Selection Experiences in Medicare HMOs: Pre-Enrollment Expenditures

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Using 1993 and 1994 data, the authors examine whether beneficiaries who enroll in a Medicare health maintenance organization (HMO), including those enrolling for only a short period of time, have lower expenditures than continuous fee-for-service (FFS) beneficiaries the year prior to enrollment. We also test whether biased selection varies by the level of HMO market penetration and the rate of market-share growth. We find favorable selection associated with enrollment into Medicare HMOs, which declines as market share increases but does not disappear. Among short-term enrollees, we find unfavorable selection, however, selection bias was not sensitive to market characteristics.

INTRODUCTION

The introduction of HMOs in 1985 is perhaps the most important paradigm shift in the history of the Medicare program. HMOs fundamentally altered the structure of Medicare by allowing the government to contract with private health plans rather than pay providers directly for services. The HMO program also introduced capitated payments as an alternative to FFS payment. Finally, the program placed the government in the dual role of manager of a system of competing health plans, in addition to its traditional role as manager of the FFS delivery system (Dowd et al., 1992).

Although it was expected that the shift to managed care would help control costs and improve the efficiency of the Medicare program, a consistent finding in the literature is that Medicare HMOs experience favorable selection relative to the FFS sector; that is, HMOs attract a disproportionate share of healthy, low-cost beneficiaries (Brown, 1988, Brown et al., 1993a,b; Eggers, 1980; Eggers and Prihoda, 1982; Garfinkel et al., 1986; Riley, Rabey, and Kasper, 1989; Riley, Lubitz, and Rabey, 1991). However, most studies of selection bias were done in the early days of the Medicare HMO program, and the results may not apply to recent experience.

Interest in biased selection in the Medicare program is driven in part by HCFA's method of paying HMOs that participate in the program. Medicare HMOs are paid 95 percent of what HCFA estimates the HMO enrollee would have cost had he or she remained in the FFS sector. Thus, from a budgetary perspective, favorable selection means that HMOs enroll beneficiaries whose expected costs are lower than the costs of beneficiaries in the same adjusted average per capita cost (AAPCC) rate cell who remain in the FFS sector (in 1993, the AAPCC rate adjusted for beneficiary age, sex, Medicaid eligibility, disability, and institutional status). In this study, however, our operational definition of favorable selection is whether the log-odds of joining a Medicare HMO in

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1994 (versus remaining in the FFS sector) increases as the individual's FFS expenditures in 1993 decrease. In other words, we determine whether low prior-year FFS expenditures predict future Medicare HMO enrollment.

It is possible that the level of favorable selection will diminish over time as HMO enrollment and market share increase (Cox and Hogan, 1996; Clement, Gleason, and Brown, 1992; U.S. General Accounting Office, 1998; Lichtenstein et al., 1991, 1992; Price Waterhouse, 1996). Both HMO market share and rate of growth in the market share may have an impact on the extent of biased selection. In areas of high HMO market penetration, beneficiaries with chronic illness and other health problems may be more familiar with HMOs and may be more willing to join and stay enrolled in them. In addition, in areas of high market penetration, HMOs may simply exhaust the supply of healthy beneficiaries (Feldman and Dowd, 1982). Consequently, favorable selection is expected to decline in areas of high HMO market share. In areas of rapid growth, which usually have high AAPCC payments, HMOs may be more willing to enroll beneficiaries regardless of their health status. HMO growth should also be related to less favorable selection, according to this hypothesis. Certainly, beneficiaries enrolling in HMOs in high market-share and high-growth areas may be less healthy than enrollees in low market-share and growth areas; yet these enrollees could still be healthier than beneficiaries staying in the FFS sector.

These two aspects of selection, exhausting the supply of healthy enrollees and willingness to enroll beneficiaries regardless of health status, although similar in effect, have different policy implications. Although the first effect may be beyond the control of HMOs (depending on the reasons for biased enrollment), the second effect clearly is within the HMO's control. Medicare HMOs are not allowed to screen enrollees, but they can vary the frequency and length of their open enrollment periods and the degree to which they advertise and otherwise make beneficiaries aware of their presence in the market. For that reason, we want to separate the effect of a limited supply of healthy enrollees from the marketwide willingness of HMOs to enroll beneficiaries regardless of health status (which, as previously stated, is more likely in markets experiencing rapid growth).

This study contributes to the debate surrounding selection bias in several ways. First, we use 1993 and 1994 data to provide an updated estimate of the degree of biased selection in HMOs that contract with Medicare. Second, we examine whether biased selection varies by the level of Medicare HMO market penetration and the rate of market-share growth in an area. Specifically, we examine whether 1994 HMO enrollees have higher patterns of expenditures in 1993 than continuous FFS beneficiaries, and where possible, we explore the effect of market characteristics.

