A Measure of the Welfare Cost of Health Insurance

by Mark V. Pauly

A measure of the economic welfare cost due to excess usage of insured services is presented, illustrated by empirical estimations of the welfare cost of existing insurance in selected years and of the effect on marginal welfare cost if all 1963 physician care had been fully insured. It is argued that no a priori *case can be made for either increasing or restricting insurance coverage as a means of reducing excess usage cost, but that empirical investigation, with refined estimates of critical parameters, will allow prediction of the effect of any health insurance package on economic welfare.*

Numerous empirical studies have noted that the existence of insurance or prepayment affects the kinds of medical care that are most used [1–6]. Not so well understood is why the existence of insurance should affect the amount of care used. The author has suggested elsewhere [7] that insurance, by lowering the point-of-service price to the individual below true cost, causes him to increase the quantity of care he demands. The individual nonetheless pays for this increased amount of care at full cost, in that he pays the actuarily necessary insurance premium in addition to the point-of-service price, and an inefficiency or economic welfare cost arises from the excess that he pays in this manner over what he would be willing to pay for the amount of care he demands under insurance.

A commonly suggested remedy for the problem of excess usage under hospitalization insurance is to increase the comprehensiveness of insurance, to cover the cost of health care regardless of where it is rendered. This, it is argued, would avoid the motivation inherent in hospitalization-only insurance to substitute relatively expensive hospital care at the lowered user price for cheaper outpatient, physician's office, or at-home care.

In its most naive form, the argument that comprehensive insurance (or specification of lower limits to the extent of benefits) will improve things because it reduces hospital use is easy to dispose of. The Report of the Advisory Committee on Hospital Effectiveness [8, p. 29] provides an example of this notion:

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> The provision [of a recommendation] looking toward regulations to establish a minimum range of benefits goes to the heart of the problem of overuse of hospital facilities and services. Patients who are insured for hospitalization but not for outpatient services, extended care or home care tend to be admitted to hospitals unnecessarily and to overstay in hospital beds when hospital care is no longer required. Such patients are a burden on the system, and while properly organized medical staff utilization review and utilization monitoring initiated by carriers are a curb on the abuses, it is evident that utilization review alone, however conducted, will not provide the protection needed to guarantee the effectiveness of the system. The removal of financial incentives to overuse and overstay is regarded as essential to achieve this result.

While it is not possible to give much substantive content to "effectiveness," even at this level of discourse it is not clear that the proposal is desirable if the "effectiveness" of the *total* health care system is considered. If insured and uninsured services are substitutes, extending coverage to previously uncovered kinds of care would redress the price imbalance to some extent by reducing the point-of-service price of the newly covered services, and use of the previously covered (higher in true cost) services would decrease, eliminating some of the welfare cost of overusage. But use of the newly covered services would increase, and overusage of these might ensue, entailing a new welfare cost. If previously uncovered services are complementary to previously covered services, then overusage of all facilities would rise. Thus if physician services, both in and out of hospital, are complementary to hospital services, extension of coverage to all physician services would increase, rather than decrease, overusage of hospitals. It will be assumed here, however, that hospital care and physician care are gross substitutes for each other.

One can, on certain standard assumptions, estimate both the welfare cost of excess usage under a given kind of insurance and the marginal welfare cost, or change in welfare cost when that insurance is made more comprehensive—whether by increasing the covered percentage of already covered expenses or by extending coverage to other kinds of previously uncovered expenses. (These alternative senses of "increased comprehensiveness," not often adequately distinguished, may have quite different consequences.) Increasing the comprehensiveness of coverage can lead either to a net gain or a net loss in economic welfare, and the net change that would result from adoption of a given insurance package can be evaluated to determine whether it is beneficial or deleterious.

The analysis presented here is not directly relevant to group practice prepayment plans, since these plans, though covering a large amount of medical expense, involve direct controls on usage of facilities: the quantity of care offered—i.e., what the patient can get for his money—is different in a prepaid group from what is available under simple comprehensive insurance. Therefore only the effect of increased comprehensiveness in coverage, with organization and method of payment held constant, is here considered.

The assumptions that underlie welfare cost analysis in general are discussed by Harberger [9]. Since this analysis is intended to be normative, the applicability of some of them to this case is further discussed.

