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Utilization Control in HMOs

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Utilization Contol in HMOs

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ABSTRACT

Health Maintenance Organizations (HMOs) have emerged as a major vehicle to reduce transaction costs associated with defining the limits of health insurance coverage and to provide appropriate provider incentives. This paper explains the heterogeneous set of incentives used by HMOs to reimburse providers and performs empirical tests of their effectiveness. The empirical analyses reveal that utilization of health care services is reduced when (1) physician compensation is based on salary or capitation arrangements rather than some measure of output; (2) bonuses and paybacks are based on individual rather than group performance; and (3) when the HMO operates as a proprietary (for-profit) organization. Utilization is not significantly impacted by incentives placed on the hospital. Finally, physician ownership of the HMO was found to lead to higher levels of utilization.

I. INTRODUCTION

Retrospective fee-for-service contracts between agent-providers and insurers have found themselves increasingly under attack. Many claim such arrangements are the major cause of the high cost of health care services in the United States. These contracts, accompanied by an insurance industry that is generally passive toward cost containment, have permitted inefficient levels of utilization of health care services.[1] In the face of mounting health care premiums, private sector initiatives spawned new forms of insurance systems. Health Maintenance Organizations (HMOs) have emerged as a major vehicle in this effort to alleviate transactions cost problems associated with defining the limits of coverage and providing appropriate provider incentives.[2] GHAA(1990) reports that there were 570 HMO plans in operation in 1989 providing coverage of health care needs for over 32 million people.

Early HMOs were generally homogeneous, organized as staff or prepaid group practice plans. In this environment, studies providing aggregate comparisons of utilization levels between HMOs and fee-for-service providers were meaningful and contributed robust results. Growth in HMOs over the past decade, particularly physician group practices (PGP) and independent practice associations(IPA), has brought much more heterogeneity into the incentive arrangements between HMOs and

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[1] Early treatment of these issues can be found in Feldstein (1973) as well as Pauly (1969).

[2] We assume HMOs are inclusive of competitive medical plans even though technical differences exist.

insurers.[3] Whereas early staff plans relied on salaried physicians, the newer PGPs and IPAs utilize an assortment of capitation and fee-for-service arrangements with doctors, including discounts, withholds and bonuses. Similarly, levels of coverage are much less uniform among HMOs than when Luft (1981) provided his definition of HMOs. This change has been a relatively recent phenomenon. In 1989, over 60 percent of the plans required a copayment on office visits compared to only 37 percent in 1986; 12 percent required a copayment for hospitalization in 1989 compared to only 5 percent in 1986.(GHAA, 1990) The net result of these changes is to blur the distinction between the HMO and more traditional forms of health care insurance. Recent studies of utilization of are much less robust, as would be expected.(McLaughlin 1988)

Expansion in the variety of financial incentive arrangements became more prevalent with the growth in HMOs. Members of Congress became concerned that provider financial incentives would be "too" effective and result in providers withholding services to the extent that quality of care might be jeopardized. Hillman (1987) argued that such compensation schemes drive a wedge between physician incentives to provide quality care and physician financial incentives. Section 9313 of the Omnibus Budget Reconciliation Act (OBRA-86), passed by Congress in 1986, put statutory restrictions on such systems. Among its many requirements is a prohibition of incentive payments to physicians from

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[3] Generally, PGPs may or may not be owned by the physicians in the group and provide services to HMO and non-HMO patients. IPAs are organizations that negotiate contracts between HMOs and sole practitioners and small group practices.

hospitals in HMOs serving Medicare patients. It also prohibits such payments between HMOs and physicians. One caveat in all such restrictions is required evidence that the potential reductions in quality of care outweigh the competitive benefits of the incentive system. Congress has delayed the enactment of the latter restriction until April 1990 to allow time for analysis of the impacts of different incentive arrangements on quality of care. The law directs the Department of Health and Human Services to request exemptions for arrangements where the perceived minor reductions in quality are outweighed by larger gains from increased efficiency.

These restrictions have generated research into the micro aspects of HMO contracts that has coincided with the general interest in the development and empirical identification of incentive compatible contracts in principal-agent models. None of the studies of health care providers have linked financial incentive arrangements to quality of care. Hillman (1987) and ICF (1988) provide typologies of incentive arrangements and surveys. Langwell and Nelson (1987) compared utilization patterns in 17 HMOs with Medicare patients treated in a fee-for-service setting. They found hospital utilization to be over 33 percent lower for Medicare patients treated by one of the HMOs. However, they could not differentiate utilization levels across the various financial incentives arrangements used by these HMO plans. Hillman, Pauly and Kerstein (1989) provide the first evidence that links physician behavior directly to various incentive arrangements.

To alter utilization levels, an HMO must somehow make real resource costs apparent to at least one party involved in the health

care episode.[4] There are three possible parties: the patient, the provider (doctors and/or hospitals) and the insurfer.[5] This internalization of costs can be categorized into three groups:

i) Patient Incentives: This group includes such controls as co-payments, deductibles, and indemnity type insurance plans. Any of these mechanisms returns a sense of price (cost) to the patient.

ii) Provider Incentives: These include compensation schemes and payment mechanisms aimed at making the physician and/or hospital aware of the real costs of the services provided.

iii) Insurer Measures: This last group includes efforts by the insurer to directly intervene on the health care decisions. The most common form of this intervention is referred to as utilization review.

Our data do not allow us to say much about patient incentives.[6] Provider incentives are the focus of the most recent literature cited above.[7] Insurer incentives, e.g. utilization decisions, has not been subject to empirical investigation.

In this paper, we analyze the types of incentive arrangements used in a sample of HMOs that operated in the state of Illinois over a three

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[4] This holds for any insurer, not just HMOs.

[5] Traditional fee-for-service payment by insurers, with no co-payments or deductibles, offered very little incentive for any decision maker to consider the real resource costs of the health care services provided. This results in over utilization of such resources. Of course, more than one of these three principals could be made to consider real resource costs.

