An outlier pool for Medicare HMO payments

by James C. Beebe

Medicare pays "at-risk" health maintenance organizations a prospective capitation amount that is established by the adjusted average per capita cost (AAPCC) formula for estimating the amount enrollees would have cost had they remained in the fee-for-service sector. Because the AAPCC accounts for a very small percentage of the variation in beneficiary costs, considerable research has been devoted to improving the formula. A way to improve the explained variance is to remove the most expensive beneficiaries from the AAPCC payment system and pay for them separately. This article examines one approach to a payment system that combines the AAPCC with an outlier payment mechanism.

Introduction

The role of at-risk health maintenance organizations (HMOs) in the Medicare program increased with the passage of the Tax Equity and Fiscal Responsibility Act of 1982. Since implementation of these provisions in 1985, the Health Care Financing Administration (HCFA) has sought ways to encourage HMO participation and enrollment to take advantage of what is widely believed to be the greater efficiency of managed-care programs relative to the fee-for-service (FFS) system. In 1987, the number of HMOs participating in Medicare reached a high of more than 160 organizations with more than 1.2 million Medicare enrollees. As of 1992, the number of participating plans had declined to 92, largely as a result of mergers and the dropping out of plans with little or no enrollment. Meanwhile, the number of enrollees continued to increase slowly to almost 1.5 million in 1992.

A major focus of these efforts to increase plan participation has been research on ways to improve the prospectively set capitation formula used to establish the payment for HMOs. The law requires that HMOs be paid an amount equal to 95 percent of the amount that their enrollees would have cost had they remained in the FFS sector. This has been implemented through the adjusted average per capita cost (AAPCC) formula. The AAPCC adjusts payments for age, sex, welfare status, institutionalization status, and geographic area. A number of studies have found evidence that these factors explain only a small proportion of the variation in the person-to-person medical care costs and are, thus, poor predictors of FFS costs (Beebe, Lubitz, and Eggers, 1985; Whitmore, 1989; Ash et al., 1989).

A major problem with predicting individual Medicare costs is the long right tail in the distribution of costs, reflecting a relatively small number of people with costs many times the average. This results in a large variance (the coefficient of variation is typically around 2.8). If an HMO should experience these high costs for a few more than the average number in this group, it could result in severe losses. The only protection against this that is available to HMOs is private reinsurance or enrolling large enough numbers of Medicare beneficiaries to reduce the chances of getting an unusually large proportion of high-cost users. Concern over an unexpectedly large number of high users tends to discourage participation in the Medicare program.

Although some studies have suggested that HMOs tend to get favorable selection and, thus, may receive more than adequate payment for their Medicare enrollees (Eggers and Prihoda, 1982; U.S. General Accounting Office, 1986; Brown, 1988), there is still concern that the program's slow growth is, in part, the result of the perception of HMOs that they will not receive an adequate return on Medicare enrollees. Because the prospective payment system (PPS) has held down FFS costs, HMOs claim that it has become increasingly difficult to reduce costs below 95 percent of FFS levels. The recent pattern of mergers and small plans dropping out of the program suggests that small plans see the risks of participating as too great. With only a small number of enrollees, a few high-cost enrollees could create serious losses for a plan.

Some have suggested that a stop-loss reinsurance plan be put into place to offset some of the expenses of unusually high cost enrollees (e.g., Cookson, 1983; Wallack, Tompkins, and Gruenberg, 1988). The Group Health Association of America's Medicare Capitation Group reached a consensus that a government-sponsored stop-loss reinsurance program should be considered (Group Health Association of America, 1989). In 1990, the Bush Administration proposed the establishment of an outlier pool payment system that would offset some of the expenses of high-cost enrollees for HMOs (Wilensky and Rossiter, 1991). The purpose of this article is to simulate some of the characteristics of this proposal. Although private reinsurance is available and commonly used in the private sector (Bovbjerg 1992), its availability and cost for HMOs enrolling Medicare beneficiaries is not known to have been specifically studied. A government-sponsored, universal reinsurance program might encourage greater participation in the Medicare program.

The prospective payment system for paying hospitals sets a precedent for making outlier payments. In PPS, from 5 to 6 percent of total hospital payments must be made for cost and/or length of stay outliers. Keeler et al. (1988) point out that such a system has four main goals:

- To reduce financial risk to hospitals.
- To improve equity by giving additional money to hospitals that treat sicker patients.