1. *It is assumed that price equals marginal cost.* While this assumption does not hold for individual components of hospital services [10], there is some evidence that hospitals have a more or less constant long-run average-cost curve [11]. Therefore the average-cost pricing policy of the typical hospital may lead to pricing at marginal cost. Physicians, on the other hand, are ordinarily supposed to earn monopoly returns [12], but some recent work by Hansen [13] implies that the prices paid for the services of a physician entering practice yield him a return on his educational investment that is only slightly different from returns to his cohort of college graduates. This suggests that prices paid to physicians need not differ more from long-run marginal cost than do the prices of other professional labor services, so that the assumption of price at least equiproportional to marginal cost is perhaps not too far wrong. In any case, if it can be determined to what extent the price of hospital or physician services diverges from marginal cost, that can easily be incorporated into the analysis.

It has been argued that insurance may improve welfare by offsetting the effects of monopoly, but any gain in economic welfare that arises from the insurance-induced approach of price to marginal cost is obtained by physicians in the form of higher incomes, not by consumers of care. That is, the loss to consumers from purchasing medical care worth less to them than its cost may be less than the increase in physicians' income from "selling" more care. On balance, then, the gain to physicians exceeds the loss to consumers, and economists would say that economic welfare has increased. But the distributional implications of this increase may be unpalatable: there is no available mechanism to redistribute income from physicians to consumers of care.

2. *It is assumed that market demand provides a relevant measure of welfare effects.* It is sometimes suggested that lack of perfect knowledge makes consumer choice an unreliable indicator of economic welfare. It is not evident, however, what would be a better indicator. "Health" is sometimes suggested, but it is not clear how health can be defined or that it is a suitable maximand. Since most public policy has been directed at specifying the kinds rather than the quantities of care to be consumed, an analysis of the economic welfare effects of altering the quantities of approved-quality care seems appropriate.

3. *It is assumed that long-run marginal cost is constant.* This greatly simplifies both the analysis and the empirical calculations and may not be too bad an approximation if a suitably long run is chosen. But alternative assumptions about the behavior of marginal and average cost could be incorporated into the analysis.

4. *It is assumed that there are no marginal external benefits arising from individuals' consumption of medical care.* Communicable disease, for example, has been reduced to relatively minor economic importance in this country, largely through public health programs rather than through individual medical care. Thus there is little epidemiological protection of society in the consumption of medical care by an additional individual. Other types of external bene-

fits may be very important, but they cannot be quantified for incorporation into the analysis.

A Measure of Welfare Cost

If an individual's demand curves for a particular kind of medical care are $d_1, d_2, \ldots, d_n$ in the cases of events $1, 2, \ldots, n$ respectively, and if the probability of occurrence of each event is $p_1, p_2, \ldots, p_n$, then an expected demand curve may be established by adding up at each price the product of the amount of care consumed if each event occurs and the probability that the event will occur. This gives the demand curve for the average individual, whose insurance-reimbursed expenses equal the premium he pays, so that he neither gains nor loses by his purchase of insurance. Demand curves used in this analysis are these mean or expected demand curves. (Zeckhauser has analyzed uncertain future demands also, under the notion of "probabilistic individual preferences" [14].)

The expected demand curve for hospital care, then, is d_h (Fig. 1), and P_h is the price for a homogeneous unit of hospital care, assumed equal to a constant long-run marginal cost. Similar demand curves d_p and d_c for non-hospitalization-connected physician care (p) and for a composite good (c) that represents all other goods are shown in Figs. 2 and 3. In the absence of any insurance, quantities h, p, and c of the respective commodities will be purchased. Now suppose insurance is provided that covers some portion I_h (Fig. 1) of the cost of hospital care as coinsurance. (The argument could also apply to 100 percent insurance.) The quantity of hospital care consumed will increase from h to h'. The pure premium paid for this insurance will equal area P_hDCB. The demand curve for physician care will shift to the left. If the demand curve for the composite good shifts to the left also, as would be expected and is shown in Fig. 3, it indicates that less is spent on other goods and more on medical care, through insurance premiums and user charges. The amount thus saved, E$p'p$F + G$c'c$H (Figs. 2 and 3), will be used to pay for the additional hospital care, an amount represented by the area Ahh'B. Neglecting income effects, the difference between the value of additional hospital care and its cost in terms of other goods is area ACB, which thus provides a measure of welfare cost.