[6] Data on individual coverage limits and restrictions are not readily available. We are currently surveying each HMO plan in our sample to get accurate information on the levels of co-payments, deductibles, and coverage restrictions in place.

[7] Hillman, et al (1989) and, to some extent, Langwell and Nelson (1987).

year period. The data set provides a consistent sample of approximately 40 HMOs per year. We attempt to confirm the results of Hillman et al. (1989) in regard to the effect of provider incentives on utilization levels and extend those results in several important areas.

First, we examine the intertemporal learning effects of providers. Second, we attempt to measure the differential impact of physician contract incentives and hospital contract incentives on the extent of hospital admissions. From these results we can determine the extent to which physicians act as sole agents or as co-agents with the hospital administration in affecting utilization of hospital services.

Finally, and most importantly, we provide evidence on the impact of the third form of control, namely management review. Our measure of this control is indirect. Specifically, we make some assumptions about the implications of HMO ownership on the type of provider contract used in these plans. The results reveal that ownership is a very important determinant of contract form and utilization.

In the next section we provide a description of the changes that have taken place in the contractual relationships between providers and third-party payers. This section includes a typology of incentive arrangements and review of existing studies that have examined the impact of these arrangements on levels of utilization. The third section contains a principal-agent framework from which the hypotheses are developed that are tested and reported in the fourth section. Conclusions are contained in the last section.

II. HISTORICAL BACKGROUND OF HMO UTILIZATION

Health care services markets have been plagued with inefficiencies generally construed to result from two types of transaction costs. These markets function with the physician, the holder of superior information, acting as agent on behalf of the patient as well as an agent on behalf of the third-party payer. Traditionally the health care services were paid for by prearranged, passive third-party payers[8]. High transactions costs are generated as a result of inefficient contracts between third-party payers, patients and providers.

The first type of cost is one caused by difficulties in defining the level of coverage.[9] The health care production function is not well defined. It is difficult to specify a unique relationship between health care service inputs and health outcomes. Wide variations in utilization of health care services have been documented. Eisenberg (1985) reports that these are only partially explained by variations in demographic and other health status variables. This makes it difficult to establish coverage parameters and can result in parameters based on inefficient practice patterns.

The second form of transaction cost centers on the type of incentives contained in the contract between the third-party payer and the provider-agent. Due to the problem of defining coverage, insurers were faced with the dilemma of attempting to provide adequate coverage to enrollees and guaranteeing reasonable participation of physicians and

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[8] For a good discussion of the growth of third-party payment mechanisms, see Evans (1983).

[9] See, for example, Zeckhauser (1970) or Zeckhauser and Zook (1981).

hospitals. Dominant insurers and public policy makers opted for coverage based on service benefits. Service benefits are defined as outcomes such as a pregnancy and delivery or an appendectomy. Providers were reimbursed on the basis of units of service contained within the service benefit package such as days in hospital room, transfusions, operating room and physician visits. Deductibles and copayments were limited in use. Providers were reimbursed on formulas based on retrospective fee-for-service. The formulas were set by a variety of cost-plus pricing mechanisms.

The extent to which various parties behave efficiently depends on the manner in which cost is spread among the parties to the contract. These fee-for-service contracts shifted all costs associated with excess utilization from the patient and provider to the third-party. This generated classic conditions for moral hazard.[10] The results of moral hazard -- excessive levels of overall spending for health care services and for specific types of services -- have been documented elsewhere.[11]

Various changes in the patient contracts have emerged in an effort to generate increased efficiency in the utilization of health services. On the patient side, copayments are being used more frequently. These increase the marginal cost of utilization to patients, putting some of the cost of the service directly on one of the decision makers.

More dramatic changes have occurred in provider contracts. These include the well documented growth in HMOs. The early HMOs were

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[10] See Pauly (1969) for an excellent discussion.

[11] Feldstein (1973) and Pauly (1969) provide good documentation.

predominantly staff models in which physicians were salaried and served only HMO patients. Providers may have an incentive to provide more than efficient levels of services as long as salaries are not based on utilization levels. PGPs, Networks, and IPAs have very heterogeneous contractual arrangements[12]. This may explain the wide range in estimates of utilization differences between HMOs and fee-for-service providers. Prior studies have found levels of hospital utilization to be lower for HMO enrollees than for fee-for-service patients. Effects of HMOs on utilization of other types of provider services have not been as well documented. Luft (1981) found levels of hospital utilization reduced from 20 to 40 percent in different plans. Others have found IPAs to have no effect on utilization. (Hornbrook and Berki, 1985) Still others have examined only PGPs due to the heterogeneity introduced by IPAs (Manning et al., 1984). These studies are missing important variations in incentives when contract specifications are not explicitly enumerated. The next section will consider a formal model of the theoretical predictions of the influence on provider behavior of different types of incentive schemes.

III. MORAL HAZARD AND THE PRINCIPAL-AGENT RELATIONSHIP

A description of the moral hazard problem involved in the relationship between the HMO and its physicians is developed in this section. This scenario is a *principal-agent relationship* with

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[12] Networks are HMOs that contract for services with more than one PGP or combination of PGP and IPA..

asymmetric information. The objective is to develop optimal incentive contracts between the agent and the principle.

In the principal-agent game, one player (an agent) performs a task for another player (the principal).[13] The principal has an information disadvantage. Differences in the quality of outcome or effort put forth by the agent cannot be distinguished from underlying changes in the state of nature. For example, an employer has difficulty judging if the laborer's slow pace toward completion of the task is due to shirking or an unexpectedly difficult task. In the present case, the HMO manager cannot be sure if the provider effort level is high, for example, due to "demand inducement" on the part of the physician or because the particular incidence of adverse health has pressing complications.

Consider a simple principal-agent setup in which the agent chooses some effort level e which, when combined with a random variable ϕ representing the state of nature, produces a profit for the principal, $\pi(e,\phi)$. For his effort, the agent receives a reward w. The principal must devise an optimal payment schedule w to maximize the function

$$E[\pi(e,\phi) - w] \tag{1}$$

where E is the standard expectation operator over the random variable ϕ.

