

Pre-Enrollment Reimbursement Patterns of Medicare Beneficiaries Enrolled in "At-Risk" HMOs

by Paul W. Eggers and Ronald Prihoda

The Health Care Financing Administration (HCFA) has initiated several demonstration projects to encourage HMOs to participate in the Medicare program under a risk mechanism. These demonstrations are designed to test innovative marketing techniques, benefit packages, and reimbursement levels. HCFA's current method for prospective payments to HMOs is based on the Adjusted Average Per Capita Cost (AAPCC). An important issue in prospective reimbursement is the extent to which the AAPCC adequately reflects the risk factors which arise out of the selection process of Medicare beneficiaries into HMOs. This study examines the pre-enrollment reimbursement experience of Medicare beneficiaries who enrolled in the demonstration HMOs to determine whether or not a non-random selection process took place.

The three demonstration HMOs included in the study are the Fallon Community Health Plan, the Greater Marshfield Community Health Plan, and the Kaiser-Permanente medical program of Portland, Oregon. The study includes 18,085 aged Medicare beneficiaries who had enrolled in the three plans as of April, 1981. We included comparison groups consisting of a 5 percent random sample of aged Medicare beneficiaries (N = 11,240) living in the same geographic areas as the control groups. The study compares the groups by total Medicare reimbursements for the years 1976 through 1979. Adjustments were made for AAPCC factor differences in the groups (age, sex, institutional status, and welfare status).

In two of the HMO areas there was evidence of a selection process among the HMOs enrollees. Enrollees in the Fallon and Kaiser health plans were found to have had 20 percent lower Medicare reimbursements than their respective comparison groups in the four years prior to enrollment. This effect was strongest for inpatient services, but a significant difference also existed for use of physician and outpatient services.

In the Marshfield HMO there was no statistically significant difference in pre-enrollment Medicare total reimbursements between the enrollee and comparison groups. However, outpatient and physician reimbursements were significantly higher (22 percent) among the enrollee group.

The results of this study suggest that the AAPCC may not be an adequate mechanism for setting prospective reimbursement rates. The Marshfield results further suggest that the type of HMO may have an influence on the selection process among Medicare beneficiaries. If Medicare beneficiaries do not have to change providers to join an HMO, as in an IPA model or a staff model which includes most of the providers in an area, the selection process may be more likely to result in an unbiased risk group.

Introduction

Health maintenance organizations (HMOs) are generally considered to be efficient alternatives to the traditional fee-for-service delivery system for providing health care. It is generally believed that HMO systems help to control the use of health care services—especially the use of costly institutional services—and hence can restrain costs. HMOs have increased substantially in the past decade. During the 1970s the number of HMOs in this country increased from 39 to 217; their enrollment increased from 3.6 million to 7.9 million (Falkson, 1980). This growth has largely been among employed persons through their health insurance plans at work. Enrollment rates of non-employed persons, including Medicare beneficiaries, have remained relatively low.

Congress has legislated changes in the Social Security Act to stimulate enrollment of Medicare beneficiaries in HMOs. Section 1876 of the Social Security Amendments of 1972 authorizes two methods for reimbursing HMOs. The first method, based on cost, employs the usual Medicare cost principles for reimbursing providers. The alternative method allows HMOs to enter into a risk-sharing contract with Medicare. It places a restriction on the *per capita* amount Medicare may reimburse an HMO based upon the amount Medicare would have otherwise reimbursed physicians and other providers of Part A and Part B services in the fee-for-service sector. This method also provides for the sharing of "savings" if *per capita* costs in the HMO are below the expected fee-for-service costs. With this risk-sharing provision, the HMO retains one-half of savings above 80 percent of the equivalent fee-for-service costs, for a maximum of 10 percent. If *per capita* costs incurred by the HMO are greater, the resulting difference (losses) must be absorbed by the HMO but can be carried forward and offset from savings realized in later years.

As of March 1981, 40 HMOs were operating under the provisions of Section 1876. Thirty-nine had chosen cost contracts, and only one (Group Health Cooperative of Puget Sound) was operating on a risk contract basis. To encourage risk contracts, the Health Care Financing Administration (HCFA) initiated several demonstrations to enroll Medicare beneficiaries in HMOs under special risk mechanisms.¹ These demonstrations are designed to test alternative risk reimbursement procedures to enroll significant numbers of Medicare beneficiaries through aggressive marketing techniques and attractive benefit packages.

¹For a detailed discussion of the demonstration projects, the legislative history, and issues involving reimbursement, marketing, and benefit packages, see Trieger *et al.*, *HMOs: Issues and Alternatives for Medicare and Medicaid*, HCFA Pub. No. 03107, April 1981.

Payment to an HMO under these demonstrations is based either on a percentage of the Adjusted Average Per Capita Cost (AAPCC) or is "capped" at a percent of the AAPCC. The AAPCC is defined in the enabling legislation as the average *per capita* cost of providing services to the enrolled group of beneficiaries if the beneficiaries had been receiving services in the fee-for-service sector of the health care system. The legislation specifies that the average cost is to be adjusted to account for actuarial differences in risk between the enrolled Medicare group and the Medicare population in the same geographic area. The legislation lists age, sex, race, institutional status, disability status, and "any other relevant factors" as factors to be used in calculating the AAPCC. The calculation of the AAPCC as implemented by HCFA includes adjustments for age, sex, institutional status, and welfare status. Disability is accounted for by calculating separate AAPCC rates for aged and disabled beneficiary enrollment groups.²

To the extent that the four factors of age, sex, institutional status, and welfare status alone do not control for major expenditure differences, the AAPCC payment could be high or low for a given enrollment group. Adverse selection (from the HMO's point of view) would occur when the risk of incurring medical expenses by an enrollment group is greater than predicted by the AAPCC. Favorable selection would occur when the risk is less than predicted by the AAPCC. In the latter case, AAPCC based payments could be high relative to risk. Thus, what might appear to be a Medicare program cost savings actually represents increased Federal costs relative to expenditures that would have accrued in a fee-for-service setting.

Objectives

This study focuses on the pre-enrollment experience of Medicare enrollees in three demonstration HMOs to determine if evidence exists of selection bias with respect to their Medicare enrollment. Medicare reimbursement rates for the HMO enrollees for a four year period prior to enrollment were compared with reimbursement rates over the same time period for a random sample of Medicare beneficiaries drawn from the HMO market area. The reimbursement rate comparisons were adjusted for differences in AAPCC factors between the HMO enrollee and comparison groups. In this sense, the study is also an evaluation of the efficiency of the AAPCC factors in accounting for differences in utilization and reimbursement. In other words, to the extent that differences in reimbursement rates exist after AAPCC adjustments are made, there is evidence of both selection bias and inefficiency in the AAPCC technique.

²For a detailed discussion of the AAPCC methodology, see Kunkel and Powell, "The Adjusted Average Per Capita Cost Under Risk Contracts With Providers of Health Care," to be published in *Transactions of the Society of Actuaries*, Vol. XXXIII.

This methodology implicitly assumes that there is some consistency in the use of services over time and that post-enrollment "risk" is related to pre-enrollment experience. This assumption is the basis for the use by insurance companies of experience rating in setting premium levels. While use of health care services in one time period is not a perfect predictor of subsequent use, there is growing evidence that patterns of use tend to be consistent over time. This relationship is strongest for ambulatory care but exists for hospitalization as well (Roos and Shapiro, 1981; Mullooby and Freeborn, 1979; McCall and Wai, 1981; Eggers, 1981).

Selection Bias

Luft (1981) has studied and summarized the research on selection bias in HMOs. He identifies four hypotheses explaining the decision to join an HMO.

(1) **The risk-vulnerability hypothesis**—This postulates that persons who anticipate large medical bills or feel that they are high risks for incurring large medical expenses will want to insure themselves against this risk by joining an HMO. This would result in adverse selection from the HMO's perspective.

(2) **Attitudes toward illness and medical care**—This theory suggests that HMOs will be more attractive to persons who believe in preventive services and are more likely to use services in the early stages of illness. This could result in either adverse or favorable selection.

(3) **Worried well**—This hypothesis suggests that some persons make excessive demands on the health care system in relation to their need for care and that the extensive ambulatory coverage available in HMOs will attract such persons, resulting in adverse selection.

