

Selection bias in health maintenance organizations: Analysis of recent evidence

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An analysis of recent research regarding selection bias in health maintenance organizations (HMO's) is presented in this article. Review of the available literature leads one to conclude that prepaid group practice HMO's do experience favorable selection. It has been demonstrated in numerous studies that prior use of health services by HMO enrollees is less than

prior use of health services by those who remain in the fee-for-service sector, and there is considerable evidence that shows a statistically significant positive relationship between prior use and current use. This is true for both those under 65 years of age and those 65 years of age or over.

Introduction

Enrollment in health maintenance organizations (HMO's) increased about 18 percent per year between 1982 and 1984 and 25 percent in 1985 (InterStudy, various years). The number of people now enrolled in HMO's exceeds 21 million, and the number of HMO's approaches 500. Most new HMO's are independent practice associations (IPA's), which account for over 50 percent of all HMO's. IPA's also account for over 50 percent of all HMO's that have risk-based contracts with Medicare.

Selection bias occurs if those who enroll in HMO's are either more or less likely to use health services after adjusting for factors used to set rates (e.g., Medicare sets HMO rates based on age, sex, Medicaid eligibility, and institutional status). If after adjusting for factors used to set rates healthier people join an HMO, then the HMO enjoys favorable selection. If after adjusting for factors used to set rates sicker people join an HMO, then the HMO experiences adverse selection. Within each group of enrollees charged the same rate, HMO's and traditional insurers desire enrollees who use fewer services. There are reasons why high users of medical services within each category might want to join an HMO (e.g., HMO's generally provide more comprehensive benefit packages) and some reasons why they might prefer to seek care in the fee-for-service system (e.g., high users of medical services often have close contact with physicians that they may be reluctant to give up). Efforts to increase HMO enrollment assume that HMO's achieve at least some of their cost savings as a result of increased efficiency and not solely because they treat a healthier population. If the latter were true, then increased HMO enrollment would not lower health care costs.

Although my purpose in this article is to examine the problems that selection bias causes in identifying the true HMO effect on utilization of services, the extent to which other problems are caused by selection bias is an important question. Pauly (1985) states,

"Interest in a policy question such as biased selection usually has some foundation in welfare economics. We want to know whether there is either inefficiency or a transfer of welfare from one set of consumers to another." Pauly is not sure that there is any inefficiency associated with self-selection bias in HMO's. Although he acknowledges that, if healthier people within each Medicare rate category are more likely to join an HMO, Medicare expenditures will increase. This transfer of funds from the general public to HMO's is viewed by Pauly as an equity problem.

It is important to distinguish between discussions of adverse selection in conventional insurance markets and biased selection in HMO markets. Adverse selection in conventional markets results from commodities exchanged, where the buyer and seller possess different information about the characteristics of a commodity. For example, adverse selection in the health insurance market exists if better risks are attracted to less comprehensive insurance plans and the insurers cannot distinguish risk levels. Rothschild and Stiglitz (1976) have shown that inefficiency arises in such situations. Biased selection in HMO's can come from either insurer selection or consumer choice. If healthier people within each rate category join an HMO, biased (favorable) selection into HMO's would exist. In this situation, it is not clear whether or not inefficiencies exist because of favorable selection.

Several studies on how people select health plans recently have been published (Wilensky and Rossiter, 1986). These studies have provided conflicting evidence concerning selection bias. Most of these studies have found no difference between the health status of HMO enrollees and those in conventional plans (Luft, 1981). Yet, a sizable body of research documents that the use of services by people who subsequently join an HMO is significantly lower than that by those who choose to remain in a conventional plan (Luft, 1981). There also is evidence that prior use is a good predictor of future use.

In this article, I analyze recent research regarding selection bias in HMO's, review studies of health plan choice and use, explain recent evidence regarding selection bias of those people 65 years of age or over and the relevance of this issue for administrators of

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Medicare's HMO program, and examine evidence concerning selection bias for people under 65 years of age.