The agent wishes to maximize expected utility expressed as a function of the payment received and the effort devoted to the task: $U(w,e)$. Under assumptions of working markets for agents, there exists

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[13] The brief review of the principal-agent relationship that follows can be supplemented by referring to Harris and Raviv (1978), Holmstrom (1979), and Shavell (1979) among others.

some threshold utility level, the reservation utility U_o, below which the agent will go elsewhere for employment. Meeting this minimum utility constraint is referred to as satisfying individual rationality.

In the absence of any information asymmetries, where the firm (the principal) is risk neutral while the worker (the agent) is risk averse, the optimal contract calls for a fixed fee regardless of the state of the world. This is equivalent to paying the agent a fixed salary.

Moral hazard can result if there are information asymmetries such that the principal is unable to ascertain whether the appropriate level of effort is being put forth by the agent. If all that is observed is the outcome, $\pi(e,\phi)$ and the agent is risk neutral, we can write the agent's utility function as $w(\pi(e,\phi)) - v(e)$. Here $v(e)$ denotes the agent's disutility from performing the effort (the cost of the effort), . The principal now maximizes the function:

(2) $$E[\pi(e,\phi) - w(\pi(e,\phi))]$$

subject to the individual rationality constraint. Since we know that $U(e,\phi) = w(\pi(e,\phi)) - v(e)$, we can rewrite (2) as:

(3) $$E[\pi(e,\phi)] - E[U(w,e)] - v(e)$$

Adding the individual rationality constraint, equation (3) can be rewritten in the form:

(4) $$E[\pi(e,\phi)] - v(e) - U_o$$

For risk neutral principals, the solution to this maximization results in the principal offering the agent a contract $w = \pi(\cdot) - p$ where p is simply the solution value of (4) at the level of effort e^* which maximizes (4). Thus, the principal offers the agent a <u>sharing</u> contract. Since all the principal can observe is the outcome π, it is optimal to

tie compensation to this value. The agent's preferences are brought in line with those of the principal.[14]

Now consider the incentives for the physician. The physician makes a decision about how much effort to use to treat a patient. The effort is some given level of health care, which we will denote by the term γ. This level of care, or more specifically the appropriate level and mix of inputs necessary to efficiently treat the patient, usually is not observable by the HMO manager due to information asymmetries about the actual health status of the individual. All the manager sees is the outcome (the profit).[15]

The unknown information in the present health care model is the actual health status of the patient upon initiation of the health care treatment session. Let this state of nature defining the actual health status of the patient be denoted by. Given a level of care, γ, the profit earned by the HMO is $\pi(\gamma,\theta)$. The principal must structure compensation such that the agent does not shirk.

In most principal-agent relationships it is assumed that profit to the principal increases in effort. The present case is somewhat different. Rather than being a monotonic function of effort, profit for the HMO is increasing and then decreasing in the level of care, γ. The health of any patient will be unduly poor if the doctor devotes zero

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[14] Numerous restrictive assumptions are necessary to get these results. For an excellent survey of this literature see Grossman and Hart (1983) or Tirole (1988).

[15] In cases of not-for-profit HMOs, the manager is still concerned with maximizing the "residual" during any given time period. The use of this residual is, of course, the focus of yet another interesting bargaining process. See, for example, Arnould and DeBrock (1985).

attention to the patient's case and the HMO will lose profits due to reduced reputation, consumer switching and possible litigation. On the other hand, excess utilization will result in negative profits for the HMO if the physician provides an extreme amount of attention to each patient. Marginal revenue of successive tests is, at best, constant.[16] However, marginal resource cost increases as the physician provides additional tests. These costs include those of the physician and congestion on jointly used devices (X-rays) and support personnel. Profit to the HMO will decline if these costs exceed the marginal revenue.

A few reasonable simplifications clarify the description of the phenomenon. Suppose there are only two possible states that nature can take. The patient arrives for medical care with underlying levels of health that are either Bad (θ_B)or Good (θ_G). The physician observes the true value of θ. The HMO is unable to determine the true status of θ but does know the profit functions that would arise conditional upon realization of θ.

Figure 1 depicts the relationship between this observed profit and γ, the unobserved effort level of the physician, given θ. We assume that $\pi(\gamma,\theta)$ increases and then decreases in amount of health care delivered by the doctor, and that the absolute level of profit has a higher potential

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[16] Instantaneous (static) revenues are constant to an HMO, as subscribers have paid their premiums in advance. However, we can use the loosely defined "reputation" effect or the "expected litigation awards" effect as the proxy for revenue (see, for example, Woodward and Warren-Boulton (1984)). More than likely, the marginal impact on the marginal revenue stream from extra care decreases as successive tests and procedures are performed.

in states of good health than in poor health. The amount of health care delivered by the physician will vary across a variety of compensation agreements offered by the HMO. The physician who faces a salary independent of the level of effort has incentives to provide the minimum level of effort because increases in γ reduce U. If the manager could not observe the true state of the patient's condition, the physician would choose effort γ so as to minimize personal effort subject to the

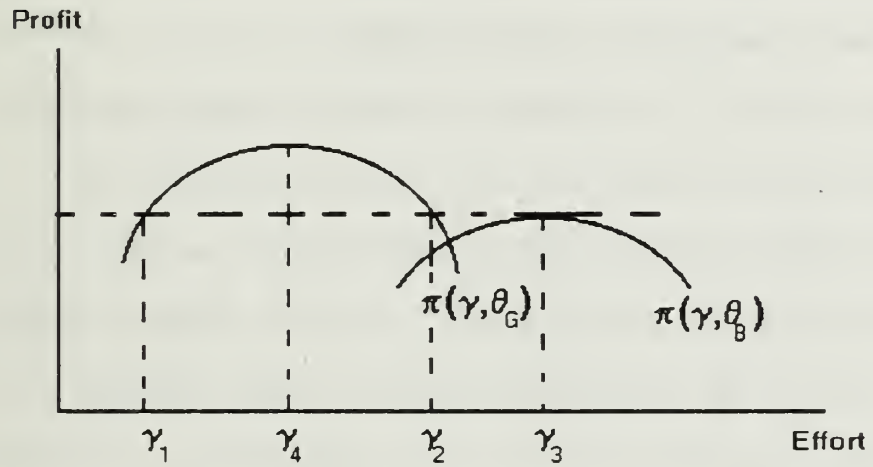

Figure 1.

minimum profit acceptable to the HMO. Then if θ_B is the realized state of nature, the doctor offers γ_3, the profit maximizing level of effort. If θ_G is realized, the doctor supplies γ_1 and the physician undersupplies effort.