(4) **Lack of integration**—A significant percentage of persons in the United States report not having a regular source of health care. Opportunity to enroll in an HMO provides these persons with access to the health care system. If their problem is lack of access, they may increase their use after enrollment. If their lack of a provider reflects a perception that they don't need one, then the HMO may be getting a preferred risk group. People well integrated into the health care system should be less likely to join an HMO because they have a provider with whom they are familiar.

All four of these incentives to join HMOs are tempered by the basic inertia of human nature. People need a reason to change providers. All things being equal, most persons will stay with their current source of care.

Luft concludes, from a review of the research literature, that predicting the direction of selection bias depends on a number of factors. These are: 1) the HMO premium the enrollee must pay, 2) available options, and 3) the necessity of changing physicians. He says:

"All evidence points to the importance of the pre-existing physician-patient relationship. People with strong ties are unwilling to break them and will prefer to retain their old coverage unless an HMO is structured to change only the financial linkages rather than the personal ties."

Several of these factors could have affected the decision of Medicare beneficiaries to enroll in the demonstration HMOs. Each of the demonstration HMOs offers increased benefits to the enrollee. Two of the three (Fallon and Marshfield) require an extra premium above the normal Part B premium to cover these services. Although this premium substitutes for the expected Medicare deductible and coinsurance amounts and is actually lower than the expected amount, it must be prepaid by the enrollee and is an expense whether or not he or she uses services. Also, in two of the three HMOs (Fallon and Kaiser) the enrollee is required to receive care only from the closed panel of physicians.

Two aspects of the Medicare program could also affect HMO enrollment. One is assignment, that is, whether or not physicians will accept the Medicare allowed fee as full payment. When physicians do not accept assignment, Medicare beneficiaries are subject to out-of-pocket costs above the usual 20 percent coinsurance required for Part B services. In areas with low rates of assignment, HMOs may appear more attractive to Medicare beneficiaries.³

A second factor concerns Medigap insurance, those private plans which primarily cover the cost-sharing parts of Medicare. If these plans are reasonably priced in an HMO catchment area, Medicare beneficiaries may opt for Medigap coverage rather than joining the HMO. Although both assignment rates and Medigap insurance could affect HMO enrollment, it is not clear how these should affect selection bias.

Previous Work

One study examining the pre-enrollment experience of Medicare beneficiaries who enrolled in an HMO has been reported (Eggers, 1980). The Group Health Cooperative (GHC) of Puget Sound, Washington contracted with HCFA to enroll Medicare beneficiaries and accept payment on a risk basis under the provisions of Section 1876. Examination of pre-HMO enrollment reimbursement and utilization data showed that Medicare beneficiaries who joined the HMO had inpatient hospital days of care rates that were 50 percent lower and inpatient reimbursement rates that

³In 1978, assignment rate for the nation was 47 percent. In Massachusetts, Wisconsin, and Oregon it was 78 percent, 39 percent, and 20 percent, respectively (McMillan *et al.*, in preparation).

were over 40 percent lower than those for other Medicare beneficiaries living in the same geographic area. Thus, the only previous evaluation of an HMO Medicare demonstration project produced strong evidence of a favorable (to the HMO) selection process.

Three limitations in the GHC study affected its generalizability. First, it was a single case study of enrollment experience in one HMO. Second, because there were no Part B reimbursement data available, a proxy for Part B, the percent of persons meeting the deductible, had to be used instead. It was possible, therefore, that Part B reimbursements per user among the HMO enrollees were sufficiently high to partially offset the observed differences in Part A reimbursements. Third, the comparison group included persons who died during the study period, whereas all the HMO enrollees obviously had to have survived the pre-enrollment period. A factor reflecting the heavy use of services in the last year of life was used to adjust the comparison group rates, but this was only an approximation technique.⁴

The current study is primarily a replication of the GHC study in three additional HMO areas. However, improvements in methodology have been made over the original study. First, we have included both Part A and Part B Medicare reimbursement records, thus enabling the study to examine differential Part A and Part B patterns of care. Second, we studied three HMOs' experiences here, thus greatly enhancing the generalizability of the findings. Third, each of these HMOs enrolled over 5,000 Medicare beneficiaries in contrast to the GHC enrollment of 1,000 at the time of the previous study. The rates, therefore, have more stability. Finally, the comparison group is composed entirely of persons who were survivors of the pre-enrollment time period, so there is no need to adjust for differences in reimbursement for persons who died during the study period.

Methodology

Site Selection

Under the HMO demonstration program, a number of HMOs agreed to enroll Medicare beneficiaries on a risk basis. At the time of this study, three HMO demonstrations had proceeded far enough to be included in the study.⁵

⁴Subsequent to the publication of the GHC study, the analysis was repeated using a random sample of Medicare beneficiaries in the Puget Sound area composed entirely of survivors. Results indicated that HMO enrollee reimbursement rates were more than 50 percent lower than this comparison group of survivors for each of the four years (1974 to 1977) prior to enrollment.

⁵The discussions of the three plans included in this study were taken from Trieger *et al.*, 1981.

Fallon

The Fallon Community Health Plan is a Federally qualified HMO jointly sponsored by the Fallon Clinic and Blue Cross of Massachusetts. Fallon is a one-group staff model HMO employing over 60 salaried staff physicians. By September 1980, it had enrolled 30,000 members in the Worcester County, Massachusetts area. As of April 1981, the plan had enrolled over 5,300 Medicare beneficiaries under the demonstration project.

Fallon's rates are based on an adjusted community rate (ACR)⁶ which is limited to 95 percent of the AAPCC. In the first year of the demonstration, Fallon's ACR was 91.4 percent of the Area Prevailing Cost (APC) for Medicare beneficiaries.⁷ An AAPCC could not be calculated due to unavailability of data on age, sex, welfare status, and institutional status of the enrollees. In the second year, Fallon was reimbursed at 95 percent of the AAPCC. The benefit package includes reduced deductibles and coinsurance, as well as certain services not included in regular Medicare coverage: preventive services, eye exams and one pair of eye glasses, prescriptions with a small copayment, and unlimited hospital days.

Kaiser

Kaiser-Permanente of Oregon is a multi-specialty group staff model (physicians are salaried) HMO serving the Portland-Vancouver metropolitan area. Its total enrollment exceeds 220,000 persons. It has a GPPP contract⁸ with Medicare to provide Part B services to 15,000 Medicare beneficiaries. By April of 1981, the plan had enrolled over 5,500 Medicare beneficiaries under the demonstration HMO project (excluding those who converted from their GPPP contracts). Kaiser's reimbursement is set at 95 percent of the AAPCC.

⁶The ACR calculation is derived by adjusting the HMO's utilization and cost statistics in its private pay market to reflect the characteristics of the Medicare population.

⁷This is simply the average Medicare reimbursement per beneficiary for that area.

⁸Section 1833 was written into the original Medicare legislation to enable group practice prepayment plans (GPPPs) to participate in Medicare with minimal constraints. GPPPs are paid for Part B services based on the portion of audited costs allocated to Medicare members. Other services covered by Medicare are billed on a charge-related-cost basis, through the routine Medicare billing procedures (that is, through carriers and intermediaries).

The basic Medicare package offered under the demonstration (the M-Plan, no premium) includes Medicare benefits without deductibles or coinsurance, routine physicals and eye exams, immunizations, full coverage for prescribed home health care, and non-psychiatric, out-patient mental health services. A random group of enrollees was offered the M-Plan or a choice of the M-Plan plus three benefit options: 1) eyeglasses, hearing aids, and drugs (with co-payments) for a \$6.00 monthly premium, 2) dental care and dentures for a \$9.81 monthly premium, or 3) eyeglasses, hearing aids, drugs, dental care, and dentures for a \$15.81 monthly premium.

Marshfield

The Greater Marshfield Community Health Plan in Marshfield, Wisconsin was established in 1971. It is sponsored by the Marshfield Clinic (a 160 physician, multi-specialty group practice), St. Joseph's Hospital, Blue Cross of Wisconsin, and Surgical Care Blue Shield. The plan serves over 55,000 residents in rural Wisconsin, incorporating all or parts of seven counties. Like Fallon and Kaiser, the plan is a group practice HMO with salaried physicians. However, the fact that it includes the major providers in the area gives it the character or appearance of an individual practice association (IPA) HMO. An IPA HMO contracts with most or all physicians in an area to provide services, usually on a fee-for-service basis. The physicians retain their private offices, thus further distinguishing the IPA from the group model, where services are usually centralized at a clinic. Marshfield is also unusual in that it maintains a large fee-for-service clientele and the physicians are often unaware of which patients are HMO members and which patients are fee-for-service.