The pre-enrollment analyses described in this article consist of two distinct but related studies. The first, referred to as the enrollment-bias study, compares 1993 pre-enrollment expenditures for beneficiaries who joined an HMO in 1994 or remained in the FFS sector. The second, referred to as the short-term enrollment-bias study, compares 1993 pre-enrollment expenditures for a small subsample of the 1994 HMO enrollees, who then disenrolled in 1994, with the same sample of continuous FFS beneficiaries.

There are several reasons beneficiaries may stay in the HMO sector for only a short time. Some beneficiaries may misunderstand the restrictions imposed by HMOs or may be dissatisfied with some aspects of care in the HMO. Other benefi-

ciaries may engage in "hit-and-run utilization," joining the HMO to use a particular service (e.g., prescription drug and/or eyeglasses coverage) at no or lower out-of-pocket cost, then return to the FFS sector. In market areas where Medicare HMOs hold continuous open enrollment, beneficiaries can move freely to and from the HMO and FFS sectors (as well as among HMOs). Still other beneficiaries might be encouraged to disenroll by the HMO (or a physician) if the beneficiary's projected health care costs exceed the AAPCC capitation rate or if access to particular services is restricted by the HMO. Furthermore, the HMO may drop its Medicare contract or the beneficiary may move to an area where the HMO is not available.

Finally, some beneficiaries who have a medigap policy may continue to pay the premium when they join an HMO. This guarantees that they can return to the FFS sector without being underwritten by an FFS medigap insurer. Such beneficiaries will want to decide quickly whether they should stay in the HMO or return to the FFS sector. As several of the listed reasons for short-term enrollment suggest, short-term enrollees may be less healthy and more risk-averse than those who remain in the HMO sector longer. Therefore, we hypothesize that higher 1993 expenditures are associated with higher probability of short-term enrollment in Medicare HMOs.

Because this study examines only pre-enrollment spending, we refer to the subset of 1994 enrollees who return to the FFS sector in 1994 as "short-term enrollees" rather than "disenrollees." To promote conceptual clarity, we define analyses of disenrollment bias as those using data on post-disenrollment expenditures. Our measure of enrollment bias, 1993 expenditures, is broadly interpreted as an indicator of beneficiary health status. Expenditures are defined as HCFA reimbursements to health care providers for care delivered to Medicare beneficiaries.

MODEL AND METHODS

Enrollment Bias

The purpose of the analysis is to determine if there is biased enrollment into Medicare HMOs. Bias is measured by the relationship between 1993 expenditures and the probability of 1994 HMO enrollment within the AAPCC payment cells. We include the AAPCC variables available in the data: age, sex, and Medicaid eligibility (the 10 age categories, sex, and Medicaid-status variables result in 40 AAPCC cells, which are reduced to 14 cells as described in the results). County of residence is controlled both through the sampling design (i.e., by drawing FFS beneficiaries only from the same counties as the HMO enrollees) and through inclusion of the county AAPCC payment rate. Because HMO enrollment might be concentrated in counties where costs are abnormally high or low, we correct for this potential source of bias by including the 1993 AAPCC payment for the county as an explanatory variable.

The dependent variable in the enrollment-bias study is the log-odds of being an "HMO joiner," an indicator that equals one if the beneficiary joins an HMO at some time during 1994 and zero if the beneficiary continues in the FFS sector. Given the logistic form of the dependent variable, the logit model is an appropriate statistical method.

There are two specifications for the model. The first specification controls for the AAPCC age-sex rate-cell variables, the subject's county of residence, and the number of days the subject was alive during 1994. The second specification tests whether enrollment bias changes as HMO

market share and rate of growth in HMO market share change, by interacting HMO market share and change in market share from 1993 to 1994 with the 1993 expenditure variable.

One important AAPCC variable is missing in our data and thus from the AAPCC adjustment variables: the institutional status of beneficiaries. HMOs are expected to have a low number of institutionalized enrollees, relative to the FFS sector, and institutionalized beneficiaries are expected to have higher expenditures. Because of this omission, our results are likely to overstate the degree of favorable selection or understate the degree of adverse selection in Medicare HMOs, depending on the finding.