If the HMO offers a fee-for-service contract, (regardless of the extent to which such fees may be discounted from usual charges), the physician has incentives to oversupply resources in state θ_G. Note on Figure 1 that if θ_B occurs, the physician offers γ_3. If θ_G occurs, the

physician maximizes utility by offering the highest amount of services possible, subject to the minimum profit constraint: γ_2.[17]

The optimal contract with moral hazard makes the physician a residual claimant. This contract would result in γ_3 if θ_B is the actual state of health or γ_4 if θ_G is the state of health.[18] However, an efficient outcome is possible if there is only one agent in the firm and all profits are distributed to that agent. If there are numerous agents in the firm and the distribution of profits is dependent upon units of effort of the group, each member will over-utilize.

This model offers several predictions. First, a compensation scheme based on fee-for-service payments will lead to increases in health care services by participating physicians *ceteris paribus*. Second, compensation based on flat salary will, *ceteris paribus*, lead to lower utilization. Third, the HMO can mitigate the moral hazard problem by appropriately structuring some profit sharing plans. In the present context, these sharing rules in HMOs take the form of withholds and bonus arrangements described in the next section. Systems that distribute more risk and create a greater potential for rewards to the provider should lead to reductions in health care utilization levels

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[17] This representative result occurs only so long as the marginal utility of income is greater than the marginal disutlilty of effort.

[18] Recall that we have assumed, for sake of simplicity, that there are only two states of the world. If the actual state of nature was represented by a distribution function, the outcome would be modified. In addition, if the HMO manager knows less than we have assumed, perhaps not even understanding the shape of the profit functions, the misallocations can be even greater. An efficient contract in which the physician has incentives to use the efficient amount of resources will contain a fixed wage and a share of the profits.

relative to the fee-for-service scenario. The empirical section will provide some tests of these hypotheses based on different fee and bonus arrangements.

IV. A WORKING TYPOLOGY

The characteristics of the contractual conditions are delineated in order to predict the relative weight of each component on the behavior of physician-agents.[19] The description of plan types and categorization of contractual arrangements used in this study draws heavily on the typology developed by ICF (1988).

Staff HMO models consist of physicians who are salaried employees of the plan. Staff models should generate efficient levels of utilization if salary levels are based on measures of efficiency but will generate moral hazard if salary is based on units of services provided. Staff models use the same methods to pay for hospital services as do other HMO models.

PGP, Network, and IPA models are more complex. First, in these models HMOs may or may not contract directly with the physicians. Usually, the HMO pays the PGP and IPA a capitation rate. However, the PGP or IPA may pay their physicians a salary, capitation rate or fee-for-services provided.[20] Although the relationship between the HMO and PGP or IPA is important, the behavior of the physician should be

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[19] A model to explain why different contract provisions are adopted by different HMOs is an interesting issue not addressed in this paper.

[20] Fee-for-services payment generally is used in connection with a discount from normal fees. Also, in some cases, the HMO specifies the nature of the arrangement between the PGP or IPA and individual physicians.

influenced more by the nature of the contract between the PGP or IPA and the physician. ICF (1988) has distinguished three factors in contracts that may influence the behavior of providers. The risk/reward factor is a measure of the ability of the payment arrangement to cover utilized services. The extent of the risk/reward borne by each provider type is another factor that would influence physician behavior. Finally, the third factor is the nature of the distribution of the risk/reward among participating physicians.

The nature of the risk/reward is determined by the degree of physician participation in surpluses, deficits or both. Physicians in staff plans are salaried and do not generally participate in deficits unless the deficits are of a magnitude that requires staff reductions. These physicians often participate in surpluses through bonus arrangement. PGP and IPA physicians often are required to share deficits and surpluses. The mechanics of these arrangements differ. Physicians may be paid a full fee-for-service price. If deficits occur in the plan, the physician could be required to return fees to the plan or the deficit could be withheld from next year's fees. Alternatively, the contract may specify that a certain percent of the fee or capitation is to be withheld until the end of the period (usually semi-annually or annually), at which time it may be returned to the physician if the plan does not show a deficit. If the physician only shares in deficits, fees will be returned to the extent of the withholding. If physicians participate in surpluses, physicians can be rewarded beyond the level of the withhold.

Several behavioral issues are raised by these arrangements. First, do providers suffer from a form of "money illusion" in looking at

such bonuses? Do providers respond the same to the possibility of having out of pocket charges (in the case of a deficit) as they respond to having the deficit covered by pools of funds generated from withholds? We see no basis for *a priori* responses to this question. However, a physician with a fee-for-service contract could generate higher income by expanding units of service beyond the levels that would provide for a return of the withholds if the provider was not responsible for out-of-pocket returns in case of deficits.

The extent of risk/reward has numerous dimensions (ICF (1988). One dimension centers on the percent of physician's compensation generated from the plan. Another dimension focuses on whether or not the plan limits the physicians risk/rewards of deficits. An adaptation of the latter dimension is useful for our purposes. We define the extent of risk/reward to be the breadth of services for which the physician is "at-risk" or shares in the distribution of surpluses. Pools of funds may be generated from withholds or administrative fiat for physicians services, referral services, and hospital services. In many cases target levels of utilization are established for each type of service. If the provider utilizes less (more) than the targeted amount of services the surplus (deficit) from that provider pool is distributed to the eligible provider. In some cases, physicians are responsible only for surpluses (deficits) in the physician pool. In other cases they may share in surpluses (deficits) in other provider pools.