In the first contract year, HCFA capitation to Marshfield was set at 99 percent of the Area Prevaling Cost. As in Fallon, an AAPCC could not be calculated due to the unavailability of data on age, sex, welfare status, and institutional status of the Medicare enrollees. In the second year, when data were available, reimbursement was set at 98 percent of the AAPCC.

Enrollees receive the basic Medicare benefits as well as reduced coinsurance and deductibles, preventive services, and unlimited hospital days.

Study Population

The study compares pre-enrollment reimbursement experience for two groups: Medicare beneficiaries who are HMO enrollees and a comparable group of Medicare beneficiaries living in the same geographic area. All beneficiaries who had enrolled in the three HMOs as of April 1981 were initially selected for inclusion. Of these, 2,100 persons had had some previous HMO and/or GPPP experience. (Most were already members of Kaiser whose membership was

changed to the risk contract.) These persons were removed from the analysis because their pre-enrollment experience would not represent reimbursement in a non-HMO setting. This left 19,518 persons for whom enrollment in one of the three demonstrations represented their first HMO experience. Disability beneficiaries (N = 550) were excluded because there were too few for a separate analysis. Forty persons had end-stage renal disease and were not included. Finally, there were 840 beneficiaries who were not residents of the counties for which data were collected.⁹ As a result, 18,088 HMO enrollees were included in the study. Of the persons without previous HMO experience, the study population represents 93 percent of the total at-risk enrollment in these HMOs.

Comparison Group

Due to the large total Medicare enrollment in the service areas of the HMOs (nearly 250,000 persons) and the problems in manipulating such a large file, a 5 percent sample (based on the terminal digits of the Health Insurance Claim number) of people living in the HMO catchment areas and not subsequently enrolling in the HMO was selected for the comparison group. As with the HMO sample, persons with previous GPPP or HMO experience, disability beneficiaries, those with end-stage renal disease, and persons not residents of the target counties were removed from the study. In total, 15,381 people were included in the comparison group.

Both the HMO enrollee and comparison groups were composed of aged Medicare beneficiaries, living in the same geographic area, who were alive in 1980. Therefore, for the years under examination (1976 through 1979), all persons were survivors. Because people use many more services in their last year of life than surviving Medicare beneficiaries, any bias for this phenomenon has been removed by including only survivors in the enrollee and comparison groups.¹⁰

⁹The following counties were included in the analysis: Fallon—Worcester; Marshfield—Clark, Marathon, Taylor, and Wood; Kaiser—Clackamas, Multnomah, and Washington counties in Oregon and Clark County in Washington.

¹⁰For discussions of reimbursement patterns in the last year of life, see Lubitz, J. *et al.*, "Use and Costs of Medicare Services in the Last Year of Life," Internal Working Paper, HCFA, ORDS, August, 1981 and Gornick, M., "Ten Years of Medicare: Impact on the Covered Population," *Social Security Bulletin*, July 1976.

Data

We derived utilization and reimbursement data from the Medicare Statistical System (MSS). The MSS includes all billing claims for which Medicare reimburses. We developed a special file for the HMO demonstration projects, one which includes 100 percent of the Part A and Part B bills¹¹ for residents of designated counties in the United States. The bills were compiled by residence of the beneficiary so that any use outside of the county is included. The file includes all Medicare bills incurred during calendar years 1976 through 1979 for residents of these counties. Because all bills include the unique beneficiary claim number, it was possible to link all bills with each individual in the HMO and comparison groups. Some enrollees and members of the comparison group undoubtedly moved during the 1976 to 1979 period; this change of address could affect the reimbursement rates.

If a person was eligible to receive services in 1976, for example, but did not live in one of these counties, his or her reimbursements would have been missed, thus biasing the reimbursement rates downward. This potential migration bias is discussed in the following section.

The Continuous Medicare History Sample (CMHS) is a 5 percent longitudinal sample of Medicare beneficiaries which includes people's addresses by year. It was therefore possible to link beneficiaries in the study (all of the comparison group because it was also a 5 percent sample and 5 percent of the HMO enrollees) with CMHS residence data to check for migration bias. Table 1 shows the results of this analysis. In the Fallon area, of those HMO enrollees living in the county in 1980 who were Medicare eligibles in 1976, 97.1 percent lived in the county in 1976. The figure for the comparison group was 95.1 percent. Thus, it appears that the comparison group rates are biased downward to a slightly greater extent than are the HMO enrollee rates. The percent of people living in the Kaiser area counties in 1976 was almost identical for the HMO enrollee and comparison groups (89.9 percent and 89.6 percent, respectively). Both groups were, therefore, biased downward to the same extent. In the Marshfield area, a higher percent of HMO enrollees (95.9 percent) lived in the counties in 1976 than did comparison group beneficiaries (90.3 percent). Comparison group rates in Marshfield are biased downward to a greater extent than HMO enrollee rates.

¹¹Medicare reimbursable services are billed by type of service. The file includes all bills for inpatient, outpatient, physician, home health, and skilled nursing facility services. Certain health care costs are not covered by Medicare and therefore are not in this study. These include dental care, outpatient drugs, eyeglasses, and nursing home care.

TABLE 1

Percent of People Living in the HMO Service Area in 1980 Who Also Lived in the Area in 1976

Area	Percent of Persons	
	HMO Enrollees	Comparison Group
Fallon	97.1	95.1
Kaiser	89.9	89.6
Marshfield	95.9	90.3

Use of Person-Years

The analysis consisted primarily of comparisons of rates of reimbursement between the HMO and comparison groups. It was important, therefore, not to include in the at-risk population persons who were not eligible to receive benefits at the time reimbursements were counted. For instance, a person age 67 in 1980 was not at risk of incurring Medicare reimbursements in 1976.¹² To accurately relate reimbursements to eligibility, we calculated months of eligibility for each individual for each of the years 1976 through 1979. This was done by counting eligibility from the time of entitlement. (Part A and Part B months of entitlement were calculated separately.) Entitlement dates were available from the Medicare master beneficiary record. We then used total person years of eligibility to calculate rates of reimbursement for each age/sex group within each HMO area. Table 2 shows the number of persons and the total person years of Medicare Part A eligibility for the HMO comparison groups for the Fallon, Marshfield, and Kaiser areas. In the Fallon area, the 5,365 HMO enrollees accounted for 3,288 person years of Medicare Part A eligibility in 1976. The 4,090 persons in the comparison group accounted for 2,999 eligibility person years in 1976. Person years increased substantially each year as more persons reached 65 and became entitled.

Adjustments for AAPCC Factors

The comparison group reimbursement rates in each HMO area serve as the basis for computing expected rates for the HMO enrollees, since the procedure produced a comparison group similar to the enrollees in terms of survival and residency. We used AAPCC underwriting factors to produce expected rates for the HMO enrollees. The Office of Financial and Actuarial Analysis provided the most recent age, sex, institutional status, and Medicare welfare status distributions for the total population in the three HMO areas and for the beneficiaries who enrolled in the HMOs. We took the age and sex of Medicare beneficiaries directly from the Master Beneficiary Records maintained by HCFA. We determined welfare status on the basis of whether Medicaid pays for (or "buys in") the

¹²This is not true, of course, if that person was a disability beneficiary prior to age 65.

TABLE 2

**Person Years of Part A Eligibility for HMO Enrollees
and Comparison Group by HMO Area,
1976 to 1979**

Year	Fallon		Kaiser		Marshfield	
	HMO Enrollees	Comparison Group	HMO Enrollees	Comparison Group	HMO Enrollees	Comparison Group
Number of People as of April, 1981	5,365	4,090	5,551	6,079	7,169	1,071
Number of Person Years						
1976	3,288	2,999	4,013	4,405	4,602	802
1977	3,704	3,241	4,356	4,775	5,094	866
1978	4,149	3,484	4,687	5,128	5,619	930
1979	4,641	3,732	5,045	5,495	6,182	984
1976-1979	15,781	13,455	18,100	19,803	21,497	3,582

Part B premium for Medicare beneficiaries. This information also was available from the Master Beneficiary Records. Institutional status is not routinely collected or maintained as part of the Medicare Statistical System. Therefore, these data had to be collected through surveys of long-term care facilities (Trieger *et al.*, 1981). The AAPCC adjustment is described in detail in the Technical Note.¹³

County Adjustments

To control for county differences in prices, access to care, and utilization patterns, we adjusted the reimbursement rates in the analysis by weighting the county-specific reimbursement rates of the comparison group to reflect the county distribution of HMO enrollees. In effect, this results in a reimbursement rate for individuals in the comparison group as if they had the same county distribution as the HMO enrollees.

