

**THE ADJUSTED AVERAGE PER CAPITA COST  
UNDER RISK CONTRACTS WITH  
PROVIDERS OF HEALTH CARE**

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**ABSTRACT**

This paper describes an actuarial methodology developed to meet the requirements of the "risk" contract that the medicare program makes available to certain health maintenance organizations. The mathematical and risk classification details of the methodology are discussed at some length. A brief discussion is given of the history and objectives of the "risk" contract. The paper summarizes frequent questions and answers about certain features of the "risk" contract that are of actuarial interest. Sufficient detail is presented to allow the practicing actuary to develop analogous contracts designed to give financial incentives to efficient providers of health care while, it is hoped, constraining employers' health care costs.

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**I. INTRODUCTION**

**T**HE continuing escalation of health care costs has focused interest on prepaid medical care delivery plans known as health maintenance organizations (HMOs). HMOs provide medical services to an enrolled group of subscribers on a prepaid, capitation basis.

For some time, the ability of HMOs to deliver quality health care service at a lower cost than the fee-for-service sector has been a subject of extensive debate. HMO proponents argue that efficient HMOs achieve quality care at a lower-than-average cost through their emphasis on preventive care and because salaried HMO physicians have a strong incentive to avoid excessive hospitalization. Fee-for-service proponents claim that many of the HMOs that achieve lower costs do so either by delivering lower-quality care or by deliberately selecting a healthier group of enrollees.

The question of HMO efficiency has been of great interest to federal health care planners. The medicare reimbursement procedure, which is based largely on reasonable costs and reasonable charges, is more like that of private health insurance than is the low-copayment, preventive care

orientation of HMOs. HMO proponents claim that medicare's orientation to fee-for-service is the reason why HMOs have not sought out medicare enrollees in large numbers. This argument concludes that medicare should allow payment to HMOs on a prepaid per capita basis. Fee-for-service proponents argue that the federal government has already spent vast sums of money and given various preferences to HMOs in spite of the public's lack of interest in HMOs. They also argue that HMOs are interested only in the healthiest part of the medicare population.

The 1972 amendments to the Social Security Act partially resolved this dilemma with a compromise, the retrospective "risk" contract of section 1876. This contract allows for a potential profit to the electing HMO with respect to its medicare membership. However, the HMO can profit only if its per capita cost of delivering care is less than medicare's estimate of what its enrollees would have cost the medicare program if they had not been enrolled in the HMO. This per capita estimate of medicare's cost is known as the adjusted average per capita cost (AAPCC) and is calculated by the Office of Financial and Actuarial Analysis of the Health Care Financing Administration.

Under the provisions of the section 1876 risk contract, the AAPCC is calculated after the close of the HMO's contract, on the basis of the actual incurred costs and enrollment of the contract period. There is no guarantee before the initiation of a contract as to the range in which the AAPCC value will fall. An HMO operating at a cost below the AAPCC is reimbursed for costs and, in addition, receives one-half of the excess of the AAPCC over the costs, such excess not to exceed 10 percent of the AAPCC. An HMO operating at a cost in excess of the AAPCC will be reimbursed only at the level of the AAPCC.

Although the risk contract was developed as a mechanism to encourage efficient HMOs to increase their medicare enrollment, it has met with very limited acceptance. To date, there has been only one risk contract under section 1876, and this contract was accepted by the HMO only after the granting of certain waivers from statutory rules. Prospective risk contracts have been made available under demonstration contracts, but currently only one HMO has accepted such a contract (although certain modifications of the prospective risk contract have been accepted). A detailed analysis of why, given its significant profit potential, the risk contract has not met with a better response is beyond the scope of this paper.

The determination of the AAPCC is not only essential for the reimbursement of risk-contract HMOs; it is also an interesting problem in the risk classification of an aged and disabled population. The following is a detailed discussion of the AAPCC.