The scope of risk/reward is limited in some plans with a stop-loss provision. The stop-loss is set at an absolute dollar level. This amount may be on a per patient level or a number of patients over a fixed time period. Behavior of the provider should be impacted most

significantly in cases where the physician agent bears risk for the broadest range of services. In those cases the physician has incentives to utilize his own services efficiently and to prescribe the most efficient mix of other health care services.

A key component of contracts instituted to influence behavior is the method of distributing the deficit or surplus among the physicians? Distribution can be based on individual or aggregate performance. When based on individual performance, distribution of deficits/surpluses is determined by the ability of the individual physician to meet utilization standards. Plans base aggregate distribution on a variety of factors such as equal shares, longevity, participation, etc. Rasmusen (1987) shows theoretical support for the contention that free rider problems are minimized when distribution is based on individual performance.

Additional incentives can be incorporated in contracts with other types of providers. Those for referral physicians are similar to the ones just described for primary care physicians, but occur less frequently. Hospital contracts may be capitation arrangements parallel those used for physicians, actual or discounted fee-for-service rates, per diem or DRG rates. Hospital contracts may include some type of risk/reward arrangement.

In summary, the hypotheses generated from this discussion are that (1) salary and capitation arrangements where income is independent of effort (and effort produces negative utility) are expected to provide greater incentives to reduce utilization than fee-for-service arrangements; (2) we have no *a priori* reason to predict different behavior from deficits versus bonuses; and (3) all such systems are

expected to be impacted by any sharing rules. Individual distribution arrangements, less susceptible to free riding than sharing rules based on group or aggregate utilization, should have a greater impact on behavior.

Other factors could influence these hypotheses. First, each payment type can be accompanied with various levels of the other risk factors. The adjustment of these other factors could reduce or even reverse any differential impact expected to exist between the basic schemes. For example, even though capitation is expected to have a greater dampening effect on physician utilization patterns than fee-for-service, a generous capitation level and a substantial withhold could reverse the predicted effects. Second, degree of risk may vary with other factors such as plan size. It may be less risky to accept capitation for a sample of patients drawn from a large plan than one drawn from a small plan if risk is distributed more evenly across larger groups. Extending the time horizon over which the contract applies could have similar effects as increasing plan size on normalizing the risk factor.

Two studies that have attempted to determine the relationship between incentive arrangements in HMO-provider contracts and utilization have found very differing results. Each paper reported only on the conditions contained in physician contracts. Langwell and Nelson (1987) in a comparison of hospital utilization rates for Medicare beneficiaries served by 17 HMOs with those served by fee-for-service providers, found that HMO patients used almost 34 percent fewer hospital days per 1000 enrollees but found no discernable pattern of utilization when categorized by incentive arrangement. Hillman, Pauly, and Kerstein

(1989) found hospitalization reduced by 13 percent in salaried plans and 7 percent in capitated plans from fee-for-service levels. Similarly office visits were reduced most when the physician was individually at risk for deficits in referral funds. Lessor levels of reductions were forthcoming from risk associated with the hospital and ancillary service funds. This effect was stronger in commercial than in not-for-profit plans. They found none of the additional arrangements such as withholds and bonuses to be a significant determinant of hospital utilization. They did not explore the possibility of a learning effect, nor did they examine the separate influence of hospital incentives.

We extend these empirical examinations in three directions. First, we test the effect of incentive arrangements on physician behavior over time. Most physicians have been trained in an environment in which their behavior is directed toward doing the stipulated procedures for the patient in the most convenient setting *regardless of the cost*. Incentives to seek the most efficient combination of inputs have been limited or nonexistent. The most obvious case is the substitution of out-patient surgery for more expensive in-patient surgery. Therefore, we hypothesize that physicians do not respond immediately to the incentive arrangements but change behavior over time. Alternatively, physicians who extract utility from their independence and control over their patients' care may resist joining managed care systems. To overcome this resistance, initially HMOs shift a limited amount of risk to providers. However, the incentives for providers to reduce levels of utilization are increased as the physicians become more accustomed to the HMO.

Second, controversy exists over whether the physician is the sole agent for the patient or shares the agency role with the hospital. The extent to which the latter case is true determines whether hospitals can influence levels of utilization. Clearly, financial incentives should increase the efficiency in the production of services. However, these same incentives may have no effect on the number of services utilized if the prescription of services is determined solely by the physician, in which case HMOs could have a greater effect on utilization by making the physician's risk/reward dependent upon hospital services than by providing a separate incentive to the hospital. If hospitals have an influence on utilization we expect capitation to result in the greatest reductions in utilization and variants of fee-for-service to have the least.

The third issue centers on investigating utilization restraint via means other than physician compensation. Techniques such as utilization review can be used by HMO management as a way of forcibly restraining utilization. The HMO might enforce utilization standards by discontinuing to contract with physicians who are constant violators. Our approach focuses on the impact of plan ownership on levels of utilization. HMOs are owned by physician groups, hospitals or independent insurance operations. Regardless of ownership, the HMO then contracts with physicians, usually through a group, to provide health care services. A common model is one in which a physician group owns an HMO that in turn contracts with the group for the provision of physician services to the HMO enrollees. The group generally accepts a capitation rate for providing services to the HMO. Individual physicians share partnership rights in the physician group. In the more traditional

format in which the physician group has no involvement in an HMO, physician's earnings consisted of a base amount plus a distribution of the surplus. The distribution, to avoid free riders and shirking, usually is determined by a production formula; that is, each physician's share of the profits is based on a formula that converts revenues generated by that physician into a payment to that physician. Various types of revenues generated carry payout weights ranging from zero to one. While this mechanism may effectively reduce incentives to free ride on a fee-for-service system, it increases incentives to provide additional services.