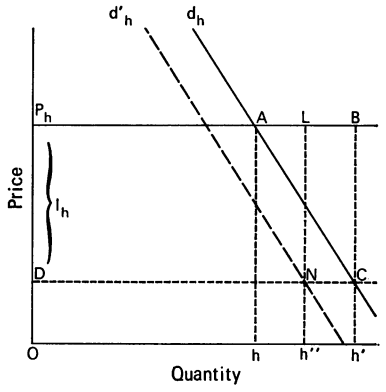

Fig. 1. Hospital care

Whether the availability of insurance will increase or decrease total economic welfare depends on a comparison of the welfare cost, measured by ACB, with the welfare gain that arises from having a fraction of uncertain expenses

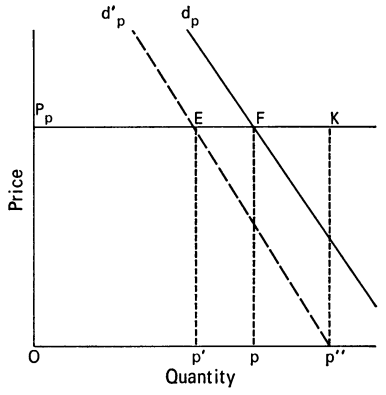

Fig. 2. Physician care

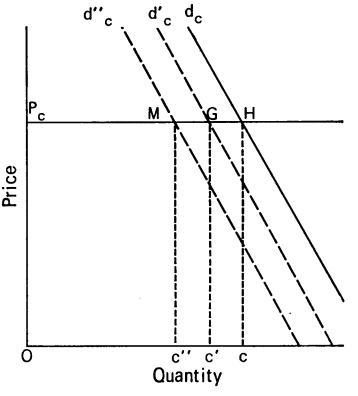

Fig. 3. Composite good

insured. The welfare gain depends in turn on the strength of risk aversion and the variability of expenses; according to the extent of overusage and its welfare cost a purchase of insurance can increase or decrease total welfare [7].

This geometric interpretation gives rise to a simple expression for welfare cost that is an adaptation of Harberger's method of analyzing the economic welfare cost of a tax [15]. Let I_h be the amount that insurance pays for each unit of hospital care. Then, if the demand curve is assumed to be linear, welfare cost (W) arising from the increase in usage due to insurance is equal to the area ACB, which may be expressed by

$$W = \tfrac{1}{2} I_h \Delta h \tag{1}$$

where $\Delta h = (h' - h)$, i.e., the change in consumption of hospital care induced by the presence of insurance. If i_h $(= I_h/P_h)$ is the fraction of cost covered by insurance, then $\Delta h = \eta_{hh} h i_h$, where η_{hh} is the own-price elasticity of demand for h. Substituting in Eq. (1), we obtain

$$W = \tfrac{1}{2} h P_h \eta_{hh} (i_h)^2 \tag{2}$$

The total insurance benefit payment B_h is equal to $hP_h i_h$, so Eq. (2) may be rewritten as

$$W = \tfrac{1}{2} B_h \eta_{hh} i_h \tag{3}$$

and with data on B_h, i_h, and η_{hh}, we can estimate the economic welfare cost of hospitalization insurance.

Empirical Estimates of Welfare Cost

Data on B_h are shown for selected years in Table 1. The relevant value of i_h is the average fraction of the cost of each unit of hospital care that is cov-

ered by insurance for those who have insurance. A figure of 0.75 is used as a reasonable approximation of this. An estimate of η_{hh} is more difficult to obtain. The price variable is not very significant in the analysis made by P. Feldstein [16] of hospital admissions and hospital patient days. Klarman reported this result as indicating a zero price elasticity of demand [17, p. 25]. A perfectly inelastic demand is, however, inconsistent with the finding that insurance, which lowers the user price of care, causes more care to be consumed. P. Feldstein estimated that the elasticity of demand is 0.25 for patient days, with respect to coverage of expenditures by insurance, and 0.45 for hospital admissions. If increases in coverage of expenditures are taken to be

Table 1. Insurance Benefits and Estimated Welfare Cost

(In billions of dollars)

Year	Hospital benefits	Surgical benefits	Other in-hospital medical benefits*	Total benefits (B_h)	Welfare cost¶
1953	1.0	0.3	0.1†	1.4	0.13
1958	2.2	0.5	0.2	2.9	0.27
1963	3.7	0.9	0.3	4.8‡	0.45

*"Other in-hospital medical benefits" assumed to be same percentage of other in-hospital medical expenses as surgical benefits are of surgical expenses.