Our sample included only those beneficiaries who were alive for the full year of 1993, so every beneficiary's expenses were observed for all of 1993. However, some of the beneficiaries in the sample died in 1994. Those who died earlier in the year were less likely to have joined an HMO because they had fewer days of "exposure" to the opportunity for joining. Death in 1994 is also an indicator of poor health status, which would be correlated with 1993 expenses. If death is correlated with the dependent variable and one of the independent variables (1993 expenses), failure to control for death would bias the coefficient of 1993 expenditures in the logit models. To avoid this potential source of bias, we included the number of days of survival in 1994 (DAYSALIVE) as an explanatory variable in our models. Other researchers have used a matched-sample design to deal with this potential bias. The two specifications are as follows:

$$\text{log odds(HMO joiner)} = \beta_0 + \beta_{AAPCC}X_{AAPCC} + \beta_{\$}1993\ \text{spending} + \beta_{AAPCC}\text{AAPCC 1993} + \beta_{DAYSALIVE}\,\text{DAYSALIVE} + u \quad (1)$$

$$\text{log odds(HMO joiner)} = \beta_0 + \beta_{AAPCC}X_{AAPCC} + \beta_{\$}\ 1993\ \text{spending} + \beta_{AAPCC}\text{AAPCC 1993} + \beta_{DAYSALIVE}\text{DAYSALIVE} + \beta_{1993MS}1993MS + \beta_{MSI}\ MS\_1993\$ + \beta_{\Delta MS}\ \Delta MS + \beta_{\Delta MSI}\Delta MS\_1993\$ + u \quad (2)$$

where

- log odds(HMO joiner) = the log of the odds that the subject joins an HMO in 1994 versus remaining in the FFS sector during 1994.
- X_{AAPCC} = 13 AAPCC rate-cell categories (females 60-64 years of age are the omitted reference category).
- 1993 spending = FFS Medicare expenditures during 1993 (in thousands).
- AAPCC 1993 = 1993 AAPCC rate in subject's county of residence.
- DAYSALIVE = the number of days the subject was alive in 1994.
- 1993MS = the 1993 Medicare HMO market share.
- MS_1993$ = interaction term (1993 market share times 1993 spending).
- ΔMS = change in the Medicare HMO market share from 1993 to 1994.
- ΔMS_1993$ = interaction term (change in market share from 1993 to 1994 times 1993 spending).
- u = unobserved error.

Our operational definition of HMO selection is the change in log-odds (HMO joiner) as 1993 spending changes or:

$$\frac{\delta \text{ log odds (HMO joiner)}}{\delta\ 1993\ \text{Spending}} = \beta_{\$} + \beta_{MSI}\ 1993MS + \beta_{\Delta MSI}\Delta MS \quad (3)$$

Short-Term Enrollment Bias

The purpose of the second set of analyses is to determine if there is biased enrollment among short-term HMO enrollees. Because short-term enrollees may be a

peculiar subset of all HMO enrollees, we compare 1993 pre-enrollment Medicare reimbursement data for these short-term enrollees with the same sample of continuous FFS beneficiaries used in the enrollment-bias analyses. Short-term enrollees had to remain in the FFS sector for at least 1 month after leaving the HMO in 1994 but after that could re-enroll in an HMO. Enrollees who switched to another HMO were not counted as short-term enrollees. Beneficiaries who died in the HMO sector in 1994 were dropped from the analysis, as they were neither short-term enrollees nor continuous FFS beneficiaries. However, subjects who left the HMO and subsequently died in the FFS sector in 1994 were included, as were continuous FFS beneficiaries who died in 1994. As a result, some of the sickest HMO enrollees were culled from the sample. This choice can be justified, as death is certainly not the same as choosing to leave the HMO sector; however, it is important to keep in mind that the results are for surviving short-term HMO enrollees.

The estimated equations and explanatory variables for short-term enrollment bias are identical to those already described for enrollment bias, except the dependent variable, which becomes log-odds prob (SHORT-TERM), defined as the log-odds ratio that the beneficiary will join an HMO in 1994 and then disenroll sometime during 1994.

DATA

The data come from files prepared by HCFA, containing basic data about each beneficiary (dates of birth and death, sex, race, periods of HMO enrollment, etc.) and 1993 expenditures. The 1993 claims were aggregated up to the beneficiary level in each file and then aggregated across files for Part A expenditures (short-stay, long-stay, and skilled nursing facility inpatient services, hospice services, and home health agency [HHA]), Part B expenditures (durable medical equipment [DME], physician/supplier, outpatient, and HHA services), and total expenditures. (The vast majority of HHA records are Part A claims, with only 1.3 percent of the FFS records and 0.6 percent of the HMO joiner records categorized as Part B claims.)