Reprint requests: James C. Beebe, Office of Research, Room 2504 Oak Meadows Building, 6325 Security Boulevard, Baltimore, Maryland 21207.

- To help reduce problems of access for patients who are likely to be very expensive.
- To reduce incentives to provide less care for the very sick.

An outlier pool system for HMOs should provide similar favorable incentives.

Outlier pool proposal

The proposal would establish a risk pool funded by an amount equal to 2 percent of the current AAPCC payments. This would be the cost equivalent of raising HMO payments from 95 percent of the AAPCC to 97 percent. Thus, the proposal is not budget neutral. The pool would pay 45 percent of the cost in excess of $50,000 for each enrollee whose costs exceed that amount. The remaining 55 percent of the costs above $50,000 would be borne by the HMO so that there would continue to be an incentive to manage care. All other aspects of the current AAPCC system would remain unchanged. This article simulates the effect of this specific proposal and variations of it on program costs relative to the current AAPCC. It also looks at the effect on HMO payments of different percents of enrollees exceeding the limit.

Data

The data used for this analysis come from the Continuous Medicare History Sample (CMHS) and the denominator file (DF) for a 0.1-percent sample of Medicare beneficiaries. The CMHS contains demographic, utilization, and reimbursement information for Medicare services for a 5-percent sample of all Medicare beneficiaries. Beginning in 1974, these data are collected for the lifetime of all sample cases. The DF contains demographic and monthly entitlement status of all Medicare beneficiaries. It covers aged, non-end stage renal disease beneficiaries who were alive as of January 1, 1987, and who were eligible for both Parts A and B at any time in 1987. The sample includes persons who became eligible during the year as well as persons who were alive on January 1, 1987, but who died during the year. Persons who were HMO members at any time in 1987 were excluded because individual expenditures for HMO members are not available in Medicare administrative data. The final analytic file contained 27,326 persons. The 1987 expenditures were adjusted to 1992 dollars using inflation factors obtained from HCFA's Office of the Actuary.

AAPCC underwriting factors for 1991 were used to assign payment amounts for individuals. Neither of the files from which the data were obtained contained institutional status, a factor used in the AAPCC formula. To adjust for this, the institutional factor was folded in with the age, sex, and welfare status factors, using the distribution of persons in these various categories from the Current Medicare Sample of the mid-1970s. This is the sample from which the original underwriting factors were obtained and which established the relationship between institutional persons and the other groups still in use today. A further adjustment was made to assure that the weighted average of the factors was equal to 1.00, using the distribution of persons in the sample file as weights.

Methods

Studies have used a number of methods for comparing the relative predictive accuracy of various alternatives and revisions to the AAPCC. The measure most commonly used is the amount of variance explained, or *R*-squared. Developing models that explain a high proportion of the variance in Medicare expenditures at the individual level has proven to be an elusive goal. Various studies (McCall and Wai, 1983; Welch, 1985; Newhouse et al., 1989) have estimated that the maximum obtainable *R*-squared is from 14 to 20 percent. This would mean that from 80 to 86 percent of individual Medicare costs are random and, thus, not predictable. Models incorporating three of the four factors currently used in the AAPCC (age, sex, welfare status) generally explain only about 1 percent of the individual variance.[1] Newhouse and colleagues (1989), using the very rich data set from the RAND Health Insurance Experiment, explained a maximum of 62 percent of the 14 to 20 percent of "explainable" variance. This translates into *R*-squared values of between 9 and 12 percent. Other models, particularly those using prior medical use experience, show promise of predicting more than 15 percent of the variance for the Medicare population. Even though this is a relatively large improvement over the current AAPCC, it still leaves most of the individual variation unexplained.

A major reason for the poor showing of prediction models is the difficulty of predicting the relatively few very large expenditures that occur in the distribution of Medicare expenditures. The outlier pool proposal could moderate the adverse effect of the largest expenditures on *R*-squared. This article compares the *R*-squared values of the new proposal with those of the three-factor AAPCC by methods described later.

For simulation purposes, each person in the sample is considered to be enrolled in an HMO. Each person is first assigned a dollar amount representing the capitation payment that the HMO would receive from HCFA under the basic AAPCC. This capitation payment was calculated by first simulating U.S. per capita costs (USPCCs) for Medicare Parts A and B (USPCCA and USPCCB) with the sample average annual expenditure per person-year. Each individual in the sample was then assigned a Part A and a Part B underwriting factor based on age, sex, and welfare status. These factors were multiplied by USPCCA and USPCCB to get each individual's basic AAPCC. The AAPCC is multiplied by .95 to establish the payment amount although this is not done for the calculation of

[1] A fourth factor, institutional status, is seldom used in models because institutional status for individuals is usually not available. It is not known how much including institutional status would contribute to the explained variance.