It is possible that HMOs could enroll beneficiaries from parts of counties that either have higher or lower reimbursement rates than the county as a whole. If so, the comparison group would not be exactly matched to the enrollee group. However, reimbursement under the AAPCC formula is based on the total county experience. Therefore, to be consistent with Medicare AAPCC reimbursement policy, we did not adjust for intra-county variation in reimbursement patterns.

¹³We adjusted the AAPCC for the comparison group by using the composition of the total population and applying it to the average reimbursement of the 5 percent sample comparison group used in the study.

Analysis

The analyses consist of year-by-year comparisons of the average reimbursements per HMO enrollee with those of the comparison group with the AAPCC adjustment. We calculated reimbursement rates for each of the years 1976 through 1979 and for the four years combined. We separated reimbursements into inpatient reimbursements, physician and outpatient department reimbursements,¹⁴ and total reimbursements. Total reimbursements include payments for skilled nursing facilities and home health agencies, as well as inpatient, physician, and outpatient services.

Significance Tests

Both the comparison group and the HMO enrollees were treated as samples from a universe of persons.¹⁵ We calculated variances for the inpatient reimbursement rates, the outpatient/physician reimbursement rates, and total reimbursement rates. We calculated

¹⁴Outpatient reimbursements include not only outpatient departments but other sources such as community health centers, rural health clinics, and limited care facilities.

¹⁵Technically, the HMO enrollees represent the universe of Medicare enrollees in each HMO, and their rates are not sample estimates but population parameters. However, by treating them as samples with variances in rates, it becomes more difficult to detect selection bias and thus represents a conservative approach for testing for the significance of an observed difference.

variances for HMO enrollees and comparison groups separately and for each of the four years of data. We also tested the differences in means for significance assuming independent samples and populations with unequal variances, as shown below:

$$t = \frac{\bar{X}_{\text{comp}} - \bar{X}_{\text{HMO}}}{\sqrt{\frac{S^2_{\text{comp}}}{N_{\text{comp}}} + \frac{S^2_{\text{HMO}}}{N_{\text{HMO}}}}}$$

We performed a two tailed test because there was reason to believe that the selection bias could operate in either direction.

We used the Bonferroni multiple comparison t-test to compare the two groups over the four years. This test permits comparison of more than one pair of estimates while maintaining an overall significance level of .05.

The four-year estimates are weighted means of the annual means. Since there is a large overlap of sampling units (persons) from year to year, the variance of the four-year estimates will include covariance terms. The formula is as follows:¹⁶

$$v = \left[\sum_{i=1}^4 n_i \cdot s_i^2 + \sum_{i=1}^4 \sum_{j>i}^4 2 n_{ij} \cdot r_{ij} \cdot s_i \cdot s_j \cdot p_{ij} \right] / (n_1 + n_2 + n_3 + n_4)^2$$

where n_i = sample size for the i^{th} year

s_i^2 = unit variance for the i^{th} year

n_{ij} = size of sample overlap for the i^{th} and j^{th} years

r_{ij} = correlation coefficient for reimbursement for the i^{th} and j^{th} years

p_{ij} = proportion of i^{th} year overlapping the j^{th} year.

The test statistic takes the same form as above, substituting

v_{comp} for $S^2_{\text{comp}}/n_{\text{comp}}$ and v_{HMO} and for $S^2_{\text{HMO}}/n_{\text{HMO}}$.

Results

Demographic Characteristics

The age/sex distribution of HMO enrollees relative to the area population determines, in large part, their expected rates. Table 3 presents the age and sex distribution of the HMO enrollees and the comparison groups as well as counts of persons who are white and those with Medicaid buy-in into Part B of Medicare. Although the AAPCC does not adjust for race, this variable was included in this table to help determine its possible impact on use rates.

¹⁶For a discussion of this, see Kish, Leslie, *Survey Sampling*, John Wiley and Sons, 1965, pp. 457.

Fallon

Enrollees in the Fallon HMO are younger than those in the comparison group. Almost half (48 percent) of the HMO enrollees are age 65 to 69, whereas only one-third (33 percent) of the comparison group falls into this age group.

At the other end of the age distribution, those above the age of 80 account for 11 percent of the HMO enrollees and 25 percent of the comparison group. Thus, the overall reimbursement rate of the HMO enrollees is expected to be lower than that of the comparison group. Males constitute a higher percent of enrollees than of the comparison group (49 percent and 37 percent, respectively). The impact of this factor alone will be to raise the expected reimbursement rate for the enrollees, since males on average have reimbursement rates about 14 percent higher than females (Hirsch, in press). Welfare status, as measured by Medicaid buy-in for Part B coverage, shows that only 2 percent of the enrollees, but 13 percent of the comparison group, are receiving welfare benefits. This also tends to reduce the expected reimbursement rates for the HMO enrollees. Finally, the enrollees have proportionately more whites than the comparison group (98 percent and 92 percent, respectively).¹⁷

Kaiser

The age/sex distribution of Medicare enrollees in the Kaiser HMO is very close to that of the comparison group. The differences that do exist occur at the older end of the age distribution. Six percent of HMO enrollees were age 85 years and over, whereas 11 percent of the comparison group fell into this age group. The racial composition of the two groups was nearly equal (95 percent white for HMO enrollees and 94 percent white for the comparison group). It was not possible to calculate the welfare status of the two groups because Oregon Medicaid does not have a buy-in provision for Part B benefits. It appears that the slightly younger age distribution of the HMO group will tend to reduce its expected reimbursement rates relative to the comparison group.

¹⁷Average reimbursements per enrollee are higher for whites than for other races, although the difference is decreasing. See Ruther and Dobson, "Equal Treatment and Unequal Benefits: A Re-Examination of the Use of Medicare Services by Race, 1967-1976," *Health Care Financing Review*, Winter 1981, Vol. 2, No. 3, pp. 55-84.

TABLE 3
Distribution of People by Age, Sex, Race, and
Welfare Status for HMO Enrollees and the Comparison Groups: 1981¹

	Fallon				Kaiser				Marshfield			
	HMO Enrollees		Comparison Group		HMO Enrollees		Comparison Group		HMO Enrollees		Comparison Group	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Persons												
Total	5,368	100	4,090	100	5,551	100	6,079	100	7,169	100	1,071	100
65-69	2,552	48	1,338	33	1,999	36	2,141	35	3,126	44	357	33
70-74	1,457	27	980	24	1,573	28	1,449	24	1,855	26	251	23
75-79	772	14	774	19	1,088	20	1,036	17	1,192	17	190	18
80-84	390	7	529	13	567	10	785	13	642	9	138	13
85+	197	4	474	12	324	6	668	11	354	5	135	13
Male												
Total	2,631	49	1,513	37	2,199	40	2,391	39	3,350	47	456	43
65-69	1,305	24	565	14	813	15	940	15	1,503	21	169	16
70-74	716	13	381	9	643	12	613	10	859	12	116	11
75-79	357	7	260	6	435	8	394	6	563	8	75	7
80-84	173	3	159	4	204	4	264	4	266	4	50	5
85+	80	1	148	4	104	2	180	3	159	2	46	4
Female												
Total	2,737	51	2,577	63	3,352	60	3,688	61	3,819	53	615	57
65-69	1,247	23	768	19	1,186	21	1,201	20	1,623	23	188	18
70-74	741	14	599	15	930	17	836	14	996	14	135	13
75-79	415	8	514	13	653	12	642	11	629	9	115	11
80-84	217	4	370	9	363	7	521	9	376	5	88	8
85+	117	2	326	8	220	4	488	8	195	3	89	8
Race												
White	5,279	98	3,763	92	5,278	95	5,726	94	7,076	99	1,051	98
Other	89	2	327	8	273	5	353	6	93	1	20	2
Welfare												
(Buy-In)	88	2	519	13	NA	NA	NA	NA	47	1	87	8
(Not Buy-In)	5,280	98	3,571	87	NA	NA	NA	NA	7,122	99	984	92

NA = Not available.