A 100-percent sample of all 1993 and 1994 HMO enrollees was drawn from the 124 counties that have at least 1,000 HMO enrollees. These 124 counties included 96 percent of all Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA)-risk HMO enrollees. Within each of the 124 counties, we selected a random sample of 10,000 FFS beneficiaries. Sampling weights were developed to reflect the disproportionate random sampling of FFS beneficiaries. For example, in a county with 100,000 FFS beneficiaries, the probability of drawing any beneficiary is 1 in 10, so the sampling weight is 10; in a county with 50,000 FFS beneficiaries, the sampling weight is 5; in a county with fewer than 10,000 FFS beneficiaries, the sampling weight was set to 1. This is the generally accepted sampling and weighting method for use in a stratified random sample.

Several inclusion criteria were applied to the sample. The subjects had to be: (1) residents of 1 of the 124 counties with more than 1,000 HMO enrollees; (2) alive for the entire 1993 calendar year; (3) eligible for both Part A and Part B Medicare for the entire 1993 calendar year; (4) persons for whom end-stage renal disease could be neither the current nor original reason for Medicare entitlement; and (5) members of a TEFRA-risk HMO if they were HMO "joiners" in 1994. Short-term enrollees are the subset of joiners who disenrolled to the FFS sector (not to another type of HMO)

Table 1
Study Sample Size

Sample	HMO Enrollees	FFS Beneficiaries
Original sample	343,737	1,158,319
Excluded Groups		
Subjects Who Died During 1993	16,896	56,205
Subjects Who Were Not Eligible for Both Part A and Part B for All of 1993	20,140	90,575
Subjects for Whom ESRD Was the Current or Original Reason for Medicare Entitlement	232	6,241
Subjects Who Joined an HMO Other than a TEFRA-Risk HMO	35,275	—
Final Sample	[1]271,194	1,005,298

[1] HMO joiners.

NOTES: HMO is health maintenance organization. FFS is fee for service. ESRD is end stage renal disease. TEFRA is Tax Equity and Fiscal Responsibility Act of 1982.

SOURCE: Call et al., Minneapolis, Minnesota, 1999.

for at least 1 month at some point during 1994. Table 1 presents the original unweighted sample size in the 124 counties, the number of beneficiaries not meeting the inclusion criteria, and the final sample size used in the analyses.

RESULTS

The variables included in the enrollment and short-term enrollment-bias analyses are presented in Table 2, as well as the proportion of the FFS beneficiaries, all HMO enrollees, and short-term enrollees (a subsample of enrollees) in each of the AAPCC cells in 1993, along with descriptive statistics for other explanatory variables. The AAPCC variables were reduced from 40 to 14 because of the low frequency of cases in some categories. Medicaid-eligible beneficiaries were combined into two categories, one representing Medicaid-eligible males and the other Medicaid-eligible females. Similarly, the non-Medicaid-eligible beneficiaries under age 65 were combined into two categories, males and females. Non-Medicaid-eligible females age 65 to 69 serve as the reference category. The sample sizes are unweighted, but the results were weighted to reflect disproportionate random sampling by county.

Table 2 shows that HMO enrollees were less likely to be dually eligible for Medicaid and Medicare and, among aged beneficiaries, were younger than continuous FFS beneficiaries. HMO enrollees had lower 1993 reimbursements than FFS beneficiaries. As expected, HMO enrollees lived a higher average number of days in 1994 than continuous FFS beneficiaries, though as discussed previously, this may be attributable in part to the sampling design. Both male and female short-term enrollees were more likely than continuous FFS beneficiaries to be dually eligible. Persons with disabilities are represented in greater proportions among short-term enrollees than FFS beneficiaries or HMO joiners. In terms of the age distribution, short-term enrollees look more like continuous FFS beneficiaries than HMO joiners in 1994. Average 1993 expenditures were higher among short-term enrollees than other HMO enrollees (joiners) and FFS beneficiaries. In the analyses that follow, 1993 spending

Table 2

Variable Definitions and Descriptive Statistics for Continuous FFS Beneficiaries, All HMO Enrollees, and Short-Term Enrollees