Background

Luft's review of HMO's in 1981 indicated that HMO's spend from 10 to 40 percent less to treat enrollees than the fee-for-service sector and that these savings are attributable to the lower hospitalization rates in HMO's (Luft, 1981). The HMO's examined by Luft experienced 20 to 40 percent fewer hospital admissions per enrollee. Luft offered several explanations for these savings. One is that HMO's substitute ambulatory care for hospital care. Another is that the clear economic incentive inherent in HMO's because of their fixed budget to care for enrollees encourages greater efficiencies in the use of all medical services. Luft also suggested that HMO's may save money because individuals who need and demand fewer health care services are more likely to choose an HMO. If the last explanation is true, then increasing the number of people in HMO's will not reduce health care costs.

People choose health plans based on the attractiveness of the health plan (i.e., utility). The utility of a health plan to a person is a function of many factors including specific characteristics of the person (e.g., age, sex, income, health status, and propensity to consume health resources) and the health plan (e.g., out-of-pocket payments, copayments, deductibles, breadth of coverage, and choice of providers). In an equation explaining health plan choice with a discrete dependent variable (either 0 or 1 according to whether a person joins an HMO), selection bias exists if those variables statistically significant in the health plan choice equation representing person characteristics (e.g., age, race, income, and health status) are also statistically significant in an equation explaining the use of health services and these variables are not used to set rates. In addition, it should be noted that selection bias also may result from unobserved variables that are necessarily excluded from both the choice and expenditure equations.

Three specification problems complicate the measurement of selection bias.¹ First, studies of health plan choice and use do not limit their data set to individuals facing the same set of options (i.e., almost all published studies of health plan choice include single people with no children, single people with children, married people with children and a working spouse with health insurance options, and other categories of people in the same equation). No study of HMO versus fee-for-service choice to date

has correctly modeled the choice across multiple health plans. The choice set has been restricted, in some cases quite arbitrarily, to two choices. It is unclear how the inclusion of people facing different choices affects estimates of selection bias. Second, there are certain factors (e.g., a person's propensity to consume health services) that can not be directly observed that affect health plan choice and use. In addition, there is an anticipated need for services. For instance, a family may in general be low users of services and belong to a plan with low premiums but higher coinsurance amounts. However, if they anticipate higher use (e.g., maternity use) they may make a change specifically for that reason. Third, no study has data on all relevant variables in the health plan choice and use equations. Most studies have poor data on health status, and few studies include such variables as the distance to an HMO or waiting times to see a physician.

In most studies of health plan choice, characteristics of people at a single site who did or did not join an HMO are compared. Usually, these studies are conducted at the time employees are provided a choice between staying in a conventional plan or switching to an HMO. These studies are subject to criticism because they do not correct for the influence of factors that are correlated with each other. Such studies usually are not generalizable to other sites.

In recent years, a number of studies based on national data sets and multivariate statistical techniques have been conducted to learn about health plan choice and use (Welch, 1985a; Farley and Monheit, 1986; Welch and Frank, 1986). Unfortunately, in these studies, not only were different categories of people combined (single with and without dependents, married with and without working spouse, married with and without dependents, etc.) but also people who had no choice among plans to choose from (less than one-fifth of the people in the National Medical Care Expenditure Survey had a choice among plans) were combined with those who could choose among many different kinds of traditional plans and HMO's. In addition, these studies often do not correct for differences in out-of-pocket premiums, copayments, deductibles, or in the number of covered services. It is impossible to assess the impact of these specification errors on estimates of selection bias.

Those who hypothesize favorable selection for HMO's believe that, other things held equal, low-risk individuals are more likely to join an HMO than high-risk individuals. If attachment to a physician is a more important factor than broader coverage for high-risk individuals, then we may expect healthier people to join HMO's. Recent studies reveal that attachments to physicians is one of the most important reasons why people do not join HMO's. Juba, Lave, and Shaddy (1986) state that ". . . integration in the local medical care system is a dominant factor in the decision to select a particular health plan . . . Families having strong, well-established ties with personal physicians will opt

¹The points concerning correctly specified choice equations are presented in a paper by Feldman and Dowd titled, "The Elasticity of Demand for Health Plans: A Multi-Employer Study," which was presented at the December 1986 American Economics Association meeting in New Orleans and was funded by the National Center for Health Services Research and Health Care Technology Assessment under grant HSO5298.

for an insurance plan that preserves these associations." Although HMO's generally provide broader coverage, this has not been found to be a significant determinant of health plan choice.