R-squared. For new eligibles and persons who died, capitation amounts were reduced for the number of months they were not enrolled. The resulting capitation amounts were then used to calculate various statistics, including *R*-squared values.

Under the outlier pool method, the HMO receives 95 percent of the basic AAPCC payment for each enrollee. For persons whose total expenses exceed $50,000, the calculation of an additional payment from the pool is made as follows:

If TOT is the total A and B actual individual costs and LIMIT is the outlier pool limit, then the outlier pool payment is

PAY = .95AAPCC + .45(TOT - LIMIT).
R-squared values are calculated using PAY1 = AAPCC + .45(TOT - LIMIT).

In general terms, the *R*-squared statistic is a measure of how well a given model predicts some actual value relative to how well the mean predicts that actual value. In my application, I am testing how well the underwriting factors versus underwriting factors plus outlier pool predict actual expenses relative to the USPCCs (USPCC = USPCCA + USPCCB). The formulas used to calculate *R*-squared are:

R-squared = 1 - sum(TOT - AAPCC)^2 / sum(TOT - USPCC)^2 for the AAPCC payment

and

R-squared = 1 - sum(TOT - PAY1)^2 / sum(TOT - USPCC)^2 for the outlier pool payment.

The summations are over all individuals.

Results

As stated earlier, the number of persons in the sample is 27,326. The basic statistics for costs (inflated to 1992) are shown in Table 1. Of the persons in the sample, 20.1 percent had at least one hospital admission; and 0.79 percent, or 216 persons, had expenditures in excess of $50,000. The coefficient of variation (CV) for the total of 2.42 indicates that the sample is a somewhat more homogenous group than the general Medicare population which, as noted, has a CV of around 2.8.

Table 1

Summary statistics (inflated to 1992 dollars) for Medicare beneficiaries in the sample

Cost	Mean	Standard deviation	Coefficient of variation
USPCCA[1]	$2,261	$6,925	3.06
USPCCB[1]	1,512	2,972	1.97
USPCC[1]	3,773	9,137	2.42

[1]See "Methods" for definitions.

SOURCE: Health Care Financing Administration: Medicare Statistical System.

Possible explanations for the difference include:

- The sample excludes beneficiaries with end stage renal disease.
- Only persons covered by both Parts A and B are included.
- Sampling error could make a small contribution.

The explained variance for the outlier pool method is highly dependent on the outlier limit. The lower the limit is, the greater will be the value of *R*-squared. This is to be expected, because the more the long right tail of the distribution is cut off the more the variance will be reduced. Table 2 shows the results of various limits. Also shown are the percent of persons exceeding the limit in this data set, the cost of financing the limit as a percent of the basic AAPCC, and the average payment under the outlier pool proposal. *R*-squared for the basic AAPCC is 1.58 percent, and the per capita payment is $3,585[2] in all cases.

Percent cost (column 4) can also be interpreted as the percent increase in payments to HMOs relative to the current AAPCC. Thus, the $50,000 limit is the equivalent of increasing the payment from 95 percent of the AAPCC to 96.8 percent of the AAPCC. Column 5 shows, as expected, that the lower the limit the higher Medicare payments. The limit of $45,850 is included in the table because this is the limit corresponding to an *R*-squared of 15 percent. A provision in the Omnibus Budget Reconciliation Act of 1990 (Public Law 101-508) (since repealed) required the Secretary of the Department of Health and Human Services to develop an HMO payment model that explains at least 15 percent of the variance.

There are three limitations to the simulation results presented in Table 2. First, the effect of the institutional status underwriting factor would be expected to increase *R*-squared, but it could not be simulated. Second, a geographic adjustment would also increase the *R*-squared. The Whitmore et al. (1989) study suggests that these two factors might increase *R*-squared by about 1.5 percent. On the other hand, these limitations are equal for both the pool method and the basic AAPCC as presented here, so that the comparison should be valid. A third limitation is that no effort to incorporate administrative costs into the analysis was made. Doing so would alter the cost figures but not *R*-squared.

