac{R^*}{h_{ij}} - MC_{ij}))} = \frac{2P_{ik} - E}{(g + g'_{ik}\,(\frac{R^*}{h_{ik}} - MC_{ik}))}$$

where P_{ij} is the price factor for the jth disease in the ith hospital

$$(P_{ij} = AR_{ij}/\overline{AR}_j),\ R^* \text{ is } \sum_j h_{ij}AR_{ij},\ g'_{ij} = dg/dAR_{ij},$$

and MC_{ij} is the marginal cost of the jth disease in the ith hospital. If g' is zero, then the price factors for the two diseases at the same hospital are equal. Further, if g' is not zero, the price factor moves in the same direction as marginal cost (since g' is negative). Thus, because the price structure is determinate and "reasonable," the third plan appears to us to be the best.

If price equalled marginal cost, only the second and third methods would satisfy our fifth desideratum -- that the formula offer the administrator an incentive to expand those parts of his operation where he does relatively well and contract those where he does relatively poorly. To bring out the point at issue, assume that the AR_{ij} are constant as size changes. Then to expand certain parts of the operation and contract others will leave the expense rating when calculated by the first formula unchanged. In the second and third formulas, expanding those operations whose expense factor $(AR_{ij}/\overline{AR}_j)$

is less than E (when E is calculated according to the corresponding formula) will decrease E and conversely. (To see this note that if $AR_{ij}/\overline{AR}_j$, is less than E, the weighted sum of the remainder of the j must be greater than E. To increase f_{ij} increases the weight of the jth disease in both formulas and so decreases E. The converse is, of course, also true.) Unfortunately, under neither plan is price likely to approximate marginal cost. We therefore turn to a modification which makes this more likely.

That modification is to allow hospitals to compete for some or all of the case types, and allow the consumer to separately insure for each case type. This is preferable not only because it gives the consumer more options, but also because it minimizes the possibilities for manipulation of the price structure. If a hospital charges an artificially high price for a particular disease group, it will face competition for that group, and it is likely to lose its revenue from that group. As a result, prices for different disease groups will probably reflect cost, which means that the hospital will be encouraged to expand its operations in those disease groups for which it is relatively efficient and contract them in those for which it is not.

However, there is a practical limit to the extent to which disaggregation can be carried. Thus, any subgroup offered to the consumer is likely to contain a number of different case types (e.g., the consumer elects hospital 1 for obstetrical care, hospital 2 for all else). In that case the analysis set out above is relevant to each subgroup (e.g., to all obstetrical cases). In other words, E_i would be computed

for a subgroup of cases (e.g., obstetrical cases) by applying the third method of computing E to that subgroup. If a consumer went to a hospital other than the one he was insured for, the fraction of his bill paid by insurance should then be the ratio of E's for that subgroup of cases. Note that if there is complete disaggregation, all formulas yield the same expense rating. The second and third formulas are equal since

$$\frac{f_{ij}}{f_i} = \frac{TR_{ij}}{TR_i} = 1.$$

They give the same index as the first formula, since there is only one term in the summation and $\overline{AR}_j$ is constant across hospitals.