The estimation of selection bias would be a simple task if high-risk and low-risk individuals could be identified prior to the enrollment decision. We could simply count the number of high risks and low risks who joined an HMO to determine whether selection bias existed. If a greater percentage of low-risk individuals joined an HMO, then we could conclude that HMO's experienced favorable selection. Most studies use self-assessed measures of health status, the number of chronic conditions, and prior use of health services to identify high risks and low risks. Yet, these studies may suffer from self-selection bias if individuals select HMO's based on factors that are not readily observable (e.g., propensity to consume health services may be correlated with health plan choice).

The Rand Health Insurance study (Manning et al., 1984) was a social experiment that examined the experience of 1,580 persons who were randomly assigned to receive care from the fee-for-service physician of their choice or from the Group Health Cooperative (GHC) of Puget Sound in the State of Washington. This experiment, which began in 1974 and ended in 1982, was not affected by self-selection bias because entrants were randomly assigned to an option. Those assigned to the fee-for-service sector faced a 0, 25, or 95 copayment rate. Those who were assigned to GHC had no copayments. (GHC does not charge for individual services, so it was not practicable to use copayments.) People were excluded from this experiment if they had high incomes, were eligible for Medicaid, or were over 62 years of age. The experiment revealed that expenditures for the GHC group were 25 percent less than the zero copayment (i.e., free care). This finding was statistically significant and may be explained by GHC's low hospital admission rate which was 40 percent less than the fee-for-service group with zero copayment.

Although the Rand study provides the strongest evidence to date that in the absence of selection bias HMO's can achieve savings, several factors mitigate the impact of this study. First, this is a study of only one prepaid group practice HMO at one site. Its success may not be duplicated by other HMO's. Second, 29 percent of the people contacted refused to enter this experiment. Rand ascertained that those people who refused to enter the experiment were similar in some respects to those people who did join the experiment. Yet, if those who did not enter the experiment differed systematically from those who entered on the basis of characteristics not observed by the Rand analysts, then the results of this study are biased. For instance, it may be that people who were strongly associated with their physicians disproportionately refused to join the experiment and that these people would have required more care whether treated at GHC or in the fee-for-service

sector. Finally, the difference between expenditures for the fee-for-service enrollees with 25 percent copayment rates and GHC enrollees was not statistically significant. Because most fee-for-service plans have copayments in this range, this suggests that transferring enrollees from most fee-for-service plans would not result in cost savings.

For several reasons, studies of health plan choice for individuals 65 years of age or over are better specified than studies for those under 65 years of age. First, Medicare beneficiaries face similar fee-for-service options. They do not face identical fee-for-service options because a substantial proportion of Medicare beneficiaries possess supplementary policies. Yet, there are more specification problems in a health plan choice equation for the nonaged relating to characteristics of the fee-for-service plan than for the aged. Most working people receive health insurance from their place of employment, and people employed by different firms face very different options. It is also common for employees to have a choice among numerous fee-for-service options.

Second, the choice of health plan for Medicare enrollees is rarely confounded by dual choice options and never confounded by choices between self-coverage and family coverage. For those 65 years of age or over Medicare does not extend to one's family, and rarely is the Medicare beneficiary covered by a spouse's health plan. People under 65 years of age generally may choose between self-policies and family policies. This choice is often complicated because the employee may be covered under a working spouse's health plan. Few studies of health plan choice for people under 65 years of age have information on the spouse's health insurance options. In addition, most studies of those under 65 years of age do not distinguish between those who have only one viable option (e.g., family coverage is not a reasonable choice for a single employee with no dependents) and those with several options.

Third, all studies of health plan choice involving the aged adjust for differences in age, sex, Medicaid eligibility, and institutional status of the beneficiary because the rates HMO's receive per beneficiary are set according to these variables. Studies of health plan choice involving the nonelderly adjust for a variety of different factors.