Variable Definition	FFS Beneficiaries		HMO Joiners		Short-Term Enrollees	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
AAPCC Beneficiary Variables[1]						
Male, Not Medicaid-Eligible, Under Age 65, Disabled	0.0424	0.6005	0.0212	0.1440	0.0519	0.2218
Male, Medicaid-Eligible	0.0551	0.6801	0.0362	0.1868	0.0397	0.1953
Male, Not Medicaid-Eligible, Age 65 to 69	0.0990	0.8902	0.1399	0.3496	0.0975	0.2966
Male, Not Medicaid-Eligible, Age 70 to 74	0.0898	0.8519	0.1100	0.3129	0.0881	0.2834
Male, Not Medicaid-Eligible, Age 75 to 79	0.0629	0.7235	0.0668	0.2496	0.0638	0.2444
Male, Not Medicaid-Eligible, Age 80 to 84	0.0358	0.5537	0.0349	0.1835	0.0368	0.1883
Male, Not Medicaid-Eligible, Over Age 84	0.0223	0.4402	0.0171	0.1297	0.0228	0.1493
Female, Not Medicaid-Eligible, Under Age 65, Disabled	0.0815	0.8155	0.0433	0.2036	0.1123	0.3157
Female, Medicaid-Eligible	0.0423	0.5997	0.0235	0.1516	0.0276	0.1639
Female, Not Medicaid-Eligible, Age 65 to 69	0.1241	0.9830	0.1688	0.3746	0.1258	0.3317
Female, Not Medicaid-Eligible, Age 70 to 74	0.1178	0.9608	0.1410	0.3480	0.1244	0.3300
Female, Not Medicaid-Eligible, Age 75 to 79	0.0947	0.8727	0.0970	0.2959	0.0965	0.2953
Female, Not Medicaid-Eligible, Age 80 to 84	0.0677	0.7488	0.0600	0.2375	0.0580	0.2517
Female, Not Medicaid-Eligible, Over Age 84	0.0598	0.7066	0.0400	0.2375	0.0446	0.2064
Additional Variables						
Total 1993 Medicare Reimbursements	3,899.19	30,188.59	2,536.62	7,270.77	4,309.06	10,184.60
Number of Days Subject Was Alive in 1994	355.2804	144.0850	362.7630	20.5809	362.8729	17.9322
1993 AAPCC Rate in Subject's County of Residence	420.4407	296.6792	425.1678	67.3090	439.3171	68.6280
1993 TEFRA-Risk HMO Market Share for County	0.1540	0.3623	0.2130	0.1221	0.2062	0.1211
1994 Market Share Less 1993 Market Share per County	0.0015	0.0043	0.0019	0.0016	0.0016	0.0014
Unweighted Sample Size	1,005,298		271,194		21,250	

[1] Equals 1 under the stated condition and 0 otherwise.

NOTES: FFS is fee for service. HMO is health maintenance organization. AAPCC is adjusted average per capita cost. TEFRA is Tax Equity and Fiscal Responsibility Act of 1982.

SOURCE: Call et al., Minneapolis, Minnesota, 1999.

Table 3

Logit Model of Effect of 1993 Medicare Reimbursements and HMO Market Share on 1994 Medicare HMO Enrollment

Variable[1]	Model 1		Model 2	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Total Expenditures	-0.0162	***0.0003	-0.0214	***0.0011
1993 Market Share	—	—	0.0645	***0.0002
1993 Market Share Times 1993 Expenditures	—	—	0.0198	***0.0031
Change in Market Share 1993-94	—	—	0.0431	***0.0002
Change in Market Share 1993-94 Times 1993 Expenditures	—	—	0.0049	*0.0025

* Coefficients are significant at the 0.05 level.

*** Coefficients are significant at the 0.001 level.

[1] Dependent variable is the log of the odds that the subject joined an HMO in 1994 versus remaining in the FFS sector during 1994.

NOTES: HMO is health maintenance organization. FFS is fee for service. AAPCC is adjusted average per capita rate. Both equations control for the AAPCC rate cells, the 1993 AAPCC payment rate per county, and the number of days the beneficiary was alive in 1994. All expenditures variables are expressed in thousands of dollars.

SOURCE: Call et al., Minneapolis, Minnesota, 1999.

is measured three ways: total reimbursed expenditures, Part A expenditures, and Part B expenditures.

Effect on 1994 HMO Enrollment

Total Reimbursed Expenditures

First we compared total Medicare reimbursed expenditures in 1993 for all HMO enrollees and FFS beneficiaries in the 124 study counties, unadjusted for any covariates (not presented in tabular form). Average 1993 health care expenditures were significantly lower ($p < 0.001$) among Medicare beneficiaries who joined an HMO in 1994 (mean = $2,537; standard deviation = $7,271) than continuous FFS beneficiaries (mean = $3,899; standard deviation = $30,189). In addition, 80 percent of enrollees had some expenditures in 1993, compared with 85 percent of beneficiaries who stayed in FFS.

Model 1 in Table 3 shows the results from a logit model of equation 1. The explanatory variables are total HCFA reimbursements for the subject in 1993, the AAPCC rate-cell variables, the number of days that the subject was alive during 1994, and the AAPCC payment rate in the subject's county in 1993 (AAPCC 1993). The negative coefficient for total expenditures indicates that higher expenditures in 1993 are negatively associated with the probability of joining an HMO in 1994.