## II. CALCULATION OF THE ADJUSTED AVERAGE PER CAPITA COST

The adjusted average per capita cost (AAPCC) is an estimate of what the average person in a group of medicare HMO enrollees would have cost the medicare program had that person not been enrolled in the HMO. The calculation is developed in a series of four conceptually simple stages:

1. Medicare national average per capita costs are estimated for the HMO's contract period.
2. Historical relationships between county and national per capita costs are used to convert the national average per capita costs to the county level for each county in the HMO's service area.
3. Expected medicare per capita costs for a given county are adjusted (by removing both reimbursement and enrollment for the HMO medicare membership) to a "non-HMO" basis.
4. Each non-HMO medicare cost per capita is disaggregated into its demographically defined component parts.

These steps are discussed in greater detail below.

*Step 1.*—The national average per capita costs to the medicare program are estimated for the time period of the HMO's contract. These numbers are known as the United States per capita costs (USPCCs) and are average incurred benefit costs per medicare enrollee, loaded for carrier and intermediary expenses (that portion of administrative expenses actually carried by the HMO under the risk contract). For each of Part A (hospital insurance) and Part B (supplementary medical insurance) of medicare, the USPCCs are developed separately for the aged, the disabled, and those beneficiaries having end-stage renal disease. The estimates that are used as the basis for the USPCCs are the most recent of the two formal medicare cost estimates prepared annually (for the president's budget and for the annual reports of the trustees of the medicare program) by the actuaries in the Office of Financial and Actuarial Analysis within the Health Care Financing Administration.

*Step 2.*—After the USPCCs have been determined, national costs to the medicare program are adjusted to a level appropriate for each county in the HMO's service area. For each such county, for each of Parts A and B, the historical relationship between the county per capita cost and the national per capita cost is established and is used to make the adjustment. These per capita costs are developed from the entire medicare enrollment and the aggregate amount of claims paid. No sample population is involved. The adjustment factor to be applied to the USPCC is the unweighted average of the ratio of county per capita cost to national per capita cost for the five most recent years for which relatively complete data are available. This factor is known as the "geographic adjustment." For that portion of the population having end-stage renal disease, the relationship between the *state* per capita cost and the national per capita cost is used to make the geographic adjustment. State data rather than county data are used because of the relatively small size of this segment of the population.

*Step 3.*—At this point, six per capita cost figures have been calculated for each county in the HMO's service area. For each of Parts A and B, there is a separate cost for each of the aged, disabled, and renal disease populations. These costs are averages for the entire county (or state for the renal disease beneficiaries) and therefore include the reimbursement and enrollment totals of the HMO. The third step is to remove the HMO's incurred cost and enrollment from the county (or state) per capita cost. This is accomplished simply by subtracting the HMO's incurred cost and enrollment from the entire county's (or state's) medicare cost and enrollment. The per capita cost is then recalculated.

*Step 4.*—In the final step, the recalculated county per capita costs are converted into rates that vary according to certain demographic variables: age, sex, welfare status, and institutional status. For each of the aged and disabled, there are thirty cells for each of Parts A and B, corresponding to different combinations of these variables (see Tables 1 and 2). The factor shown in each cell is the ratio of the cost for a medicare beneficiary having that particular demographic-cell characteristic to the average per capita cost. These relative cost factors are referred to as demographic

TABLE 1  
DEMOGRAPHIC COST FACTORS FOR THE AGED

Sex and Age Group	Institutionalized	Noninstitutionalized Welfare	Noninstitutionalized Nonwelfare
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

factors, and were developed from the last three years (1974-76) of the Current Medicare Survey, incorporating roughly 20,000 medicare beneficiary-years of observations. Through the use of these demographic factors, the county per capita costs are converted into rates. (A detailed methodology for this step is shown in the Appendix.) However, no demographic adjustment is made to the state per capita cost for those beneficiaries having end-stage renal disease.

For each county in the HMO's service area there will be thirty rates for each of Parts A and B, for the aged and disabled populations separately. These rates, or some percentage of these rates, will be applied to the HMO's monthly enrollment to determine the prospective AAPCC payment.