The analysis just mentioned looks at the outlier pool proposal primarily from the government's point of view. From an HMO's perspective, the payment it receives will depend on the percent of enrollees who exceed the limit. Table 3 shows a simulation of this for a fixed limit of $50,000. The percent exceeding the limit was varied by randomly deleting persons above the limit to get a lower than average percent above the limit or randomly deleting persons below the limit to get a higher than average percent above the limit. This procedure introduces some stochastic error, so it should not be assumed that the results shown in Table 3 would

[2]The payment is 95 percent of the sample average expenditures of $3,773 shown in Table 1, reflecting the statutory reduction in payment.

Table 2

Effects of different limits on *R*-squared and the HMO capitation payments

Cost of the limit (1)	Outlier pool R^2 (2)	Percent of persons exceeding limit (3)	Percent cost in excess of AAPCC payments (4)	Per capita payment (5)
$10,000	52.56	11.10	19.47	$4,283
20,000	37.73	5.05	9.98	3,943
30,000	26.53	2.47	5.46	3,781
40,000	18.54	1.40	3.12	3,697
45,850	15.00	0.99	2.34	3,675
50,000	12.89	0.79	1.81	3,650
60,000	9.07	0.46	1.06	3,623
70,000	6.49	0.26	0.64	3,608
80,000	4.80	0.15	0.39	3,599
90,000	3.66	0.10	0.22	3,593
100,000	2.82	0.07	0.14	3,590
AAPCC	1.58	—	0.00	3,585

NOTE: AAPCC is adjusted average per capita cost. HMO is health maintenance organization.

SOURCE: Health Care Financing Administration: Medicare Statistical System.

Table 3

Effects of different proportions of persons exceeding the $50,000 limit on HMO capitation payments

Percent exceeding limit (1)	Basic AAPCC per capita payment (2)	Outlier pool per capita contribution (3)	Outlier pool per capita payment (4)	Actual per capita expense (5)	Percent profit (+) or loss (−) to the HMO	
					With outlier (6)	Without outlier (7)
0.10	$3,585	$10	$3,595	$3,331	+7.9	+7.6
0.32	3,585	27	3,612	3,474	+4.0	+3.2
0.52	3,585	45	3,630	3,607	+0.6	−0.6
0.63	3,586	50	3,636	3,671	−1.0	−2.3
0.79	3,585	64	3,649	3,774	−3.3	−5.0
0.99	3,581	81	3,662	3,907	−6.3	−8.3
1.32	3,593	107	3,700	4,053	−8.7	−11.1
1.95	3,579	159	3,738	4,515	−17.2	−20.7

NOTES: HMO is health maintenance organization. AAPCC is adjusted average per capita cost.

SOURCE: Health Care Financing Administration: Medicare Statistical System.

hold exactly if different observations happened to be randomly deleted. For example, column 2, "Basic AAPCC per capita payment," would be constant if it were not for stochastic error.

Under the conditions simulated here, actual expenses increase much more rapidly than do the payments under either the basic AAPCC or the outlier pool method. It is apparent that the outlier pool method "overpays" only slightly more than the basic AAPCC when favorable selection occurs while providing a little higher percentage of protection against adverse selection.

The outlier pool method pays more in every case, reflecting the fact that an extra 2 percent has been put into the system. If the method were budget neutral, that is, if the 2-percent pool money were taken from the basic AAPCC payment, HMOs with favorable selection would not do as well as under the basic AAPCC. For example, with 0.10 percent exceeding the limit (top row), the profit would be +5.8 percent instead of +7.9 percent. HMOs with unfavorable selection would still do better than under the AAPCC, but not as well as shown previously. With 1.95 percent exceeding the limit (bottom row), the loss would be -18.9 percent instead of -17.2 percent.

Discussion

This analysis shows that an outlier pool payment method for HMOs could provide some protection against the risk of an unexpectedly high proportion of high-cost users at a relatively modest cost. The proposal studied here would increase current costs by about 2 percent for coverage of 45 percent of costs over a $50,000 limit. If we were willing to increase costs by 5 percent, this limit could be lowered to about $32,000. A 5-percent cost increase would be equivalent to increasing payments to 100 percent of the AAPCC, a move that has been advocated by some as an incentive to bring more Medicare beneficiaries under managed care. Such a move might also be justified on the grounds of fairness. A recent study by Welch (1991) suggests that areas with high HMO market penetration tend to have lower overall costs for the Medicare

program. He attributes this to the spill-over effects of conservative medical practice. As penetration increases, continuing to pay at 95 percent of the AAPCC may put HMOs at a competitive disadvantage.