Many physician groups that subsequently own HMOs have continued to use this reimbursement scheme for the provision of services to HMO enrollees. In some cases the production formula remains unchanged. In others the weight is lower in the production formula for production credits or payouts generated from the treatment of HMO patients than those generated from the treatment of fee-for-service patients. A reduction of the production credit is similar to an increase in the withhold. However, incentives for the physician to alter utilization or treatment methods are not materially changed because compensation remains determined by the units of services provided. This may be evidence that physicians, when in control, would prefer to minimize constraints on their own behavior. This assumes that reductions in freedom of behavior generate disutility to the individual providers.

Clearly the strategic choice of the physician depends on his or her assumptions about the behavior of the other physicians in the group. It there is no penalty for excess levels of utilization each physician will increase production credits as if in the fee-for-service mode.

Essentially, this is a prisoners dilemma effect in which all physicians in the group operate at high levels of utilization. Alternatively, control over the actual utilization by physician members of the group is expected for HMOs owned by an outside party.. Thus, we expect the HMO to be more cooperative with their own "members", providing less utilization review policing mechanisms, where owned by the providers.

Several models of group behavior support this idea. The Median Voter Model predicts that the leadership of the physician group owning the HMO would be forced to offer compensation plans most attractive to the majority of its members. Even though these leaders may understand the sub-optimality of the non-cooperative result (all doctors over utilizing in an attempt to gain on the group), they would be forced to offer such a mechanism due to the pressure to maintain support of the majority of the member providers.

Ceteris paribus, utilization rates are expected to be reduced more in physician owned HMOs in which the capitation of the group is passed on to the individual physicians than in cases in which the group is capitated but the individual provider in the group still faces a fee-for-service compensation arrangement.

V. ESTIMATION OF INCENTIVE EFFECTS ON PHYSICIAN BEHAVIOR

Data

Data used for the empirical specifications come from a sample drawn from all HMOs in the state of Illinois that filed reports with the Illinois Department of Insurance. Table 1 lists the variables used.

Table 1
Variables Names and Descriptions

HMO Plan Characteristics	
ADMIT	Hospital admissions per 1,000 enrollees
AGE	Period of time HMO has been in operation
ENROLL	Total enrollment of the HMO
PREM	Monthly premiums per HMO member
Market Characteristics (County Level Observations)	
PCY	Per Capita Income (000s)
EDUC12	Percent of Population 25 years and older with at least 12 years education
DRPOP	Physicians per 100,000 Population
BEDSPOP	Hospital Beds per 100,000 Population
Dummy Variables (0-1 indicators)	
STOPLOSS	Stop-Loss provisions exist
BOWN	Physician bonus based on individual utilization
HFFS	Hospital payment is fee-for-service
HOSPOWN	HMO is owned by the hospital
HCAP	Hospital compensation is capitated
MEDICARE	HMO accepts medicare payment for members
MDOWN	HMO is owned by the physicians
NONPROF	HMO has non-profit status
PCAP	Physician compensation is straight salary
PFFS	Physician compensation is Fee-For-Service
YR86	1986 data
YR87	1987 data

Financial, utilization and contractual data were taken from reports filed with the Illinois Department of Insurance. Forty one plans filed financial and utilization data for at least one of the three years including 1985, 1986 and 1987. Thirty five plans filed reports containing some information describing contractual arrangements with providers. Additional data were obtained directly from the plans. Plan type and age of plan were taken from various issues of Interstudy Edge. Market characteristics data were taken from the Area Resource File tapes. After deleting observations with missing variables, plans that closed, and a plan that merged into another, the data set was reduced to 76 observations. While the number of observations lost clearly is not

trivial the lost observations appear to be randomly distributed across plan types.

Empirical Specification:

Several hypotheses were developed regarding physician behavior in an HMO environment in section III of the paper. These can be summarized as follows:

- HMOs that compensate physicians on a fee-for-service basis will have higher utilization levels, *ceteris paribus* than those plans where physicians are compensated by flat salary.

- Physicians subject to bonus payments (sharing rules) based on individual behavior will have lower utilization levels than those whose bonus is based on group behavior.

- Managerial control of HMOs may have a significant impact on types of incentives employed in contracts and on utilization levels. Plans owned by providers will see less stringent utilization review and policies.

- Physician behavior will be altered more by actual than by perceived behavior. That is, older HMOs that have had incentive effects in place longer will have lower utilization.

These hypotheses are tested by considering the effects of a variety of HMO arrangements on utilization while controlling for other plan characteristics. A description of variables used in the model follows.

Dependent Variable:

The measure of utilization used as the dependent variable is the total number of hospital admissions per 1,000 HMO enrollees, ADMIT.[21]

Independent Variables:

The independent variables can be grouped into those that measure the actual contractual arrangements, those that measure HMO specific characteristics, and characteristics of the individual market served by the HMO.

Physician Compensation Arrangements: Provider contractual arrangements are captured with a number of binary variables. The first set of variables identifies whether the physician is paid on the basis of fee-for service, PFFS, capitation, PCAP, or salary, PSAL. The hypotheses predicts that utilization will be higher when the physician is paid on the basis of fee-for-service. In the actual estimation, PCAP is the suppressed variable; thus the expected sign of the coefficient on PFFS is positive. We have no a priori reason for predicting differential effects on utilization from salary or capitation.