†"Other in-hospital medical expenses" for 1953, not separated in survey, are assumed to be 10 percent of total physician expenditures.

‡Row does not add to total because of rounding.

¶Calculated using Eq. (3), with i_h (fraction insured) taken as 0.75 of total expenditure for those insured; η_{hh} (own-price elasticity of demand) estimated as 0.25; B_h as in table.

DATA SOURCES: Refs. 1, Tables 26, 27, 50; 3, Tables 1, 2, 68, 69.

equivalent to like percentage decreases in user prices, these results may be interpreted to suggest an own-price elasticity of demand for patient days of 0.25. This is the estimate for elasticity used in the calculation of economic welfare costs given in Table 1.

These welfare cost estimates are not precise, of course, but they serve to give a rough idea of the magnitudes involved. Welfare cost is about 10 percent of the total and involves a dollar amount of perhaps $400–$500 million in recent years. Relative to the total, the welfare cost of excess usage appears important but not crucial; it is, however, larger than Harberger's estimate of the welfare cost of monopoly in all manufacturing in 1954 [9]. Since individuals apparently are willing to buy insurance despite this cost, it can be considered to provide a lower-bound estimate of the value of insurance against possible hospitalization expenses. It also gives some notion of the scope of gains that might accrue if excess usage under insurance were somehow curbed.

Marginal Welfare Cost: The Effect of Increased Comprehensiveness

Greater Percent Coverage

If the demand curve for a given type of medical expense is linear, it can be shown that increasing the percentage covered increases economic welfare cost and does so at an increasing rate. Suppose insurance against 10 percent of the cost of each unit of hospital care is provided (Fig. 4). As described earlier, economic welfare cost is measured by area ACB. Now suppose the comprehensiveness of coverage is increased by additional increments of 10 percent. Welfare cost grows with each increment. It is equal to area ACB for the first 10 percent, area BCED for the second 10 percent, and so on, becoming area FGHJ for the last 10 percent of coverage. If the demand curve is convex to the origin, marginal welfare cost increases even more rapidly.

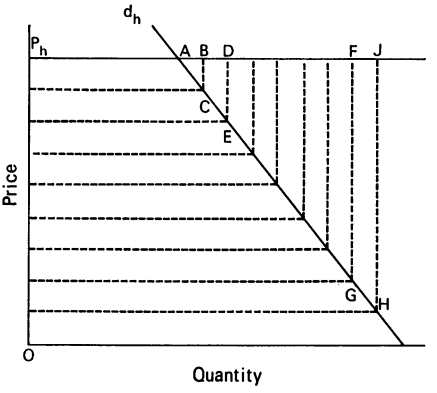

Fig. 4. Hospital care

Increasing marginal welfare cost implies that the larger the fraction of hospitalization expense covered by insurance, the greater will be the increase in welfare cost arising from increasing the comprehensiveness of this coverage. Pushing coverage of hospitalization expenses to the last 10 or 20 percent of each dollar of cost will generally involve a larger increase in the economic welfare cost of overusage than did coverage of the first 10 or 20 percent. The reason for this is that the additional units of care that the consumer is induced to buy by cutting the last 10 percent of price are worth very little to him, while the units he is induced to buy by the initial 10 percent cut have a worth to him almost equal to their cost.

Extension to Previously Uncovered Services

The consequence of the extension of insurance to previously uncovered kinds of care cannot be analyzed as simply as the case of increased coverage of care already covered. The analysis is therefore confined, for the sake of simplicity, to a situation wherein hospitalization has previously been covered, lowering the user cost to $P_h - I_h$, and insurance is extended, on a compulsory basis, to all physician care, regardless of where rendered. (The assumption of compulsoriness does away with the necessity of considering the extent to which some hospitalization-insured persons might cease to insure for any kind of physician care if the marginal welfare cost of overusage is positive.)