¹Persons with both Part A and Part B entitlements.

Marshfield

The HMO enrollees in this area were younger and had a higher percentage of males than the comparison group. Seventy percent of the HMO enrollees were age 65 to 74 as compared to 56 percent of the comparison group. Males accounted for 47 percent of the HMO group and 43 percent of the comparison group. In addition, 8 percent of the comparison group and only 1 percent of the HMO group were Medicaid recipients. Thus, the HMO group is heavily weighted with persons who have lower expected rates of reimbursements.

In summary, the data in Table 3 illustrate the need to adjust the observed reimbursements in the analysis. We did so using the AAPCC algorithm described in the methods section.

Another factor which could affect the reimbursement rates in the analysis is the distribution of enrollees and comparison group members by county. To the extent that an HMO draws persons disproportionately from high cost (or low cost) areas, the comparison of reimbursement rates will be biased upward (or downward).

Table 4 presents the county distribution of HMO enrollees, their respective comparison groups, and the total Medicare population within each of the three HMO areas. Because the Fallon enrollees were drawn almost entirely from Worcester County, Massachusetts, the comparison group was also limited to residents of Worcester. In the Kaiser area, there were

small differences in county of residence between the two groups. A slightly higher percentage of HMO enrollees were residents of Multnomah County than the comparison group (64 percent and 58 percent, respectively).

There was a bigger difference in county of residence within the Marshfield area. Over one-half of the people in the comparison group were residents of Marathon County, whereas only one-fifth of the HMO enrollees lived in that county. Two-thirds of the HMO group were residents of Clark and Wood Counties. These counties accounted for 41 percent of the comparison group. In both the Kaiser and Marshfield areas, the comparison group, being a random sample of beneficiaries, tended to more closely approximate the county distribution of all Medicare beneficiaries than did the HMO enrollees.

Reimbursement Rates

Tables 5, 6, and 7 present the reimbursement comparisons for Fallon, Kaiser, and Marshfield, respectively. Comparison group reimbursement rates are presented unadjusted for AAPCC factors and after the AAPCC adjustment. The analysis centers on the differences in rates after AAPCC adjustment. The unadjusted comparison group rates are presented to illustrate the effects of the AAPCC adjustment.

TABLE 4

Distribution of Medicare Beneficiaries (Part A) for HMO Enrollees; Comparison Group and Total Medicare Population by HMO Area, by County (1979)

	HMO Enrollees		Comparison Group		All Persons	
	Number	Percent	Number	Percent	Number	Percent
Fallon	4,641	100	3,732	100	80,212	100
Worcester	4,641	100	3,732	100	80,212	100
Kaiser	5,045	100	5,495	100	129,231	100
Clackamas	603	12	864	16	18,974	15
Multnomah	3,224	64	3,174	58	77,010	60
Washington	493	10	804	15	16,895	13
Clark	725	14	649	12	16,352	13
Marshfield	6,182	100	984	100	27,518	100
Clark	2,015	33	155	16	5,007	18
Marathon	1,300	21	514	52	11,320	41
Taylor	795	13	67	7	2,320	8
Wood	2,072	34	248	25	8,871	32

TABLE 5

**Fallon: Inpatient, Physician and Outpatient, and Total Reimbursements per Person
Year of Eligibility for HMO Enrollees and Comparison Group,
1976 Through 1979**

Year	Person Years ¹		HMO Enrollees	Unadjusted ² Comparison Group	Percentage Difference	AAPCC Adjusted Comparison Group	Percentage Difference
	HMO Enrollee	Comparison Group					
Hospital Inpatient Reimbursements per Person							
					(t value)		
1976	3,288	2,999	\$254	\$368	- 31% (- 4.13)*	\$311	- 18% (- 2.07)
1977	3,704	3,241	\$296	\$453	- 35% (- 4.68)*	\$383	- 23% (- 2.59)*
1978	4,149	3,484	\$317	\$554	- 43% (- 6.11)*	\$468	- 32% (- 3.89)*
1979	4,641	3,732	\$409	\$597	- 31% (- 4.45)*	\$504	- 19% (- 2.25)
1976-79	15,781	13,455	\$326	\$501	- 35% (- 8.08)*	\$423	- 23% (- 4.48)*
Physician and Outpatient Reimbursements per Person							
					(t value)		
1976	3,259	2,975	\$111	\$131	- 15% (- 2.72)*	\$121	- 8% (- 1.36)
1977	3,670	3,227	\$148	\$175	- 16% (- 3.04)*	\$162	- 9% (- 1.58)
1978	4,117	3,471	\$156	\$206	- 24% (- 5.31)*	\$191	- 18% (- 3.72)*
1979	4,614	3,721	\$206	\$264	- 22% (- 5.23)*	\$244	- 15% (- 3.43)*
1976-79	15,659	13,394	\$160	\$198	- 19% (- 6.31)*	\$183	- 13% (- 3.82)*
Total Reimbursements per Person							
					(t value)		
1976	3,291	3,028	\$374	\$512	- 27% (- 3.96)*	\$443	- 16% (- 1.98)
1977	3,709	3,265	\$450	\$647	- 31% (- 4.73)*	\$561	- 20% (- 2.66)*
1978	4,254	3,501	\$484	\$786	- 38% (- 6.30)*	\$681	- 29% (- 4.11)*
1979	4,642	3,744	\$634	\$894	- 29% (- 4.90)*	\$777	- 18% (- 2.70)*
1976-79	15,797	13,538	\$497	\$721	- 31% (- 8.06)*	\$625	- 21% (- 4.61)*

¹Person years are the total years of Medicare eligibility for a group for a given year. Person years are calculated for Part A, Part B, and Parts A and/or B separately. See the Technical Note for further discussion of person years.

²Unadjusted for AAPCC factors although adjusted for county distribution.

*Indicates t value exceeds the .05 probability critical value. For the individual year rate comparisons, this value is 2.498 (Bonferroni Test; see Technical Note). For the four year summed rate comparison, the critical value is 1.96.

Fallon

The hospital inpatient reimbursement rate for the HMO enrollees in 1976 was \$254 per person.¹⁸ By 1979 this had risen to \$409. For the comparison group, the 1976 and 1979 adjusted rates were \$311 and \$504, respectively. In these four years the hospital inpatient reimbursement rates for HMO enrollees ranged from 18 percent to 32 percent below the adjusted reimbursement rates for the comparison group, with a four year average difference of 23 percent. In two of the years, the difference was statistically significant at the .05 confidence level. The four year average difference was also statistically significant.

Although the differences were not as great as with inpatient reimbursements, the HMO enrollees in the Fallon area had lower Part B reimbursements than the adjusted comparison group. The HMO enrollee rate was \$111 in 1976 and increased each year, up to \$206 in 1979. The 1976 and 1979 adjusted rates for the comparison group were \$121 and \$244, respectively. The difference in rates between the two groups ranged from 8 percent to 18 percent during the four years. The four year average difference in rates was 13 percent (\$160 for the HMO enrollee group and \$183 for the comparison group). In 1978, 1979, and for the four year average, the differences were statistically significant.

¹⁸Although most of the inpatient reimbursements are for short-stay facilities, use of services in long-stay facilities is included as well.