Remembering that all expenditures are expressed in thousands of dollars, the coefficient for total expenditures (-0.0162) can be evaluated in two ways. First, the coefficient can be exponentiated ($e^{-0.0162} = 0.98$), showing that an additional $1,000 of Medicare reimbursements in 1993 reduces the odds of joining an HMO in 1994 by 2 percent. About 3 percent of the total sample joined an HMO in 1994. Thus, the odds ratio of joining an HMO versus staying in the FFS sector was about $0.0300 \div 0.9700 = 0.0309$. An additional $1,000 of reimbursements in 1993 would reduce that ratio to roughly $e^{-0.0162} \times 0.0309 = 0.0304$.

The second interpretation of the coefficient is the change in the probability of HMO enrollment associated with a $1,000 increase in total reimbursements in 1993. That effect is estimated by $\beta \times P \times (1- P)$, where P is the probability of joining an HMO in 1994 (roughly 0.03 in our data). The estimated effect of an additional $1,000 of 1993 reimbursements on the probability of joining an HMO in 1994 is

quite small: -0.0162 x 0.03 x 0.97 or a decrease in the probability of -0.0005 (i.e., a reduction from 0.0300 to 0.0295).

These results must be interpreted carefully. On the one hand, there are significant differences in mean 1993 expenditures between 1994 HMO enrollees and continuous FFS beneficiaries ($944 after controlling for the AAPCC variables and other county characteristics). On the other hand, when a person in the FFS sector spends an additional $1,000 in 1993, the probability that they will join an HMO in 1994 does not change to a great extent. We also compared the probability of joining an HMO among "low-cost" (i.e., annual spending of less than $50,000) and "high-cost" beneficiaries (i.e., annual spending of $50,000 or more) and found that beneficiaries at the upper end of the expenditure spectrum were less likely than low-cost beneficiaries to join HMOs.

Our second specification (equation 2) examines the way in which biased selection changes as the market share of HMOs increases. As previously discussed, we hypothesized that the growth rate in market measures the HMO's willingness to accept beneficiaries regardless of their health risk and that HMO market share measures depletion of the pool of good risks. The results from the second specification are shown in Model 2 of Table 3.

The negative coefficient for total expenditures indicates that HMOs enjoy favorable selection at low market penetration. However, β_{MSI} and $\beta_{\Delta MSI}$ are positive in the estimated equation, indicating that favorable selection declines as market share and change in market share increase. The latter finding is consistent with the theory that HMOs are less interested in influencing the selection process in areas of rapid HMO growth. The change in selection as market share increases can be calculated by substituting the estimated coeffcients into equation (3). At zero HMO market share and zero growth, the righthand side of equation 3 becomes -0.0214 + 0.0198 * 0.0 = -0.0214, whereas at 50-percent market penetration (and growth held at zero), the biased selection value becomes -0.0214 + 0.0198 * 0.50 = -0.0115, a reduction in absolute value (toward zero) of about 46 percent. However, favorable selection is not completely eliminated until the HMO market share is 100 percent.

Several important factors affect these estimates. First, the greatest market share we observe is 52 percent. Any statement about what happens above 52 percent is only inference, based on data with market shares at or below 52 percent. Second, our model constrains the interaction effect to be linear. In fact, the erosion of favorable selection might be gradual at first but accelerate as market share increases or be more intense at lower market shares but gradually decreasing. Estimating a non-linear effect by including the square of market share and its interaction with 1993 expenditures would have introduced severe multicollinearity into the model, so we decided to rely on the less flexible but probably more robust estimates from the linear model. Non-linearities could have very pronounced effects on the change in bias in upper ranges of market share.

Part A and Part B Expenditures

In the next series of analyses, total expenditures are broken down into Part A (e.g., inpatient) and Part B (e.g., outpatient) expenditures. The analyses of Part A and Part B expenditures do not incorporate the market-share and market-change variables because of the difficulty of interpreting results, which include multiple interaction terms. As may be expected, mean 1993 Part A and B expenditures were significantly higher for continuous FFS beneficiaries compared with HMO enrollees (not shown in tabular form).

Table 4

Logit Model of Effect of 1993 Part A and Part B Expenditures on 1994 HMO Enrollment

Variable[1]	Parameter Estimate	Standard Error
Part A Expenditures	-0.0029	***0.0004
Part B Expenditures	-0.0662	***0.0013

***Coefficients are significant at the 0.001 level.

[1] Dependent variable is the log of the odds that the subject joined an HMO in 1994 versus remaining in the FFS sector during 1994.

NOTES: HMO is health maintenance organization. FFS is fee for service. AAPCC is adjusted average per capita cost. Equation controls for the AAPCC rate cells, the 1993 AAPCC payment rate per county, and the number of days the beneficiary was alive in 1994. All expenditures variables are expressed in thousands of dollars.