In this situation, then, the full coverage of the cost of physician care reduces the user price in Fig. 2 from P_p to 0 and increases the quantity de-

manded from p' to p'' (p'' could be larger or smaller than p, the amount of physician care consumed in the absence of insurance against any cost). The additional amount spent on physician care, represented by area E$p'p''$K, must be made available by a change in the amount spent on hospital care and the composite good, which together represent all other goods.

The value to consumers of the hospital care they are induced to give up is area N$h''h'$C (*not* L$h''h'$B), and the value of the composite good they are induced to give up is M$c''c'$G, while the benefit from the additional physician care they obtain is E$p'p''$. The net change in economic welfare cost can be either positive or negative, depending upon the relative sizes of these areas. If the reduction in usage of (expensive) hospital facilities more than offsets the increase in usage of physician services, welfare cost decreases. Should overusage of physician services override the reduction in use of hospital facilities, the net change is an increase in welfare cost.

The latter would occur if usage of hospital facilities remained relatively insensitive to coverage of out-of-hospital physician services and if usage of physician services should nonetheless increase considerably when the user price was cut by insurance, or if hospital and physician services were complementary rather than mutually substitutable as has been assumed here. To the extent that they show complementarity, marginal welfare cost must increase with added coverage of physician services.

The coverage of physician care would not leave the individual entirely neutral as regards forms of care, since at any set of relative prices he may still prefer hospital care for some conditions and physician care for others. But it would bring the ratio of the two user prices back toward the ratio of their factor costs. Indeed, if demand elasticities were the same for both kinds of care, a uniform percentage coinsurance (less than 100 percent) on both would preserve the cost ratio exactly in their prices: if hospital cost per unit is twice that for physician care, 90 percent coverage of each would still leave the consumer paying twice as much per unit for hospital care as for physician care, and the only result would be an increased usage of medical care in general. If demand elasticities differ between kinds of care, there would of course be no special advantage to uniform coinsurance.

Empirical Estimates of Marginal Welfare Cost

In terms of the geometry of Figs. 1, 2, and 3, the difference between what the additional physician care costs and what it is worth is Ep''K. The difference between what the reductions in hospital care and in the composite good are worth to the consumers and what they save on cost is

$$(\mathrm{N}h''h'C + \mathrm{M}c''c'\mathrm{G}) - (\mathrm{L}h''h'\mathrm{B} + \mathrm{M}c''c'\mathrm{G})$$

or LNCB. So the marginal welfare cost (ΔW) equals area Ep''K minus area LNCB; that is:

$$\Delta W = \tfrac{1}{2} P_p \Delta p - i_h P_h \Delta_p h \qquad (4)$$

where $\Delta_p h$ is the change in h produced by coverage of physician services. We can rewrite Eq. (4) as

$$\Delta W = \tfrac{1}{2} p P_p \eta_{pp} (i_p)^2 - h P_h \eta_{hp} i_p i_h \quad (5)$$

where η_{hp} is the cross-elasticity of demand. In terms of benefits this becomes

$$\Delta W = \tfrac{1}{2} B_p \eta_{pp} i_p - B_h \eta_{hp} i_p \quad (6)$$

The first term measures the increase in excess usage of physician care, and the second term the reduction in usage of hospital care. With Eq. (6) one can calculate the change in welfare cost that occurs when comprehensiveness is increased, given values for η_{pp} and η_{hp}.

Values for these demand elasticities can be approximated only roughly at present; but studies of comprehensive prepayment plans, which in effect provide 100 percent insurance against the costs of physician services, have found hospital use reduced by 20 percent [18, p. 957]. Although this figure is strictly relevant only for prepaid group-practice plans and probably overstates the reduction in use that would result with fee-for-service reimbursement of physicians, it is taken as an approximation of η_{hp} for calculation in the absence of any other base figure. With regard to values for η_{pp}, Feldstein [16] estimated the elasticity of demand for *all types* of physician care to be 0.19. Since surgical and in-hospital medical care are covered by hospitalization insurance for most persons who have insurance, and since the demand elasticity for these components of physician services is doubtless low, the elasticity for generally

Table 2. Marginal Welfare Cost for Full Coverage of 1963 Physician Care for Various Values of Demand Elasticity η_{pp}

(In billions of dollars)

Assumed values of η_{pp}	Nonhospital physician care benefits (B_p)*	Marginal welfare cost (ΔW)†
0.2	4.3	−0.27
0.25	4.5	−0.14
0.3	4.8	+0.09
0.5	5.4	+0.64
1.0	7.2	+2.79
1.5	9.0	+6.21

*B_p estimated as $(1 + \eta_{pp}) \times$ actual 1963 benefits, $3.6 billion.