TABLE 6

**Kaiser: Inpatient, Physician and Outpatient, and Total Reimbursements per Person
Year of Eligibility for HMO Enrollees and Comparison Group,
1976 Through 1979**

Year	Person Years ¹		HMO Enrollees	Unadjusted ² Comparison Group	Percentage Difference	AAPCC Adjusted Comparison Group	Percentage Difference
	HMO Enrollees	Comparison Group					
Hospital Inpatient Reimbursements per Person							
					(t value)		
1976	4,013	4,405	\$200	\$321	-38% (-5.46)*	\$284	-30% (-3.79)*
1977	4,356	4,775	\$281	\$354	-21% (-2.77)*	\$313	-10% (-1.21)
1978	4,687	5,128	\$294	\$404	-27% (-4.11)*	\$358	-18% (-2.39)
1979	5,045	5,495	\$319	\$560	-43% (-6.81)*	\$496	-36% (-5.00)*
1976-79	18,100	19,803	\$277	\$417	-34% (-8.54)*	\$369	-25% (-5.61)*
Physician and Outpatient Reimbursements per Person							
					(t value)		
1976	3,980	4,443	\$116	\$137	-18% (-2.99)*	\$129	-14% (-1.85)
1977	4,323	4,799	\$146	\$160	-8% (-1.71)	\$150	-3% (-.49)
1978	4,653	5,135	\$153	\$187	-17% (-4.19)*	\$176	-13% (-2.84)*
1979	5,016	5,494	\$175	\$225	-20% (-4.91)*	\$212	-16% (-3.64)*
1976-79	17,972	19,872	\$149	\$180	-16% (-5.94)*	\$169	-12% (-3.83)*
Total Reimbursements per Person							
					(t value)		
1976	4,017	4,510	\$321	\$464	-31% (-4.94)*	\$419	-23% (-3.38)*
1977	4,359	4,854	\$435	\$519	-16% (-2.47)	\$469	-7% (-1.00)
1978	4,688	5,189	\$460	\$604	-24% (-4.19)*	\$546	-16% (-2.50)*
1979	5,046	5,538	\$507	\$822	-38% (-6.93)*	\$741	-32% (-5.15)*
1976-79	18,729	20,091	\$436	\$614	-29% (-8.42)*	\$554	-21% (-5.58)*

¹Person years are the total years of Medicare eligibility for a group for a given year. Person years are calculated for Part A, Part B, and Parts A and/or B separately. See the Technical Note for further discussion of person years.

²Unadjusted for AAPCC factors although adjusted for county distribution.

*Indicates t value exceeds the .05 probability critical value. For the individual year rate comparisons, this value is 2.498 (Bonferroni Test; see Technical Note). For the four year summed rate comparison, the critical value is 1.96.

Total reimbursements (which include skilled nursing facility and home health agency reimbursements as well as hospital inpatient, physician, and outpatient reimbursements) tended to reflect Part A patterns more closely than Part B, because Part A reimbursements per person are more than twice as great as Part B reimbursements. Over the four year period under consideration, total reimbursements per HMO enrollee ranged from 16 percent to 29 percent below the adjusted reimbursement rate for the comparison group. The four year average difference was 21 percent (\$497 for the HMO enrollees and \$625 for the comparison group). Except for 1976, each of the individual years and the four year average differences were statistically significant.

Kaiser

Relative reimbursement rates between the two groups in the Kaiser area paralleled those in the Fallon area (Table 6). Inpatient hospital reimbursements for the HMO enrollees increased from \$200 in 1976 to \$319 in 1979, with a four year average of \$277. The comparison group's adjusted rates were \$284 in 1976 and \$496 in 1979, with a four year average of \$369. The yearly differences in rates ranged from 10 percent to 36 percent, and the four year average difference was 25 percent. In two years, 1976 and 1979, and for the four year average, the differences were statistically significant.

TABLE 7

**Marshfield: Inpatient, Physician and Outpatient, and Total Reimbursements per Person
Year of Eligibility for HMO Enrollees and Comparison Group,
1976 Through 1979**

Year	Person Years ¹		HMO Enrollees	Unadjusted ² Comparison Group	Percentage Difference	AAPCC Adjusted Comparison Group	Percentage Difference
	HMO Enrollees	Comparison Group					
Hospital Inpatient Reimbursements per Person							
(t value)							
1976	4,602	802	\$142	\$210	- 32% (- 2.45)	\$167	- 15% (- .90)
1977	5,094	866	\$198	\$273	- 27% (- 2.18)	\$218	- 9% (- .58)
1978	5,619	930	\$250	\$289	- 14% (- 1.13)	\$231	+ 8% (+ .55)
1979	6,182	984	\$342	\$460	- 26% (- 2.51)*	\$367	- 7% (- .53)
1976-79	21,497	3,582	\$241	\$314	- 23% (- 3.44)*	\$250	- 4% (- .42)
Physician and Outpatient Reimbursements per Person							
(t value)							
1976	4,585	799	\$108	\$104	+ 4% (+ .38)	\$ 92	+ 18% (+ 1.54)
1977	5,075	863	\$137	\$124	+ 11% (+ 1.09)	\$109	+ 26% (+ 2.35)
1978	5,590	928	\$171	\$145	+ 18% (+ 1.98)	\$128	+ 34% (+ 3.28)*
1979	6,153	983	\$204	\$209	- 2% (- .29)	\$185	+ 11% (+ 1.10)
1976-79	21,403	3,573	\$159	\$148	+ 7% (+ 1.38)	\$131	+ 22% (+ 3.50)*
Total Reimbursements per Person							
(t value)							
1976	4,610	809	\$250	\$317	- 21% (- 1.83)	\$262	- 4% (- .33)
1977	5,099	873	\$337	\$401	- 16% (- 1.45)	\$330	+ 2% (+ .16)
1978	5,621	936	\$425	\$446	- 5% (- .46)	\$368	+ 15% (+ 1.24)
1979	6,184	988	\$552	\$685	- 19% (- 2.13)	\$565	- 2% (- .21)
1976-79	21,514	3,606	\$403	\$471	- 14% (- 2.40)*	\$388	+ 4% (+ .53)

¹Person years are the total years of Medicare eligibility for a group for a given year. Person years are calculated for Part A, Part B, and Parts A and/or B separately. See the Technical Note for further discussion of person years.

²Unadjusted for AAPCC factors although adjusted for county distribution.

*Indicates t value exceeds the .05 probability critical value. For the individual year rate comparisons, this value is 2.498 (Bonferroni Test; see Technical Note). For the four year summed rate comparison, the critical value is 1.96.

In outpatient and physician reimbursements the HMO enrollees again had lower rates than the comparison group. But, as was the case with the Fallon enrollees, the differences were not as great as they were for inpatients. Adjusted differences between the two groups ranged between 3 and 16 percent. *Per capita* average reimbursements for the four years for the HMO enrollees and the comparison groups were \$149 and \$169, respectively, a 12 percent difference, which was statistically significant.

After adjusting for AAPCC factors, the differences between the two groups for total reimbursements ranged from 7 percent in 1977 to 32 percent in 1979. The four year average total reimbursement rate for the HMO enrollees was \$436, which was 21 percent below the adjusted total reimbursement rate of the comparison group (\$554). Results were statistically significant every year except 1977, and they were also significant for the four year average.

Marshfield

Comparisons for Marshfield (Table 7) are markedly different from those found either in Fallon or Kaiser. Differences between the two groups in hospital inpatient reimbursement rates were smaller in Marshfield than in the other two areas. In 1978, the reimbursement rate for the HMO enrollees was 8 percent higher than the corresponding adjusted rate for the comparison group. In the three other years, the HMO enrollee rates ranged from 7 to 15 percent below the adjusted comparison group rates. Over all four years, the HMO enrollee rate was only 4 percent below that of the comparison group. In none of the four years, nor in the four year average, were the AAPCC adjusted differences statistically significant.

With regard to physician and outpatient reimbursements, the HMO enrollees were heavier users than the comparison group (with adjustment). HMO enrollees' reimbursement rates ranged from 11 percent higher in 1979 to 34 percent higher in 1978 (statistically significant) than the comparison group. Over all four years, the HMO enrollee rate of \$159 was 22 percent higher than the comparison group adjusted rate of \$131. It was also statistically significant.

Naturally, the higher inpatient reimbursements for the comparison group and the higher physician and outpatient reimbursements for the HMO enrollees tended to offset each other in the total reimbursement rates. In two of the years (1976 and 1979), the adjusted total reimbursements for the comparison group are higher; in the other two years (1977 and 1978), the HMO enrollee rates are higher. As a result, the four year average shows the HMO enrollee total reimbursements of \$403 per person to be 4 percent greater than the AAPCC adjusted reimbursement rate of \$388 for the comparison group. None of the total reimbursement differences were statistically significant.

The Marshfield results are similar to a previous study of self-selection at Marshfield (Broida *et al.*, 1975). In that study of enrolled persons under age 65, pre-enrollment ambulatory use was higher than that of a comparable group using fee-for-service medical care. There was little difference in the use of hospital care.