SOURCE: Call et al., Minneapolis, Minnesota, 1999.

Specifically, continuous FFS beneficiaries spent $2,382 on Part A services in 1993, compared with $1,445 among HMO enrollees. Similarly, 1993 Part B expenditures for FFS beneficiaries were $1,517, compared with $1,092 for HMO enrollees.

Table 4 shows the results of a logit model, similar to equation 1. A $1,000 increase in Part B expenditures has a larger negative effect on the probability of HMO enrollment than an equal increase in Part A expenditures. (These estimates give the effect of a $1,000 increase in Part A or Part B expenditures, holding spending on the other part constant. That interpretation, although statistically correct, is problematic from a substantive standpoint, because it is highly unlikely that a beneficiary could have Part A expenditures without also incurring Part B expenditures.) Part B expenditures frequently result from utilization of services prescribed by a personal physician (i.e., usual source of care). Part A expenditures may or may not have that association. The greater impact of Part B expenditures on HMO enrollment thus may be evidence that closer ties to a personal physician, in addition to higher levels of expenditures, are negatively associated with the probability of HMO enrollment.

By exponentiating the coefficients of the Part A and Part B variables, we can determine that a $1,000 decrease in Part A spending is associated with a 0.6-percent increase in the relative odds of joining an HMO in 1994, whereas a $1,000 decrease in Part B spending is associated with a 6.4-percent increase in the relative odds of HMO enrollment.

Effect on Short-Term HMO Enrollment

Total Reimbursed Expenditures

Short-term HMO enrollees spent $410 more than continuous FFS beneficiaries in 1993 ($3,899 and $4,309, respectively), however, this difference is not statistically significant (t = 1.95). When we controlled for AAPCC rate-cell variables, the AAPCC payment rate in the county, and the number of days the beneficiary was alive during 1994, the difference in conditional means fell to $295.

The logit regression of Model 1 (Table 5) shows that 1993 Medicare reimbursements are positively associated with the log-odds that a subject was a short-term HMO enrollee as opposed to a continuous FFS beneficiary. The coefficient is not large and the associated odds ratio is 1.004. It is important to remember, however, that even if the coefficient were zero, the finding would still indicate that short-term enrollees had high 1993 Medicare reimbursements relative to all 1994 HMO enrollees, because all enrollees had lower 1993 reimbursements than continuous FFS beneficiaries in the analyses.

Model 2 includes the main effect and interactions of total reimbursements with TEFRA-risk HMO market share and the change in HMO market share from 1993 to 1994. Neither interaction is significant, indicating that the degree of short-term enrollment bias does not vary as HMO market share increases.

Table 5

Logit Model of the Effect of 1993 Medicare Reimbursements and HMO Market Share on Short-Term Enrollment

Variable[1]	Model 1 Parameter Estimate	Model 1 Standard Error	Model 2 Parameter Estimate	Model 2 Standard Error
Total Expenditures	0.0037	***0.0006	0.0026	0.0020 (NS)
1993 Market Share	—	—	0.0402	***0.0007
Change in Market Share 1993-94	—	—	0.0220	***0.0006
Market Share 1993-94 Times 1993 Expenditures	—	—	0.0068	0.0057 (NS)
Change in Market Share 1993-94 Times 1993 Expenditures	—	—	-0.0038	0.0057 (NS)

*** Coefficients are significant at the 0.001 level.

[1] Dependent variable is the log of the odds that the subject joined an HMO in 1994 versus remaining in the FFS sector during 1994.

NOTES: HMO is health maintenance organization. NS is not significant. FFS is fee for service. AAPCC is adjusted average per capita rate. Both equations control for the AAPCC rate cells, the 1993 AAPCC payment rate per county, and the number of days the beneficiary was alive in 1994. All expenditures variables are expressed in thousands of dollars.

SOURCE: Call et al., Minneapolis, Minnesota, 1999.

Part A and Part B Expenditures

Short-term enrollees were more likely to have Part A and Part B reimbursements than continuous FFS beneficiaries (22 percent of short-term enrollees versus 19 percent of FFS beneficiaries had Part A expenditures; 88 percent versus 85 percent had Part B expenditures). However, the difference in mean reimbursements was significant only for Part B reimbursements ($1,762 for short-term enrollees, compared with $1,517 for FFS beneficiaries).

The logit regression (Table 6) indicates that 1993 Part A reimbursements do not have a significant influence on short-term enrollment, controlling for Part B reimbursements. On the other hand, higher Part B reimbursements in 1993 are significantly associated with a higher probability of short-term enrollment in 1994. The odds ratio associated with Part B reimbursements is 1.01. Again, it is important to point out that even though the effect is small, it indicates that short-term enrollees had higher expenditures relative to all HMO enrollees.