†Calculated using Eq. (6), with B_h (total hospital benefits) = $4.7 billion; i_p (fraction of physician expenses paid by insurance) = 1.00; i_h (fraction of hospital expenses paid by insurance) = 0.75; η_{hp} (cross-elasticity of demand) = 0.20; B_p and η_{pp} as in table.

DATA SOURCE: Ref 1, Tables 26 and 27.

uncovered services probably exceeds 0.2. If physicians practice monopolistic price discrimination, as Kessel [19] has suggested, then it must be true that demand elasticity at the relevant point on the demand curve is greater than unity. Since good estimates are not available, several values, assumed to fall within a reasonable range, are used in the calculations. Table 2, on the previous page, presents some values of ΔW computed for these various assumed reasonable values of η_{pp}, using 1963 data for total hospitalization benefits and expenditures on non-hospital-connected physician care.

The results of the calculations show that, for some reasonable values of the parameters, increasing comprehensiveness may lead to an increase in the economic welfare cost of overusage, which may offset any welfare gains to risk-averting consumers from having uncertain out-of-hospital physician charges insured. For values of own-price elasticity of demand for physician care less than 0.3, the change in welfare cost is negative but small, suggesting that increased comprehensiveness may improve economic welfare if elasticity is low, although the net improvement is likely not to be great. The change in welfare cost becomes positive and increasingly large when the elasticity of demand for out-of-hospital physician services is 0.3 or greater. This positive welfare cost may provide an explanation of why comprehensive insurance has not been purchased on a large scale.

The Role of Demand Elasticity

Analysis has served to identify demand elasticity as one of the parameters that are critical in determining whether the net change in welfare cost with increased coverage will be positive or negative. If the demand for a particular type of care is very inelastic, extending insurance to cover the cost of that care would have a small effect on welfare cost. There would, of course, be a correspondingly small effect on the use of other (more expensive) kinds of care. If the demand is more elastic, the effect of insurance is ambiguous. Demand can be elastic because the good in question can substitute for one higher in true cost but already insured; in such a case, extension of insurance to the less costly substitute may reduce welfare cost. If there are no already-insured close substitutes, then extension of insurance to the good in question may result in an increase in welfare cost. In general, if the own-price elasticity of demand for drugs, for example, is high and if drug care is not a good substitute for hospital and physician care, providing insurance on drugs equal to that on other goods is likely to result in an increase in welfare cost. Since own-price elasticity of demand for drugs with large reductions in price seems, from the experience of national health services, to be very large [20, p. 155], full coverage of the cost of drugs would probably increase economic welfare cost significantly. Similar comments would apply to coverage of the cost of dental care.

A final point needs to be noted. Increasingly comprehensive insurance will

always be accompanied by an increasing increment in welfare cost, which will lead to a net welfare loss if it is not offset by an economic welfare gain resulting from having uncertain expenses insured. This gain depends on the strength of risk aversion and the expected variance of expenses. The latter determinant appears, in general, to vary inversely with elasticity of demand, being greatest for hospitalization and less for physician care, optometric care, dental care, etc. This also suggests that increased comprehensiveness of coverage is likely to entail more inefficiency, to lead to more "overuse" and "abuse," as coverage is extended to types of care for which there are no close substitutes and for which the demand over the range of prices covered by insurance is more elastic.

The method of analysis illustrated here can be extended to determine the welfare cost of any insurance package, by an adaptation of Harberger's formula for the welfare cost of a set of excise taxes [15, p. 41]. Conceptually, one first estimates the welfare cost when only one kind of care is insured, then how this cost changes when insurance is extended to a second kind of care; then one examines the effect on this net welfare cost of extending insurance to a third service, and so on. With better estimates of elasticities, use of this method could determine whether increased comprehensiveness would be beneficial, providing a firmer basis for policy suggestions.

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