Current law permits only retrospective risk contracts. At the close of the HMO's contract period, the AAPCC is determined (for each of Parts A and B) as the weighted average of the rates discussed above. The weights are the HMO's medicare enrollment by county for each category.

TABLE 2  
DEMOGRAPHIC COST FACTORS FOR THE DISABLED

Sex and Age Group	Institutionalized	Noninstitutionalized Welfare	Noninstitutionalized Nonwelfare
Part A—Hospital Insurance			
Male:			
Under 35 .....	1.20	.75	.40
35-44 .....	1.10	.95	.50
45-54 .....	1.00	1.15	.60
55-59 .....	.90	1.60	.85
60-64 .....	.55	1.75	.95
Female:			
Under 35 .....	1.40	1.00	.40
35-44 .....	1.45	1.20	.65
45-54 .....	1.55	1.55	1.00
55-59 .....	1.15	1.60	1.15
60-64 .....	.60	1.45	1.20
Part B—Supplementary Medical Insurance			
Male:			
Under 35 .....	1.10	.70	.30
35-44 .....	1.15	.85	.40
45-54 .....	1.15	1.10	.55
55-59 .....	1.15	1.35	.80
60-64 .....	.95	1.45	.95
Female:			
Under 35 .....	1.40	.75	.50
35-44 .....	1.75	1.10	.80
45-54 .....	1.95	1.50	1.15
55-59 .....	1.60	1.60	1.25
60-64 .....	1.15	1.55	1.25

The Appendix contains a brief mathematical demonstration of the conceptual relationship between the retrospective and the prospective AAPCC. Because of the various approximations and projections, the prospective AAPCC generally will not equal the retrospective AAPCC.

### III. DISCUSSION

Throughout the history of the risk contract, certain aspects of the AAPCC concept and methodology have been questioned. The most frequent comments and replies are given below.

Three major concerns apply to the input used in the AAPCC calculation.

*Comment:* The USPCC (and hence the AAPCC) may be set artificially low because of pressure to reduce medicare expenditures. Politically determined projections of inflation could have the same effect.

*Reply:* The USPCC is taken from one of two formal cost estimates prepared each year for Congress and the Executive Branch. These estimates provide the basis for financial planning for the medicare program and therefore are subject to intense executive and legislative scrutiny. It is unlikely that the people preparing these estimates would risk their credibility in the manner described. In the past, the short-term expenditure estimates have been well within a reasonable range of error.

*Comment:* The calculation of geographic relationships between county costs and national average costs should give more weight to recent years. Perhaps the averaging should be dropped in favor of trending.

*Reply:* The use of an unweighted average of the five most recent years for which relatively complete data are available is a compromise between accuracy and stability. The geographic relationships can be extremely volatile, even for some large counties; however, given the completeness of the data, these relationships cannot be ignored. The unweighted five-year average considers recent data but does not risk the disastrous results of trending from, or giving heavy weight to, an atypical recent year.

*Comment:* The demographic factors are out of date and do not vary by state.

*Reply:* The demographic factors were developed from the most recent large-scale study of medicare experience (the Current Medicare Survey) that treats the demographic variables required by Section 1876. No recent study can match this survey in size or objectivity. Any study done separately by state would be prohibitively expensive given the present level of use of the risk contract.

Two comments have been made concerning the AAPCC methodology.

*Comment:* The calculation should include race as a demographic variable.

*Reply:* It is impossible to define race in a manner that permits good analytical or administrative treatment. Furthermore, it is not clear that race, per se, has an impact on cost. Most, if not all, of the effects perceived as being due to race

probably are explainable through other factors, such as geography and welfare status, which are explicitly addressed.

*Comment:* The calculation should adjust for health status.