Because they are better specified, studies of selection bias in risk-based Medicare HMO's are easier to compare than studies of health plan choice for the nonaged working population. This is fortunate because the potential impact of selection bias for risk-based Medicare HMO's is great. Medicare regulations set reimbursement rates for risk-based HMO's on the basis of the age, sex, Medicaid eligibility, and institutional status of the beneficiary. HMO's are not able to set rates for Medicare beneficiaries based on their experience with this group. Consequently, HMO's are liable to the extent they are unable to adjust rates upward if they are losing money. Medicare is at risk because it is required to pay a set rate to an HMO even though an

HMO may be realizing a profit simply because it has enrolled healthier beneficiaries. To date, Medicare has not terminated a risk-based contract because an HMO was making substantial profits on its Medicare enrollees.

In the remainder of this article recent studies of the health plan choices for individuals 65 years of age or over (the elderly), will be examined, followed by an examination of recent studies of health plan choice for individuals under 65 years of age (the nonelderly). The significance of the choices made are discussed with particular reference to the administration of the Medicare program.

Selection bias among the elderly

Section 1876 of the Social Security Amendments of 1972 empowered Medicare to sign risk-based contracts with HMO's. Group Health Cooperative (GHC) of Puget Sound was the only HMO with a risk-based contract in 1980. Medicare initiated numerous demonstration projects in the early 1980's to encourage HMO's to participate in the Medicare program on a risk basis (U.S. Congress, 1986). The Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982 made it more attractive for HMO's to participate on a risk basis with Medicare. It was not until January 1985, however, that regulations were implemented for this provision of TEFRA. Among other things, these regulations permitted non-Federally qualified HMO's (referred to as competitive medicalplans) to contract with Medicare on a risk basis. All demonstration projects have been switched under TEFRA although a few still have waivers for specific requirements.

TEFRA has had dramatic effects on Medicare enrollment in risk-based HMO's. There are more than 830,000 Medicare enrollees in risk-based HMO's and the rate of enrollment is increasing at a rapid rate (American Hospital Association, 1987). Risk-based HMO's are paid a set fee for each Medicare enrollee, as opposed to providers in the traditional fee-for-service sector and HMO's that do not sign a risk-based contract. If risk-based HMO's enroll Medicare beneficiaries who are less likely to consume health services, then Medicare payments would exceed what they would have paid if all beneficiaries were in the fee-for-service system. Also, if better risks join risk-based HMO's, then payment rates to HMO's will rise because these rates are based on the cost of providing care to beneficiaries in the fee-for-service sector (Ginsberg and Hackbarth, 1986).

Introduction in Congress of the Durenberger bill in December 1985 heightened concern about how people select health plans (U.S. Congress, 1986). This bill establishes a voucher system to stimulate competition among health plans treating the elderly. There is evidence that care in HMO's is less costly than care provided in the fee-for-service sector, and those who support a voucher system argue that vouchers would result in the greater use of HMO's. A voucher system would make fixed per capita payments to qualifying

medical plans (either HMO's or traditional indemnity insurance plans) on behalf of Medicare beneficiaries who chose the plan. Medicare beneficiaries who chose a plan that cost less than the voucher amount would be permitted to keep the difference or use the money to purchase more comprehensive coverage. Medicare beneficiaries who chose a plan that cost more than the voucher amount would be required to pay the difference out of pocket. Proponents of this policy believe it would increase HMO enrollment because it would enable Medicare beneficiaries to share the savings resulting from their decision to join an HMO. Presently, most of the benefits of the lower costs experienced by Medicare beneficiaries in HMO's are captured by the Medicare program.

The potential effects of selection bias on Medicare costs are considerable. It was stated in a recent Congressional Budget Office study that "Each year, barely 50 percent of Medicare reimbursements are made on behalf of only 5 percent of enrollees. In 1984, no reimbursements were made for 30 percent of enrollees" (U.S. Congress, 1986). Medicare is concerned that risk-based HMO's will enroll disproportionately large numbers of beneficiaries who use few or no services. It was concluded from a draft report of the General Accounting Office (GAO) that Medicare enrollees are healthier than the general population (*The Washington Post*, 1986). The mortality rates of Medicare enrollees in 27 risk-based HMO's were examined. Medicare beneficiaries in HMO's had mortality rates equal to 74 percent of their projected level adjusted for age, sex, Medicaid eligibility, and institutional status. This suggests that HMO's are enrolling healthier beneficiaries. The results of this study may be biased, however, because it did not control for geographic variations in mortality. Thus, the low mortality of HMO enrollees in Florida is at least partly the result of the generally low mortality rates among the aged in Florida.