Discussion

Two conclusions can be drawn from the reimbursement analyses. First, in each of the three HMO areas HMO enrollee reimbursement rates were lower than unadjusted reimbursement rates for the comparison groups. Because the enrollees tended to be younger and less likely to be on welfare, this was to be expected. The AAPCC formula, by controlling for these factors, should have reduced the differences between the groups. Before AAPCC adjustment, the HMO enrollee total reimbursement rates in Fallon and Kaiser were 31 percent and 29 percent lower than their respective comparison groups. With AAPCC adjustment, these differences were reduced to 21 percent, a 32 percent reduction in Fallon and a 28 percent reduction in Kaiser. In Marshfield, the AAPCC adjustment resulted in the HMO total reimbursement rates changing from 14 percent below the comparison group rate to 4 percent above the comparison group rate. Thus the AAPCC is at least partially successful in determining an appropriate reimbursement rate for HMOs.

Second, despite the use of an AAPCC adjustment to the data, significant differences between HMO enrollee and comparison groups remain in two of the three HMOs. Under the assumption that pre-enrollment experience is predictive of future experience, apparently there are selection factors for which AAPCC does not control which can affect enrollment in HMOs and subsequent financial experience.

Age/Sex Adjustment

The possibility also exists that one or more AAPCC factors are inappropriate adjustors and that a better adjustment mechanism can be developed. It was not the purpose of this study to develop new actuarial adjustment procedures. Nevertheless, simpler methods of adjusting rate data do exist. A typical method of adjusting health related data is direct age/sex standardization. It is of interest, therefore, to perform an age/sex standardization and compare the results to the AAPCC adjustment.

Table 8 shows 1976 to 1979 average reimbursement rates broken into age/sex categories. In Fallon, the unadjusted percent difference between the two groups is - 31 percent. In nine of the ten age/sex cells, the HMO enrollees had lower reimbursement rates. In the tenth cell (males age 80-84), the HMO group was 1 percent higher. In six of the cells, the difference was greater than 30 percent.

In Kaiser, the total unadjusted difference was - 29 percent, and in all ten age/sex cells the HMO enrollees had lower reimbursement rates. In six of the cells the difference was greater than 30 percent.

In Marshfield, the total unadjusted difference was - 14 percent. The comparison group in Marshfield is smaller than in the other areas which leads to greater variation between cells. In seven of the cells, the comparison group had higher reimbursement rates, while in three cells the HMO enrollees had the higher rates. These variations are probably due to both a) the small difference in total reimbursements for the groups as a whole and b) the relatively small number of persons in the individual cells for the comparison group.

Table 9 shows the age/sex adjusted total reimbursement rates and the AAPCC adjusted rates. In each HMO area the age/sex adjustment reduces the difference between the two groups, but not as much as the AAPCC adjustment does.

TABLE 8

**Total Reimbursement per Person for the Years 1976 Through 1979,
(Weighted Average) in the Three HMO Areas by Age and Sex**

	Fallon					Kaiser					Marshfield				
	HMO Enrollees	(N) ¹	Comparison Group	(N)	Percent Difference	HMO Enrollees	(N)	Comparison Group	(N)	Percent Difference	HMO Enrollees	(N)	Comparison Group	(N)	Percent Difference
All Persons	\$497	(15797)	\$721	(13538)	- 31%	\$436	(18109)	\$614	(20091)	- 29%	\$403	(21514)	\$471	(3606)	- 14%
65-69	\$389	(7756)	\$590	(4837)	- 34%	\$348	(7265)	\$519	(7426)	- 33%	\$358	(9273)	\$448	(1263)	- 20%
70-74	\$568	(4472)	\$645	(3399)	- 12%	\$483	(5366)	\$615	(4889)	- 21%	\$403	(8105)	\$384	(932)	+ 5%
75-79	\$626	(2121)	\$887	(2540)	- 29%	\$501	(3186)	\$699	(3708)	- 28%	\$433	(3532)	\$374	(614)	+ 16%
80-84	\$692	(1048)	\$903	(1589)	- 23%	\$495	(1519)	\$672	(2422)	- 26%	\$493	(1849)	\$570	(462)	- 14%
85+	\$614	(400)	\$877	(1174)	- 30%	\$574	(713)	\$759	(1647)	- 24%	\$602	(755)	\$632	(335)	- 5%
All Males	\$554	(7897)	\$754	(4987)	- 27%	\$474	(7180)	\$662	(7750)	- 28%	\$471	(10037)	\$489	(1515)	- 4%
65-69	\$426	(3981)	\$643	(2059)	- 34%	\$391	(3032)	\$564	(3287)	- 31%	\$442	(4447)	\$510	(608)	- 13%
70-74	\$644	(2192)	\$703	(1264)	- 8%	\$516	(2146)	\$748	(1949)	- 31%	\$444	(2853)	\$456	(404)	- 3%
75-79	\$726	(928)	\$937	(889)	- 23%	\$529	(1218)	\$790	(1311)	- 33%	\$513	(1617)	\$345	(224)	+ 49%
80-84	\$841	(440)	\$830	(490)	+ 1%	\$532	(554)	\$597	(771)	- 11%	\$565	(801)	\$495	(173)	+ 14%
85+	\$740	(157)	\$1085	(285)	- 32%	\$733	(230)	\$742	(433)	- 1%	\$684	(319)	\$788	(106)	- 13%
All Females	\$443	(8099)	\$702	(8551)	- 37%	\$412	(10930)	\$538	(12341)	- 29%	\$344	(11478)	\$425	(2091)	- 19%
65-69	\$350	(3776)	\$550	(2778)	- 36%	\$316	(4233)	\$483	(4139)	- 35%	\$281	(4826)	\$391	(655)	- 28%
70-74	\$494	(2280)	\$612	(2134)	- 19%	\$461	(3220)	\$527	(2940)	- 13%	\$367	(3252)	\$330	(528)	+ 11%
75-79	\$547	(1193)	\$859	(1651)	- 36%	\$483	(1968)	\$650	(2397)	- 26%	\$366	(1915)	\$390	(390)	- 6%
80-84	\$585	(608)	\$936	(1099)	- 38%	\$475	(1025)	\$708	(1651)	- 33%	\$437	(1048)	\$615	(289)	- 29%
85+	\$532	(243)	\$810	(889)	- 34%	\$498	(483)	\$766	(1214)	- 35%	\$543	(436)	\$559	(229)	- 3%

¹N equals the sum total of person years of Medicare eligibility for that age/sex category for the years 1976 through 1979 combined.

TABLE 9
Differences in Total Reimbursements per Person
Between HMO Enrollees and Comparison Groups for the Three HMO Areas:
1976 to 1979 Combined

HMO Area	Total Reimbursements						
	HMO Enrollees	Comparison Group			Age/Sex Adjusted	AAPCC Adjusted	Percent Difference
		Unadjusted	Percent Difference	Percent Difference			
Fallon	\$497	\$721	- 31%	\$682	\$625	- 27%	- 21%
Kaiser	\$436	\$614	- 29%	\$602	\$554	- 28%	- 21%
Marshfield	\$403	\$471	- 14%	\$436	\$388	- 7%	+ 4%

Conclusions

The intent of this study was to determine whether an adverse or favorable selection process existed among Medicare beneficiaries enrolling in each of three HMOs contracting with HCFA to provide services to beneficiaries. This was done by comparing the pre-enrollment reimbursement experience of Medicare beneficiaries who enrolled in HMOs with a random sample of Medicare beneficiaries living in the same geographic area. Because reimbursement to an HMO is based on the AAPCC for the area in which the HMO is located, we applied AAPCC adjustments to the rates to control for differences in age, sex, welfare status, and institutional status.

In two of the three HMO areas, Fallon and Kaiser, pre-enrollment rates for the HMO enrollees were significantly lower than the reimbursement rates among the comparison group beneficiaries, both before and after adjustment for AAPCC factors. This indicates a selection process which favors the HMO. The differential was greatest for inpatient services but existed for outpatient and physician services as well. Therefore, the argument that people who choose HMOs are predisposed toward higher use of ambulatory services in lieu of inpatient services is not supported for the Medicare beneficiaries enrolled in these HMOs. The pre-enrollment experience for Fallon and Kaiser is similar to that reported earlier for Group Health Cooperative (Eggers, 1980).

The Marshfield experience was different. For this HMO, after adjusting for AAPCC factors, there was no statistically significant difference between the HMO and comparison groups in total reimbursements. While the HMO enrollees had lower inpatient reimbursement rates, these were offset by a higher use of ambulatory services (outpatient and physician services).