*Reply:* No attempt is made to adjust the AAPCC calculation for health status, for several reasons. It is not clear that the present section 1876 intends quantitative treatment of health status, since the only variables mentioned are age, sex, disability status, race, geography, and institutional status. The open enrollment requirements presumably should create a reasonable mix of health statuses. Given that all applicants must be accepted, and given the age of the population, there is no insurance industry system for quantifying the effect of health that meets the needs of the AAPCC calculation. In addition, even if it were theoretically possible, any such adjustment probably would be very costly to implement. It has always been recognized that enrollment of a healthier-than-average population would defeat the intent of the risk contract. The Office of Financial and Actuarial Analysis has qualified its AAPCC calculations, stating that the values are appropriate only if a true open enrollment has been achieved. The problem of dealing with health status is best treated by administrative means.

Concern has been expressed about the overall accuracy and implementation of the prospective AAPCC.

*Comment:* There could easily be errors in the prospective AAPCC.

*Reply:* There are, by definition, approximations and assumptions involved in any estimate of future cost levels. However, in the past, such projection errors for medicare costs have been relatively small. Additionally, there are minor discrepancies in establishing the equivalence of prospective and retrospective AAPCCs. Differences are due mainly to the effect of estimating the future HMO cost levels and the effect of HMO practices that could alter the demographics of the non-HMO population. However, under conditions where the given HMO has a fairly small part of the county's medicare enrollment, the error due to demographic changes is quite small, and the overall effect is still a reasonable basis for contracting.

*Comment:* The prospective approach is too complicated; it does not result in a "single number" AAPCC.

*Reply:* There are few concepts more clearly imbedded in the idea of the risk contract than that of explicit adjustment for the demographics of the enrollees. A single-number AAPCC is possible only if the demographic composition of the HMO's population is completely determined in advance of the contracting period. With new people enrolling and present enrollees dying and leaving, the HMO cannot guarantee the demographics of the enrollees. However, if the HMO has a large medicare population, it should be able to estimate an average single-number AAPCC from the rates given, with a high enough degree of accuracy to tolerate whatever payment fluctuations occur in its medicare reimbursement. While single-number pricing has certain appealing characteristics (especially simplicity), such a contract clearly is not a risk contract under the intent of the 1972 amendments.

## APPENDIX

CONVERSION OF COUNTY PER CAPITA COSTS INTO RATES, AND  
 DEMONSTRATION OF THE CONCEPTUAL EQUIVALENCE  
 OF THE RETROSPECTIVE AND PROSPECTIVE  
 AAPCC CALCULATIONS

The present AAPCC methodology adjusts for age, sex, welfare status, and institutional status of the medicare beneficiaries in a given county.<sup>1</sup> Tables 1 and 2 show the demographic cells used in this adjustment. The adjustment process hinges on the demographic factors ( $DF_i$  for each demographic cell  $i$ ) developed from the Current Medicare Survey. Each factor relates the medicare cost for a person in that demographic cell to the cost for the average medicare beneficiary (factor = 1.00). Because of rounding and shifts in the demographic distribution of the medicare population, it is possible that the average demographic factor for the entire medicare population would not be exactly 1.00, although it should be close to that value. Demographic distributions for a given county could lead to an average demographic factor other than 1.00. The extent of institutionalization can be extremely volatile, especially for a small county. Welfare entitlement can vary dramatically by state. Even age-sex differences can have an impact. This problem of county demographic variations is addressed by adjusting the county non-HMO per capita cost ( $PCC_{nh}$ ) to the theoretical level,  $K$ , that would result if the county demographic distribution were such as to give an average demographic factor of 1.00. This is accomplished simply by dividing  $PCC_{nh}$  by the average demographic factor for the county, calculated by using the actual non-HMO county population ( ${}_{nh}P_i$  for each demographic cell  $i$ ):

$$K = PCC_{nh} \left[ ({}_{nh}P_1 DF_1 + \dots + {}_{nh}P_{30} DF_{30}) / \sum_{i=1}^{30} {}_{nh}P_i \right]^{-1} .$$

This calculation (and, in fact, the entire AAPCC calculation) must be done separately for each of aged Part A, aged Part B, disabled Part A, and disabled Part B beneficiaries for each county in the HMO's service area. Demographic adjustments are not made for medicare beneficiaries with end-stage renal disease because we cannot determine the significance of demographics in determining the cost for people having this rare and extremely costly condition. After the county non-HMO per capita cost has been standardized for demographic variables, yielding a value for  $K$  as defined above, it is possible to estimate the amount that those in a given demographic cell