The GAO did not offer an explanation of why Medicare enrollees who shift to HMO's are healthier, but it did state that there is a potential for HMO's to screen applicants to enroll healthier individuals. In the GAO, it was concluded that, to realize any savings, the rates paid to HMO's could be no more than 89 percent of the Medicare's adjusted average per capita cost (AAPCC) for fee-for-service enrollees in the county. The AAPCC is adjusted for age, sex, Medicaid eligibility, and institutional status. Medicare now pays 95 percent of its AAPCC as stipulated in TEFRA.

Many of the HMO's in the GAO study were IPA's. New concerns have been raised that IPA's signing risk contracts with Medicare are adept at encouraging those least likely to need health care to join. There is fear that physicians who are members of IPA's may encourage patients who are low utilizers of health services to join an IPA, and treat patients who are high users of medical services on a fee-for-service basis. It makes economic sense for physicians to enroll the low utilizers of services in an IPA and receive a fixed capitation fee for these enrollees, and

treat the high users on a fee-for-service basis. To date, there is little evidence to indicate that this is occurring, and most of the evidence of favorable selection in Medicare risk-based HMO's comes from prepaid group practice HMO's.

There is considerable evidence that enrollees in HMO's have lower pre-enrollment expenditures than those enrolled in traditional plans. This evidence will be discussed in this article, and evidence that prior use is a good predictor of future use will be examined. The evidence suggests that HMO's with Medicare risk-based contracts experience favorable selection.

Eggers (1980) compared 1,000 Medicare enrollees at Group Health Cooperative (GHC) between October 1976 and July 1979 and 200,000 Medicare beneficiaries in the surrounding six-county area. He found that the GHC Medicare enrollees had a hospital use rate of over 50 percent below the control group after controlling for age, sex, Medicaid eligibility, and institutional status.

In another study, Eggers and Prihoda (1982) reviewed the experience of Medicare enrollees in the Fallon Community Health Plan in Massachusetts, the Kaiser Permanente in Portland, Ore., and the Greater Marshfield Community Health Plan in Wisconsin. Evidence of selection bias was found in two of the three sites. Comparison groups were composed of a 5-percent sample of Medicare beneficiaries living in the HMO catchment areas. The Fallon Community Health Plan is a one-group staff model that signed up about 5,000 Medicare beneficiaries under a risk-demonstration project. The inpatient hospital reimbursement rates for Medicare beneficiaries at Fallon were between 18 and 32 percent below the comparison group for the years 1976 through 1980, and the Part B reimbursements were between 8 and 18 percent less. Inpatient hospital reimbursement levels for Medicare enrollees at Kaiser Permanente were between 10 and 30 percent below its comparison group for this period. The reimbursement rates for Part B services were between 3 and 16 percent below.

The Greater Marshfield Community Health Plan is located in rural Wisconsin and services 53,000 residents. It is a group-practice HMO that employs most of the physicians in the Marshfield area. These physicians retain their private offices and many treat patients on a fee-for-service basis. The inpatient hospital reimbursement rate for Medicare enrollees at Marshfield ranged from 8 to 15 percent higher than the comparison group. Eggers and Prihoda hypothesized that, because Marshfield employs almost all physicians in the area, it does not employ the same degree of favorable selection found at traditional type, group-practice HMO's.

It has been shown in other studies that prior use is a good predictor of future use. Anderson and Knickman (1984) studied the records of 200,000 Medicare beneficiaries during 1974 and 1975. They found that beneficiaries hospitalized in 1974 were more than twice as likely to be hospitalized in 1975 than beneficiaries not hospitalized in 1974. In a similar study, Anderson, Resnick, and Gertman (1982)

used records of Medicare beneficiaries in Los Angeles County between 1974 and 1977 to demonstrate that prior use is a good predictor of future use. Eggers (1981) used records from a sample of 13,000 beneficiaries in 1978 and 1979 to demonstrate the power of prior use to predict future use. He showed that the coefficient for a beneficiary in 1978 was more than five times as large as the coefficients for age and sex in an equation explaining the level of reimbursement in 1979. McCall and Wai (1985) examined a sample of 4,300 Medicare beneficiaries from 1974 to 1978 and stated that, "Results are consistent with previous longitudinal analyses. We find consistent high users of services who consume substantial portions of total expenditures and consistent nonusers having none or few services."