Table 6

Logit Model of Effect of 1993 Part A and Part B Expenditures on 1994 Short-Term HMO Enrollment

Variable[1]	Parameter Estimate	Standard Error
Part A Expenditures	0.0012	0.0008(NS)
Part B Expenditures	0.0113	***0.0013

***Coefficients are significant at the 0.001 level.

[1] Dependent variable is the log of the odds that the subject joined an HMO in 1994 versus remaining in the FFS sector during 1994.

NOTES: HMO is health maintenance organization. NS is not significant. FFS is fee for service. AAPCC is adjusted average per capita cost. Equation controls for the AAPCC rate cells, the 1993 AAPCC payment rate per county, and the number of days the beneficiary was alive in 1994. All expenditures variables are expressed in thousands of dollars.

SOURCE: Call et al., Minneapolis, Minnesota, 1999.

SUMMARY AND CONCLUSIONS

Our study of pre-enrollment expenditures indicates that higher 1993 reimbursements were associated with a lower probability of Medicare risk HMO enrollment in 1994. Low Part B reimbursements were a more important predictor of HMO enrollment than low Part A reimbursements. Furthermore, we found that the degree of favorable selection into HMOs declines as the market share of Medicare HMOs increases, but our results indicate that favorable selection does not disappear at

less than 100 percent HMO market share. (Currently the highest level of market penetration is approximately 52 percent.)

We also find that pre-enrollment expenditures are positively associated with short-term enrollment in 1994 (that is, joining an HMO in 1994 and then disenrolling the same year for at least 1 month). Because 1993 expenditures are negatively associated with joining an HMO in 1994, the positive association of expenditures with short-term enrollment means that the short-term enrollees are a very unusual subgroup, composed of higher spending beneficiaries. However, our findings for short-term enrollees are consistent with other research concluding that disenrollees are less healthy and more costly than beneficiaries who remain enrolled in HMO and FFS sectors (Cox and Hogan, 1996; Morgan et al., 1997; Riley, Ingber, and Tudor, 1997).

Total expenditures had a small effect on the probability of being a short-term enrollee versus a continuing FFS beneficiary. Further, the effect does not change significantly as the market share of Medicare HMOs increases. Higher expenditures for Part B services were associated with a lower probability of HMO enrollment and a higher probability that the enrollee will return quickly to the FFS sector. Again, the effects were larger for Part B than for Part A expenditures.

It is important to note that several provisions in the Balanced Budget Act (BBA) of 1997 are targeted toward overcoming selection issues among Medicare HMOs. The first requires HCFA to change the way it pays HMOs participating in the program. In addition to the current risk-adjustment methodology based on demographic factors (average FFS payments within AAPCC cells), beneficiary health status will be taken into account. Specifically, the Principal Inpatient Diagnostic Cost Groups adjuster uses prior-year encounter data indicating diagnoses that trigger higher payments to the HMO enrolling that beneficiary. This provision, targeting health plan behavior, is based on the premise that appropriately compensating HMOs that enroll sicker beneficiaries will diminish favorable selection. It is conceivable that HMOs may compete for beneficiaries within diagnostic groups whose care they have learned to manage efficiently.

The second BBA provision limits the beneficiary's ability to continuously enroll in and disenroll from Medicare HMOs. When the enrollment (or "lock-in") provision is fully implemented in 2003, beneficiaries will only be able to change plans once a year during the first 3 months of each year and during the annual open-enrollment period. This provision may affect beneficiary behavior in a number of ways. A longer lock-in period may decrease beneficiaries' willingness to enroll in HMOs, especially among those who anticipate difficulty regaining medigap supplemental insurance. A lock-in provision also will discourage "hit-and-run utilization." Both effects would increase favorable HMO selection. However, the lock-in provision also means that the HMO may have to provide care for sick enrollees for a longer period of time because their access to the FFS sector or another HMO will be restricted.

In conclusion, the results of this study are consistent with previous research indicating favorable selection associated with enrollment into TEFRA-risk HMOs contracting with Medicare. Using pre-enrollment (1993) Medicare reimbursements as an indicator of beneficiary health status, we find that beneficiaries joining an HMO in 1994 were healthier than those remaining in FFS. But the subset of HMO enrollees who returned to the FFS sector in 1994 were less healthy than all HMO enrollees

and continuous FFS beneficiaries. Favorable HMO selection among all joiners declines as HMO market share and HMO growth rate increase, but it does not disappear until the HMO market share reaches 100 percent. Enrollment bias among short-term enrollees was not sensitive to HMO market share. The findings suggest that Medicare HMOs continued to enjoy favorable selection as recently as 1994.

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