In addition to the basic compensation method, as shown in the principal-agent discussion above, the optimal compensation system involves some type of sharing rule. In the present context, these roles are filled by bonus arrangements. The HMO holds back a certain share of

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[21] We attempted with limited success to estimate a similar model with physician encounters as the dependent variable. The lack of significance may result from the fact that primary care physicians are an inexpensive input compared to referral physician services and hospital services. Thus, primary care physicians may be encouraged to substitute their services for more costly inputs.

each payment made to its physicians.[22] At the end of the period, physician are awarded bonuses based on utilization patterns; these bonuses may depend on individual provider output or the output of the group. HMOs that base each physicians' bonus on his utilization pattern are denoted by the variable BOWN. Other plans base the bonus for each physician on the utilization of a group of physicians. This group could include the entire corps of physicians in the HMO or a subset of the physicians. The earlier analysis predicts that the sign of the coefficients on BOWN should be negative reflecting the greater reaction to incentives when each physician realizes that the bonus is a direct function of his/her own behavior.[23]

Hospital Incentives: Variables identifying whether the hospital is paid on some form of fee-for-service (HFFS), per diem reimbursement (HPDIEM) or straight capitation basis (HCAP) are included to determine if financial incentives directed toward the hospital have an influence on utilization beyond those directed at the physician. HPDIEM will be the omitted category in the estimation. The model predicts that hospital

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[22] The withhold can be an explicit share of each payment or it can be implicit, coming in the form of residual claims to the HMO at the end of the period.

[23] The actual amount of funds going into the pool are derived from different sources. BHOSP indicates compensation systems where the bonuses to physicians are based on utilization of medical and hospital services. This variable was suppressed because only six observations in the sample reported that the physician bonus did not depend on hospital admissions. Additionally this provides further justification for using hospital utilization to measure effectiveness of physician incentives.

utilization should be higher if payment is based on HFFS and lower if capitated.[24]

Managerial Control: We use the form of ownership, physician owned (MDOWN), hospital owned (HOSPOWN) or independently owned, as a measure of the degree of managerial control.[25] As discussed above, if providers control the HMO, we expect to find higher utilization than where an independent firm owns the plan because the physician gets disutility from loss of freedom of behavior. The model predicts positive coefficients on HOSPOWN and MDOWN if provider ownership results in less restrictive utilization review procedures.[26]

HMO Characteristics: Three variables are included to measure differentials in individual plan characteristics. Not-for-profit firms are expected to be less stringent monitors of utilization and thus the coefficient on NONPROF should be positive. A continuous variable measuring the number of years the HMO has been in existence, AGE, is used as a proxy to capture the "experience" on the part of the HMO managers. Older more established HMOs are expected to monitor and control utilization and expenditures more efficiently, generating a negative coefficient on AGE. Conversely, if newer entrants learn from older firms, the coefficient on AGE should be positive.

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[24] The hospital incentive mechanism should influence the efficiency and therefore the cost of units of services produced even if the number of units is not affected. We do not measure the cost effects.

[25] The suppressed category is those HMOs that are independently owned; i.e. owned by neither the physicians nor the hospital.

[26] The model does not offer any predictions as to the relative size of the (expected positive) coefficients on MDOWN and HOSPOWN.

The final measure of plan characteristics is number of enrollees, ENROLL. All large plans are networks over which administrative control and monitoring of physicians may be more difficult due to the more diverse organizations and geographic spread. This should generate a positive relationship between size and utilization. Number of enrollees could have a positive or negative impact on risk. Larger plans are less likely to be impacted by actuarial outliers. However, these plans may press into a member base that has greater demand for health care services.

Patient Characteristics: The data do not provide a detailed breakdown of demographic characteristics (age, sex, race, etc.) of patients. Nor do the data inform as to incentives such as extent of coverage, deductibles, co-insurance, etc. Monthly premiums, PREM, is used as an indicator of the type of coverage offered to the patient as well as the characteristics of the patients being covered. Higher values of PREM correspond to more complete coverage of health care expenditures, older enrollees, and other demographic characteristics of enrollees. The coefficient on this variable is expected to be positive. Finally, we have two dummy variables, YR86 and YR87 used to capture any year to year differences in the data.

Market Characteristics: Several variables are included to account for other exogenous differences across markets. No hypotheses about the coefficients of these variables is predicted by our model. However, the existence of such data is important to improving the estimates of our more critical coefficients. On the patient side, we add two variables, per capita income (PCY) and the percentage of the population 25 years and older who have at least 12 years of education (EDUC12). Two

variables introduced on the provider side are the ratio physicians per 100,000 people, DRPOP, and the ratio of hospital beds per 100,000 people in the county, BEDSPOP.

Table 2 presents descriptive statistics of the variables used in the estimation.

Table 2.
Descriptive Statistics

Variable	Mean	Std Dev	Minimum	Maximum
ADMIT	94.9434	33.7066	8.7000	175.5000
MEDICARE	0.2632	0.4433	0.0000	1.0000
HCAP	0.1053	0.3089	0.0000	1.0000
HFFS	0.3553	0.4818	0.0000	1.0000
STOPLOSS	0.4342	0.4989	0.0000	1.0000
YR86	0.3421	0.4776	0.0000	1.0000
YR87	0.3947	0.4920	0.0000	1.0000
HOSPOWN	0.1711	0.3791	0.0000	1.0000
MDOWN	0.1974	0.4007	0.0000	1.0000
PCY	13.6940	0.9892	11.3200	14.3470
EDUC12	67.0132	5.5510	64.0000	81.0000
NONPROF	0.3684	0.4856	0.0000	1.0000
PREM	6.7827	2.4169	0.2770	16.7900
ENROLL	49.4556	74.2424	0.1130	455.8860
AGE	4.2542	6.5442	0.0000	31.6600
PSAL	0.1316	0.3403	0.0000	1.0000
PFFS	0.2632	0.4433	0.0000	1.0000
PBOWN	0.3421	0.4776	0.0000	1.0000
DRPOP	0.2122	0.0595	0.0465	0.2835
BEDSPOP	0.5102	0.0863	0.3003	0.8475

Empirical Results:

Tables 3 provides a listing of the results from estimating the model. The estimates are reasonable and consistent with the expected outcomes. The existence of fee-for-service had the indicated sign and was significant. HMOs with fee-for-service can expect 18 percent higher hospital admissions over the course of the year than those with salary

or capitation, given that the mean of ADMIT in this sample was 95. This difference in utilization is slightly larger difference in utilization than the one found by Hillman, et al (1989). The strongly negative coefficient found on PSAL confirms our predictions of significantly lower levels of hospital admissions when provider compensation is not directly related to utilization.