Studies of individuals under 65 years of age also reveal that prior use is a good predictor of future use. Densen, Shapiro, and Einhorn (1959) and Mullooly and Freeborn (1979) examine those under 65 years of age and show that individual utilization patterns are consistent over time.

In a recent article by Welch (1985b), he suggests that the existence of a phenomenon referred to as "regression toward the mean" weakens the evidence of favorable selection in HMO's. Regression toward the mean is the tendency of a variable to move towards its mean over time, and it was originally observed in offspring of tall parents (i.e., offspring of tall parents were not as far above the mean as their parents). Welch argues that the assumption that last year's medical expenditure is an unbiased estimation of this year's expenditure is incorrect. From the Rand Health Insurance Experiment and the McCall and Wai studies, he finds that autocorrelation of expenditures adjusted for age, sex, and other stable characteristics is about .2. He concludes that, if Medicare beneficiaries who enroll in a risk-based HMO have annual expenditures \$500 less than beneficiaries who do not enroll, the expected difference in the following year is about \$100; and this difference is expected to fall in subsequent years.

Although Welch presents a compelling argument, there are several reasons to be skeptical about his conclusion. First, Welch used estimates of autocorrelation obtained from the Rand Health Insurance Experiment and McCall and Wai studies. Yet, the error components model used in these studies is quite restrictive; and it assumes that the correlation of error terms over time remains unchanged, regardless of how far apart in time the error terms are (i.e., that first, second, third, and higher order autocorrelations are equal). McCall and Wai found that the probability that a nonuser of health services in 1975 would be a nonuser in 1976 was 63 percent, in 1977 it was 54 percent, and in 1978 it was 44 percent. This suggests that autocorrelation decreases over time and that the disturbance term in the error component model should be modeled using some scheme where the disturbance term in the current period is a function of the disturbance term in the prior period

(i.e., where first, second, third, and higher order autocorrelation are not equal). Ellis (1986) found that correlation between total covered costs in 1982 and 1983 for a sample of 13,816 non-HMO enrollees was .541. Thus, .2 may be an underestimate.

Studies by the Congressional Budget Office (U.S. Congress, 1982) and Andersen and Knickman (1984) show that the expenditures of high and low users in 1 year regress towards the mean in subsequent years. Welch uses this evidence to conclude that the low users who join HMO's would have incurred higher expenditures in subsequent years. This is true only if the group of low users who join HMO's is a random sample of all low users. It may be that the group of low users who join HMO's are consistently low users over time.

Selection bias among the nonelderly

Luft's book on HMO's contains a good review of the evidence on selection bias available in 1981 (Luft, 1981). At that time, there was only one HMO with a risk-based contract with Medicare. Because there were no studies of selection bias using data from this HMO, Luft's review of selection bias in HMO's pertains to the nonelderly. Luft found that surveys that compare characteristics of HMO and non-HMO enrollees reveal few systematic differences between the health status of these two groups. Luft also found that data on people who subsequently joined HMO's revealed that these people were lower users of hospital care than those who chose to remain in a conventional plan. (All of this evidence related to prepaid group practice HMO's. Luft found no evidence of selection bias in IPA's).

Luft reconciles these apparently conflicting observations by hypothesizing that there are two factors at work. He reasons that when HMO out-of-pocket premiums are high they attract generally sicker people who anticipate substantial usage of HMO services and that people who have strong ties with physicians (generally sicker people) are less likely to join an HMO. These factors explain why a sickly person might or might not join an HMO. However, they do not explain why before-and-after studies of expenditures find evidence of selection bias and why studies of health status of HMO and non-HMO enrollees find no evidence of selection bias.

The studies reviewed by Luft were descriptive, and they contained simple comparisons of the characteristics of those who did and did not join an HMO. Multivariate statistical techniques were used in more recent studies of selection bias to analyze how people choose among HMO's and traditional health plans and how this choice affects the utilization of health services. Multivariate statistical techniques are designed to isolate and estimate the effect of each variable and to take into account the correlation among explanatory variables. Several of these studies are based on national data.