<sup>1</sup> This adjustment does not apply to those beneficiaries suffering from end-stage renal disease.



would have cost medicare had they not been enrolled in an HMO, simply by multiplying  $K$  by  $DF_i$  for each cell  $i$ . This procedure allows the AAPCC to be presented as a set of rates,  $R_i = K DF_i$ , varying according to the demographic cells shown in Tables 1 and 2. The usefulness of this technique lies in the ability to give a reasonable prospective approach to estimating what a group of HMO enrollees would have cost the medicare program, even though the demographic characteristics of these enrollees are not known in advance. An HMO can then enroll medicare beneficiaries without regard to their demographic characteristics, and the medicare program will still be able to satisfy the statutory requirement of adjusting reimbursement for the demographic characteristics of the enrollees.

When the HMO enrollment is known, a weighted average rate can be calculated by using the HMO's enrolled population in cell  $i$  ( ${}_h P_i$ ) as the weight for  $R_i$ , as follows:

$$({}_h P_1 R_1 + {}_h P_2 R_2 + \dots + {}_h P_{30} R_{30}) / \sum_{i=1}^{30} {}_h P_i .$$

Note that this is conceptually equivalent to the retrospective AAPCC:

$$AAPCC = PCC_{nh} \frac{({}_h P_1 DF_1 + {}_h P_2 DF_2 + \dots + {}_h P_{30} DF_{30}) / \sum_{i=1}^{30} {}_h P_i}{({}_{nh} P_1 DF_1 + {}_{nh} P_2 DF_2 + \dots + {}_{nh} P_{30} DF_{30}) / \sum_{i=1}^{30} {}_{nh} P_i} .$$

However, because of certain necessary approximations, the retrospective and prospective calculations will not, in practice, give precisely the same number. The remainder of this Appendix summarizes definitions and demonstrates the conceptual equivalence of the prospective and retrospective AAPCC calculations. The following definitions will be used:

$AAPCC$  = Adjusted average per capita cost;

$USPCC$  = United States per capita cost;

$PCC_{nh}$  = County per capita cost for the average non-HMO medicare resident;

$DF_i$  = Demographic factor for cell  $i$

= Ratio of (a) the expected non-HMO medicare per capita cost in demographic cell  $i$  (see Tables 1 and 2) to (b) the expected cost for the average medicare beneficiary;

${}_h P_i$  = Number of HMO medicare enrollees in the given county in demographic cell  $i$ ;

${}_{nh}P_i$  = Number of non-HMO medicare enrollees in the given county in demographic cell  $i$ ;

$$K = PCC_{nh} \left[ ({}_{nh}P_1 DF_1 + {}_{nh}P_2 DF_2 + \dots + {}_{nh}P_{30} DF_{30}) / \sum_{i=1}^{30} {}_{nh}P_i \right]^{-1};$$

$$R_i = K DF_i .$$

The following is a demonstration of the conceptual equivalence of the retrospective and prospective AAPCC calculations:

$$AAPCC = PCC_{nh} \frac{\text{Average } DF \text{ for HMO population}}{\text{Average } DF \text{ for non-HMO population}} \quad (\text{Retrospective})$$

$$= PCC_{nh} \frac{({}_hP_1 DF_1 + \dots + {}_hP_{30} DF_{30}) / \sum_{i=1}^{30} {}_hP_i}{({}_{nh}P_1 DF_1 + \dots + {}_{nh}P_{30} DF_{30}) / \sum_{i=1}^{30} {}_{nh}P_i}$$

$$= K({}_hP_1 DF_1 + \dots + {}_hP_{30} DF_{30}) / \sum_{i=1}^{30} {}_hP_i$$

$$= ({}_hP_1 R_1 + \dots + {}_hP_{30} R_{30}) / \sum_{i=1}^{30} {}_hP_i \quad (\text{Prospective}) .$$