Table 3.
Regression Results for ADMIT

R^2 = .649 Degrees of Freedom=56

Variable	Estimate	Standard Error	t-value	PLIM
CONSTANT	-269.606746	292.841075	-0.920659	0.361
MEDICARE	16.364423	12.271759	1.333503	0.188
HCAP	-7.076378	12.259224	-0.577229	0.566
HFFS	0.103692	7.354832	0.014098	0.989
STOPLOSS	14.727038	12.003203	1.226926	0.225
YR86	4.139172	7.392539	0.559912	0.578
YR87	5.525436	7.332877	0.753515	0.454
HOSPOWN	20.798744	11.431995	1.819345	0.074
MDOWN	21.467592	16.093408	1.333937	0.188
DRPOP	65.709677	76.649564	0.857274	0.395
PCY	11.364158	11.293220	1.006281	0.319
BEDSPOP	93.411977	50.812285	1.838374	0.071
EDUC12	1.557501	2.134081	0.729823	0.469
NONPROF	31.524180	11.007239	2.863950	0.006
PREM	2.855358	1.846011	1.546771	0.128
ENROLL	0.089379	0.052296	1.709109	0.093
AGE	0.705017	0.837745	0.841566	0.404
PSAL	-89.775203	23.776838	-3.775742	0.000
PFFS	17.480257	9.389617	1.861658	0.068
PBOWN	-28.103180	7.658132	-3.669717	0.001

Strong confirmation is found for the hypothesis that bonuses based on a physician's own behavior as opposed to group behavior have more effect on utilization. Hillman et al (1989) found arrangements such as bonuses to have no effect beyond that of the basic payment method. The number of admissions per 1,000 is 29 percent lower for systems based on

individual than for aggregate based bonus systems. This provides evidence that even within HMO models physicians do not trust the effectiveness of whatever administrative or incentive schemes might be in place to influence *group* behavior. The physician responds with more effective utilization restraints when an HMO bases the physician's bonus distributions on own behavior,

Both dummy variables indicating ownership of the HMO by provider groups, our measures of managerial control, have positive coefficients. However, only the coefficient on HOSPOWN is measured with sufficient precision to confirm our hypothesis. Effectively, a typical HMO can expect to have 22 percent *less* utilization when the management is not under the control of a provider group. Put differently, our estimates indicate that strong utilization review is a type of restriction on providers that is less likely to be imposed by the providers upon themselves than by independent (non provider owned) HMOs.

In no case were the variables describing the method by which the hospital was compensated significant. As shown in Table 3, HFFS and HCAP have the predicted sign but both were not statistically significant. Although we cannot say anything about the influence of the hospital payment mechanism on the efficiency of producing a unit of service, there is no support for the hypothesis that the hospital has an influence on utilization beyond that of the physician. Clearly, efforts to develop incentives to generate efficient levels of utilization should be directed at the physician agent. These results do not support the contention that the physician and hospital are co-agents.

Not-for-profit status is found to lead to significantly higher utilization in an HMO. Our estimates indicate that not-for-profit plans

can expect about 33 percent higher levels of utilization, confirming our predictions about the relative efficiency of proprietary organizations. AGE, the proxy of learning and experience on the part of HMO managers, has a positive impact on ADMIT. However, it was not measured with enough precision to permit any conclusion.

Size of the HMO, ENROLL, was positive and significant lending support to the contention that size increases the cost of monitoring.[27] Finally, the variable PREM, used as a proxy for patient demand, has a positive coefficient, indicating its role as a proxy for both coverage levels as well as the general health of the membership.

VI. CONCLUSION

Economists have done extensive research on the utilization patterns of physicians under different health care delivery vehicles. The results of most of this research confirms that the HMO is a successful vehicle for cost containment. New and increasingly complicated contractual arrangements between physicians and HMOs have led to clear and significant differences in provider incentives and methods of operation. It is no longer possible to use the term "HMO" as a generic representation of a cost containment health care delivery scheme.

Viewing the primary decision makers in the health care episode as a triad is a useful device. Patients, providers, and insurers are all participants in a health care episode. This paper has considered

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[27] In addition, this coefficient may be evidence that large HMOs move from "more healthy" populations to riskier membership rolls.

attempts to restrain utilization via the second and third groups: providers and insurers. Simple application of the principal-agent model has been applied to health care markets that provides hypotheses concerning the amount of provider effort one should expect to see under different compensation schemes. In addition we presented a method to proxy the degree of managerial oversight of the utilization decision.

The empirical analysis provides strong evidence to support the hypotheses that (1) physician behavior is influenced by financial incentives, (2) managerial control in HMOs *not* owned by providers results significantly more stringent controls on utilization, (3) that reward structures will reduce utilization most if they are not based on levels of utilization, even at discounted rates, (4) bonus systems are most effective when they minimize the free rider problems when based on individual rather than group behavior, and (5) incentives to capture rents from physician ownership of HMOs do not provide adequate bases for reducing individual levels of utilization. This latter result may indicate that physicians are less willing to place controls on themselves as they are to accept such controls imposed by others.

The results suggest a number of directions for future research on HMO provider incentives. First, one of the reasons for lack of precision in some of the estimates is the collinearity among the variables. This collinearity is the result of the fact that the relationship between plan type and incentives is not random. There is a need to examine why different HMOs choose different incentives schemes in the first place. A second issue not addressed in this paper is the primary role of incentives directed to enrollees. Finally, the availability of more accurate measures of utilization review by

management would permit a more direct test of our hypothesis concerning the relationship between managerial control and ownership.[28] Hopefully, future research will confirm the robustness of the results presented in this paper.

The clear implication is that further empirical research into the "new competition" in health care delivery must pay careful attention to the issue of incentives and compensation arrangements. The key feature of all such plans is an effort to make *some* decision maker aware of the resource costs of the health care services requested/provided.

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[28] These might include evidence of the degree of mandatory reviews, prior approvals, utilization standards, procedural protocols and measures that may indicate more stringent managerial control of utilization.

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