In general, the results found by Luft are confirmed in recent studies, most of which reveal that HMO

enrollees experience lower health expenditures during the period prior to joining an HMO than those who remain in traditional plans. In addition, in most recent studies, it was found that the health status of HMO and non-HMO enrollees is about the same. There are exceptions, especially for studies of health status. For examples, Grazier and others (1986) found little or no difference in prior use between those who chose an IPA in Seattle and those who remained in the fee-for-service plan. Dowd and Feldman (1986) found the health status of HMO enrollees in the Twin Cities to be better than enrollees in traditional plans. Health status in this study was defined as the presence of chronic conditions. In the following paragraphs, we discuss some of the studies that confirm Luft's findings.

In their studies, Roghman et al. (1977), Jackson-Beeck and Kleinman (1983), and Buchanan and Cretin (1986) show that people who enrolled in prepaid group practice HMO's used fewer health care services than people who remained under traditional plans during the period prior to enrollment. Roghman et al. analyzed 377,000 people in Rochester, N.Y., who had the option of enrolling in a prepaid group practice HMO, an IPA, or remaining under a traditional plan in 1975. Substantial favorable selection bias was found in the prepaid group practice plans and unfavorable selection bias was experienced by the IPA. Persons joining the IPA used 13 percent more days in 1972 than those who remained in the fee-for-service plan.

Jackson-Beeck and Kleinman (1983) analyzed data on 57,684 people employed by 11 firms in the Twin Cities area who were given an option in 1978 of joining an HMO. Almost 25 percent of the employees joined an HMO. The group exiting to an HMO experienced 53 percent fewer hospital days per capita than the group that stayed with a traditional fee-for-service plan. This difference persisted after controlling for age and sex.

Buchanan and Cretin (1986) analyzed data on about 30,000 employees of a large aerospace firm in California and Arizona who, between 1978 and 1982, were offered a choice between one of two HMO's and a fee-for-service plan underwritten by the firm. The authors conclude that, "when premium differentials are modest (as they are in this case), single employees and younger families with lower total claims may opt for an HMO." This finding persisted even after pre-HMO enrollment expenditures were adjusted for age and sex.

In studies by Grazier et al. (1986), Welch and Frank (1986), and Welch, Frank, and Diehr (1984), it is shown that the health status of HMO enrollees is about the same as that of enrollees in traditional health plans. In their study, Grazier et al. analyzed data from a sample of 2,000 families of Washington State employees who were members of Blue Cross of Washington and Alaska or the Group Health Cooperative of Puget Sound. These employees were offered the option of joining an IPA type HMO, United Healthcare, in 1978. The State paid the entire

premium for all three plans. Grazier et al. found that, "The physical health status measures were similar between Blue Cross and Group Health Cooperative groups and did not appear to affect change-of-plan decisions." Physical health status is measured by self-perceived assessments (excellent, good, fair, or poor) and by the number of chronic conditions. The variable most closely related to changing plans was dissatisfaction with the current plan.

Welch and Frank used logit analysis to study the health plan choices of people in the National Medical Care Utilization and Expenditure Survey, a national sample of the civilian, noninstitutionalized population collected by the National Center for Health Statistics in 1980. The authors created one observation per family with the variables age, education, and insurance coverage pertaining to the head of household. The only significant variables in the health plan choice equation were income and HMO percent of market share. Self-perceived health status and the number of chronic conditions were not related to health plan choice.

Welch, Frank, and Diehr studied a sample of people in a section of Seattle who were given a choice between GHC and Blue Cross of Washington and Alaska. The sample was limited to persons under 65 years of age who were not on public assistance and whose income did not exceed the poverty level by more than \$2,000 (i.e., the medically needy). Choice equations were estimated using logit techniques, and a multistage selection technique developed by Heckman, Lee, and Olsen was used to estimate the effect of HMO choice on utilization. The authors concluded that, where health is assessed by self-measurement and the number of chronic conditions, there is little evidence that the healthy disproportionately selected GHC.