Bovbjerg (1992) states that HMOs commonly obtain individual reinsurance for costs exceeding a range of from $25,000 to $75,000. Thus, this proposal is in line with current practice in that regard. There are, however, some differences. First, the current proposal covers only 45 percent of costs exceeding the limit, and it is for Medicare enrollees only. HMOs would still probably want to purchase private reinsurance for their private business and the remaining high costs of Medicare enrollees. Second, the system would be mandatory for all HMOs that accept Medicare enrollees. Because the program costs would be financed by an add-on to present costs, some HMOs might prefer to have the extra 2-percent payment and be left to buy a private reinsurance plan that best fits their needs.

There are some negatives to the outlier pool payment system. It could tend to decrease cost-containment incentives for high-cost patients. However, under the system analyzed here, the HMO remains responsible for 55 percent of costs above $50,000. This should still be an adequate incentive to contain costs. A problem that many HMOs might have would be the need to install systems that would assign costs to ambulatory care, inpatient physician care, and, possibly, to hospital care in some cases. One way to alleviate the data problems would be to reinsure only specific services for which data are more readily available, such as hospital stays. These could be covered at something greater than the 45-percent rate and provide the same overall degree of protection.

References

Ash, A., Porell, F., Gruenberg, L., et al.: Adjusting Medicare capitation payments using prior hospitalization data. *Health Care Financing Review* 10(4):17-30. HCFA Pub. No. 03284. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Summer 1989.

Beebe, J., Lubitz, J., and Eggers, P.: Using prior utilization information to determine payments for Medicare enrollees in health maintenance organizations. *Health Care Financing Review* 6(3):27-38. HCFA Pub. No. 03198. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Spring 1985.

Bovbjerg, R.: Reform of Financing for Health Coverage: What Can Reinsurance Accomplish? *Inquiry* 29:158-175, Summer 1992.

Brown, R.: Biased Selection in the Medicare Competition Demonstration. Unpublished report. Princeton, NJ. Mathematica Policy Research, Inc. Mar. 1988.

Cookson, J.: Review of AAPCC Methodology for Implementing Prospective Contracts with HMO's. Unpublished report. Philadelphia, PA. Milliman & Robertson, Inc. Aug. 1983.

Eggers, P.W., and Prihoda, R.: Pre-Enrollment Reimbursement Patterns of Medicare Beneficiaries Enrolled in "At-Risk" HMOs. *Health Care Financing Review* 4(2):55-73. HCFA Pub. No. 03146. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Sept. 1982.

Group Health Association of America: GHAA's Medicare Capitation Group: Summary of Discussion. Unpublished report. Group Health Association of America. Dec. 1989.

Keeler, E.M., Carter, G.M., Trude, E.: Insurance Aspects of DRG Outlier Payments. *Journal of Health Economics* 7:193-214, 1988.

McCall, N., and Wai, H.: An Analysis of the Use of Medicare Services by the Continuously Enrolled Aged. *Medical Care* 21(6):567-585, June 1983.

Newhouse, J., Manning, W., Keeler, E., and Sloss, E.: Adjusting capitation rates using objective health measures and prior utilization. *Health Care Financing Review* 10(3):41-54. HCFA Pub. No. 03280. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Spring 1989.

U.S. General Accounting Office: *Medicare: Issues Raised by Florida Health Maintenance Organizations.* Report to the Congress Pub. No. GAO/HRD-86-97. Washington. U.S. Government Printing Office, July 1986.

Wallack, S.S., Tompkins, C.P., and Gruenberg, L.: A Plan for Rewarding Efficient HMOs. *Health Affairs* 7(3):80-97, Summer 1988.

Welch, W.P.: Medicare capitation payments to HMOs in light of regression toward the mean in health care costs. In Scheffler, R.M., and Rossiter, L.F., eds.: *Advances in Health Economics and Health Services Research.* Vol. 6. Greenwich, CT. JAI Press, 1985.

Welch, W.P.: HMO Market Share and Its Effect on Local Medicare Costs. Unpublished report. The Urban Institute, Feb. 1991.

Whitmore, R.W., Paul, J.E., Gibbs, D.A., and Beebe, J.C.: Using health indicators in calculating the AAPCC. In Scheffler, R.M. and Rossiter, L.F., eds.: *Advances in Health Economics and Health Services Research.* Vol. 10. Greenwich, CT. JAI Press, 1989.

Wilensky, G.R., and Rossiter, L.F.: Coordinated Care and Public Programs. *Health Affairs* 10(4):62-77, Winter 1991.