The results of this study have implications both for Medicare payments under prepayment mechanisms and for the selection issue in general. First, HCFA created the AAPCC methodology to adjust HMO payments to account for variations in enrollment mix by age, sex, welfare status, and institutional status and to take into account regional variation in health care costs. A major concern has been the extent to which unmeasured beneficiary characteristics that affect utilization and reimbursement are present in people who enroll in HMOs. The results in Fallon and Kaiser (as well as GHC) suggest that important decisions can exist among the enrollee population which the present AAPCC adjustment mechanism cannot correct. This is not to say that the AAPCC factors are inappropriate or inaccurate for calculating reimbursement amounts. As this study shows, the AAPCC mechanism accounted for part of the variation in pre-enrollment reimbursement rates. Moreover, compared with a traditional age/sex adjustment, the AAPCC reduced reimbursement differences to a greater extent. Yet this study seems to indicate that the present AAPCC factors are not sufficient.

HCFA is currently evaluating the AAPCC mechanism. The AAPCC calculation involves yearly surveys of the institutionalized population in each HMO area. This procedure is expensive, time consuming, and subject to severe under-reporting (Trieger *et al.*, 1981).

The second implication of the study relates to the selection bias issue. Although it is not possible to rule out enrollment measures designed to select healthier beneficiaries for the HMOs, there are reasons to believe that such selection did not take place. First, all three HMOs enrolled thousands of people over a relatively short period of time. This alone suggests a fair open enrollment process. Second, the demonstrations were closely monitored to assure a fair enrollment process. Third, it is not easy to determine risk, even if the HMOs were intent on doing so. Finally, Marshfield's failure to experience favorable selection is further evidence that the HMOs were not actively encouraging it.

Assuming that the selection bias was on the part of the enrollees, there is reason to suspect that, in Luft's terms, integration into the health system may be a determining factor. The major factor differentiating Marshfield from the Kaiser and Fallon HMOs (and GHC) is that Marshfield operates much like an IPA, whereas the other three are closed panel HMOs. People enrolling in Fallon, Kaiser, or GHC probably had to give up their previous sources of care. Because Marshfield is essentially the only significant provider of care in its area, most enrollees probably already were receiving care from a Marshfield physician and therefore did not have to change physicians. Fallon and Kaiser may have enrolled more persons who did not have a personal physician or a strong attachment to their previous physician.

If lack of integration is a key factor in determining enrollment in HMOs for the Medicare population, it could have two consequences. First, it might be that the study HMOs enrolled persons who simply had a lower need for care. Data from the National Center for Health Statistics show that the primary reason given for not having a physician is that the person doesn't perceive a need for one (Blumberg, 1978). In this case, the HMO would be achieving favorable selection.

Alternatively, the low reimbursement rates and possible lack of integration prior to enrollment could indicate unmet need and underservice among these populations. If so, the HMOs may be increasing access to care for these persons by enrolling them, and the cost of providing services to a population without previous access to care might increase. The question of whether low pre-enrollment use rates represent less need for care or less access to care cannot be determined simply by examining pre-enrollment patterns. What happens to these patients after enrollment is equally important. Continued low use rates would support the favorable selection process hypothesis. If use rates rise and remain high, lack of access would appear to be a determinant of low pre-enrollment rates.

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Technical Note: Calculation of AAPCC Adjustment

In the reimbursement formula for HMOs under risk, the ratio of the underwriting index for the enrolled group to the underwriting index for the county population is used to adjust the county *per capita* cost to reflect the characteristics of the HMO enrollees.

Equation 1 represents the AAPCC formula:

$$(1) \text{ AAPCC} = \text{USPCC} \times \frac{\text{APCC}_{\text{Co.}}}{\text{APCC}_{\text{U.S.}}} \times \frac{\sum_{i=1}^{30} U_i \times E_{i\text{HMO}}}{\sum_{i=1}^{30} E_{i\text{HMO}}} \bigg/ \frac{\sum_{i=1}^{30} U_i \times E_{i\text{Co.}}}{\sum_{i=1}^{30} E_{i\text{Co.}}}$$

where: AAPCC = adjusted average *per capita* cost
 USPCC = U.S. average *per capita* cost to the Medicare program

$\frac{\text{APCC}_{\text{Co.}}}{\text{APCC}_{\text{U.S.}}}$ = ratio of *per capita* reimbursement in the county to the U.S. (five year average)

and: U_i = a unique underwriting index which represents the ratio of risk for a particular subset of the Medicare population to the national average. Thirty population subsets are defined by the four variables: age (5 groups), sex (two groups), institutional and welfare status (three groups).

E_i = the number of Medicare beneficiaries in a unique underwriting index cell. Table A-1 shows the underwriting factors used for aged Medicare beneficiaries.

Thus, the last factor represents the ratio of relative cost differences in the HMO to that of non-HMO enrollees due to demographic characteristics. It is calculated by dividing the number representing the relative risk of HMO enrollees by the number representing the relative risk of non-HMO enrollees in a given county. The product of all these factors gives the AAPCC.

In this study, we used the ratio of the HMO enrollee underwriting index to the comparison group underwriting index to adjust the comparison group reimbursement rates to obtain an expected average reimbursement rate for the HMO enrollees.

Substituting the comparison group reimbursement rate into the AAPCC equation:

$$E \text{ Reim}_{\text{HMO}} = \text{AAPCC Adjusted Reim}_{\text{comp}} = \text{Reim}_{\text{comp}} \times$$

$$\frac{\sum_{i=1}^{30} U_i \times E_{i\text{HMO}}}{\sum_{i=1}^{30} E_{i\text{HMO}}} \bigg/ \frac{\sum_{i=1}^{30} U_i \times E_{i\text{Co.}}}{\sum_{i=1}^{30} E_{i\text{Co.}}}$$

where: $E \text{ Reim}_{\text{HMO}}$ = the expected average reimbursement rate for the HMO
 AAPCC Adjusted $\text{Reim}_{\text{comp}}$ = the AAPCC adjusted *per capita* reimbursement rate for the comparison group
 $\text{Reim}_{\text{comp}}$ = the unadjusted *per capita* reimbursement rate for the comparison group. The data available for the calculation of the AAPCC weighting factors are described in the following sections.

TABLE A-1

AAPCC Underwriting Factors for the Aged

Sex and Age Group	Institutionalized	Noninstitutionalized Welfare	Noninstitutionalized Non-Welfare
Part A - Hospital Insurance			
Male:			
65-69	2.05	1.35	.70
70-74	2.15	1.55	.80
75-79	2.35	1.95	1.00
80-84	2.35	2.30	1.20
85 and over	2.35	2.60	1.35
Female:			
65-69	1.65	.90	.60
70-74	1.90	1.15	.70
74-79	2.20	1.50	.90
80-84	2.20	1.80	1.10
85 and over	2.20	2.15	1.25
Part B - Supplementary Medical Insurance			
Male:			
65-69	1.75	1.20	.85
70-74	1.90	1.40	1.00
75-79	1.90	1.55	1.10
80-84	1.90	1.70	1.15
85 and over	1.90	1.70	1.15
Female:			
65-69	1.55	1.10	.70
70-74	1.60	1.15	.80
75-79	1.70	1.25	.95
80-84	1.70	1.25	1.00
85 and over	1.70	1.25	1.05

Fallon

Estimates of HMO enrollee and county area, age, sex, welfare, and institutional status were available for 1981. The calculations were done for both the enrollee and comparison groups, thus accounting for all the AAPCC factors.

Kaiser

Population estimates for the four AAPCC factors were not available for 1981. These data were available for the general population in this service area for 1980. We therefore calculated an underwriting index for the control group based on all factors. Data for the enrollees were limited to age/sex distribution by county, and we calculated an underwriting index on the basis of these distributions. The net effect of omitting enrollee welfare and institutional status from the AAPCC is to bias this factor downward for the enrollee group. This in turn reduces the expected reimbursement rate, making it easier to detect an adverse selection and more difficult to detect a favorable selection for the HMO.

Marshfield

As with Kaiser, population distributions by AAPCC factor were available for 1980, but HMO enrollment distributions were not available. We separated the HMO group enrollment counts into age, sex, and welfare status by county. The AAPCC for the HMO enrollment group is biased downward due to the absence of data on institutional status. As with the Kaiser enrollment group, this made it easier to detect adverse selection and more difficult to detect favorable selection.

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