The results found by Luft and confirmed in most recent studies (i.e., that self-assessments of health status and the number of chronic conditions do not vary significantly between those who join and those who do not join an HMO; those who joined HMO's used fewer health services than those who did not join an HMO during the time period prior to the enrollment decision), make it difficult to generalize about selection bias in HMO's. One way of interpreting these findings is that HMO's attract people whose propensity to use health services given a specific health state is less than those who do not join an HMO. Part of the logic behind HMO's is their emphasis on preventive medicine and health maintenance. Emphasizing preventive services may be good marketing strategy not only because it attracts new enrollees, but because it attracts enrollees who are parsimonious users of medical services. If this were true, HMO enrollees might not possess better measures of health status than enrollees in conventional plans, but they would demand fewer health services. In other words, although there may be no difference in need (i.e., health status), there seems to be a difference in the propensity to consume health

services as evidenced by the demand for health services.

This reasoning hypothesizes the existence of an unobservable variable (propensity to consume health services given a specific health state) that affects both the decision whether or not to join an HMO and the quantity of health care services consumed. A new statistical technique pioneered by Heckman, Lee, and Olsen is designed to take into account the impact of unobservable variables on estimates of selection bias in HMO's (Heckman, 1979; Lee, 1978; Olsen, 1982). This technique was used by Welch, Frank, and Diehr (1984). Estimates using this technique suggest that the effect of unobservable variables is significant.

This technique has several limitations. First, analysts who have used it have found that estimates using the correction factor lack robustness (i.e., small changes in the specification of the expenditure equation yield substantial changes in estimates) and often do not make sense (Welch, Frank, and Diehr, 1984). Second, this technique makes some strong assumptions. It hypothesizes the existence of a linear choice function where all people who join an HMO have positive values for this function and that the error term in this function is normally distributed with mean zero. This technique also assumes that error terms in the choice and expenditure equations are bivariate normal. There is no research that indicates the consequences of violations of these assumptions. Because of these concerns, it is still an open question of whether selection bias attributable to unobserved variables can be addressed adequately without conducting a randomized experiment.

Final remarks

Review of the available literature leads one to conclude that prepaid group practice HMO's do experience favorable selection. Numerous studies demonstrate that prior use of health services for HMO enrollees is less than prior use of health services for those who remain in the fee-for-service sector. There is considerable evidence that shows a statistically significant positive relationship between prior use and current use. These findings reflect the experience of HMO's with both the elderly and nonelderly populations.

Available evidence indicates that the health status of those who join HMO's is not significantly different from those who choose a traditional health plan. Health status in these studies is measured by self-assessments and the number of chronic conditions. This can be reconciled with the finding that HMO enrollees experience lower use of health services during the period prior to the enrollment decision by hypothesizing that, for a given health status, those who join an HMO are more conservative users of medical services than those who do not. HMO's stress their commitment to preventive care and health maintenance, and this may attract enrollees who are more conservative users of health services.

There is much less evidence regarding selection bias in IPA's. Luft (1981) found no evidence of selection bias in IPA's. There is concern about the potential impact of selection bias in Medicare risk-based HMO's, and a recent study by the U.S. General Accounting Office (1980) indicates that IPA's and prepaid group practice HMO's with Medicare risk-based contracts do experience favorable selection. Medicare is currently funding an evaluation of about 25 risk-based HMO's, and this evaluation is examining the issue of selection bias. The results of this evaluation should be available later this year.

There is a need for more research on selection bias in HMO's. Little is known about the consequences of selection bias in HMO's on the performance of the market for health services. Are there inefficiencies associated with selection bias in HMO's? Does selection bias in HMO's affect the ability of the market to achieve a stable equilibrium? What are the long-term effects of selection bias? In addition, there is a dire need for more information on the extent of selection bias in IPA's. It would also be interesting to know whether selection bias in HMO's varies with the proportion of people enrolled in HMO's in different areas (e.g., does selection bias decrease as the percent of people in HMO's increase?). In addition, it would be interesting to know how the absolute level of the difference between the HMO and fee-for-service premiums affects selection bias. Presumably, favorable selection bias into HMO's decreases as HMO premiums increase relative to fee-for-service premiums. Research in these areas is needed to enable policy analysts to learn about the extent of selection bias in HMO's and its impact on the market for health services.

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