Modified Capitation and Treatment Incentives for End Stage Renal Disease

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This study developed a modified capitation payment method for the Medicare end stage renal disease (ESRD) program designed to support appropriate treatment choices and protect health plans from undue financial risk. The payment method consists of risk-adjusted monthly capitated payments for individuals on dialysis or with functioning kidney grafts, lump sum event payments for expected incremental costs of kidney transplantations or graft failures, and outlier payments for expensive patients. The methodology explained 25 percent of variation in annual payments per patient. Risk adjustment captured substantial variations across patient groups. Outlier payments reduced health plan risk by up to 15 percent.

INTRODUCTION

Use of managed care and capitation payment methods has been growing as payers, including Medicare and Medicaid, have sought to contain escalating health care costs. Capitated health plans have incentives to control costs of care for their enrollees by managing care proactively, reducing the prices they pay providers, and seeking other operating efficiencies. Because these plans are organized to manage care, they are well positioned to improve the quality and coordination of care and to establish quality assurance programs based on explicit quality standards. Cost control incentives also could have undesired consequences, however, if capitated plans selected less expensive enrollees, underserved enrollees, or emphasized costs over clinical considerations in choosing treatment technologies. These issues are particularly important for individuals with high cost health conditions, such as ESRD patients, the chronically mentally ill, or acquired immunodeficiency syndrome (AIDS) patients. Such negative consequences could be mitigated by design of capitation methods that paid plans fairly for these patients and created financial incentives that were compatible with appropriate clinical care for their conditions.

This article describes a modified capitation method developed to establish payments for health plan enrollees with ESRD. The payment method was designed for use in a health plan system for the Medicare ESRD program, which is the primary insurer for ESRD patients.[1] Two purposes have guided development of this payment design: To attain equitable capitation payments for plans and Medicare, and to mitigate undesired effects of capitation incentives on ESRD beneficiaries enrolled in health plans.

A capitated payment system is being explored for the Medicare ESRD program as an option to control its rapid growth in costs. Although Medicare's risk program

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[1]About 93 percent of ESRD patients have Medicare coverage (Health Care Financing Administration, 1992).

currently offers capitated health plan options for other beneficiaries, ESRD beneficiaries may not participate unless they already were health plan members when kidney failure occurred. This policy reflects concerns regarding the high cost of care of ESRD patients that, combined with inadequacies of the current ESRD capitation rates, poses undue financial risk for health plans, and could lead to inadequate care for these patients. The current capitated payments are flat rates based on State-level adjusted average per capita costs (AAPCCs) for all ESRD beneficiaries.

A modified capitation method consists of individual payment components that are designed to reflect the treatment options, clinical processes, and variations in costs of care for a particular chronic health condition. Such components may include, for example, capitation payments for different types of services, payments that blend capitation rates with fee-for-service (FFS) payments, fixed payments for high-cost events, or reinsurance mechanisms. A modified capitation system for any given health condition would be unique, but many of the payment design elements we test here for ESRD might be adapted for other chronic conditions as well.

The design of a modified capitation method would be only one component of the development of a capitated health plan system for the Medicare ESRD program. Policies also would be established regarding benefits packages, health plan enrollment and disenrollment by ESRD beneficiaries, and performance standards for health plans. Other policies would address requirements for quality assurance, provider financial arrangements, and health plan financial solvency. While design of such a system might draw upon current Medicare risk program policies, ESRD capitation policies would require careful consideration to ensure they are responsive to the unique needs of the ESRD population. Design issues for other components of a capitation payment system are discussed further in the full study report (Farley et al., 1994).

Of the various forms of managed care, a fully capitated system is the most highly structured and would place health plans at greatest financial risk. Other models also might be used for the ESRD program, such as preferred provider organizations or point of service plans. These models have weaker cost control incentives than full capitation, but they may offer better protection for access and quality of care. Medicare also might share risk with health plans through some form of partial capitation. Where a policy decision is made to use a capitated approach for ESRD beneficiaries, however, we suggest use of some form of modified capitation payments, rather than a flat capitation rate.

Patients with ESRD have permanent loss of kidney function, which is fatal unless they receive treatment to cleanse their bodies of metabolic waste products. ESRD is treated by either kidney transplantation or renal dialysis. Because access to transplants is limited by the supply of donor kidneys, and many patients do not qualify medically as transplant candidates, only about 22 percent of ESRD patients have functioning kidney transplants. Dialysis patients are treated with either hemodialysis or peritoneal dialysis.

Medicare pays monthly capitation payments to physicians for routine dialysis supervision and pays dialysis facilities a fixed payment for each dialysis treatment. These payments are called composite rates because they are an average (composite) of individual rates that previously had been paid for hemodialysis or peritoneal dialysis treatments in outpatient or home settings. All other services, including hospital stays, are paid under Medicare (FFS) payment policies.

A form of modified capitation payment could offer better control of Medicare costs than the existing ESRD payment policies. It also would improve upon the current AAPCCs for ESRD beneficiaries, which do not recognize differences in service use and costs among ESRD patients using different treatment modalities. A payment system that established fair rates for participating plans, along with incentives that are compatible with clinical care processes, could help enhance care for ESRD beneficiaries and control growth in Medicare costs.

PAYMENT DESIGN APPROACH AND ISSUES

In designing a modified capitation method for health plans serving ESRD enrollees, the definition of individual payment components is guided by information on the disease process and the methods and cost of treatments. Then payment amounts are derived for each component using data on the relevant costs of care per patient. Payments also may be adjusted to manage selection bias or financial risk.

The modified capitation method that we developed uses separate monthly capitation rates for dialysis patients and those who have functioning kidney grafts. These payments are risk adjusted to reduce risk selection incentives and impacts. Lump sum event payments also are provided to cover the expected incremental costs for the high-cost events of kidney transplantation or graft failure. Fixed loss outlier payments for unusually expensive patients are provided to mitigate health plan risk. This method demonstrates how components may be designed to reflect clinical treatment processes, and how payment adjustments may be used to manage health plans' risk.

Payment Components and Choice of Modality

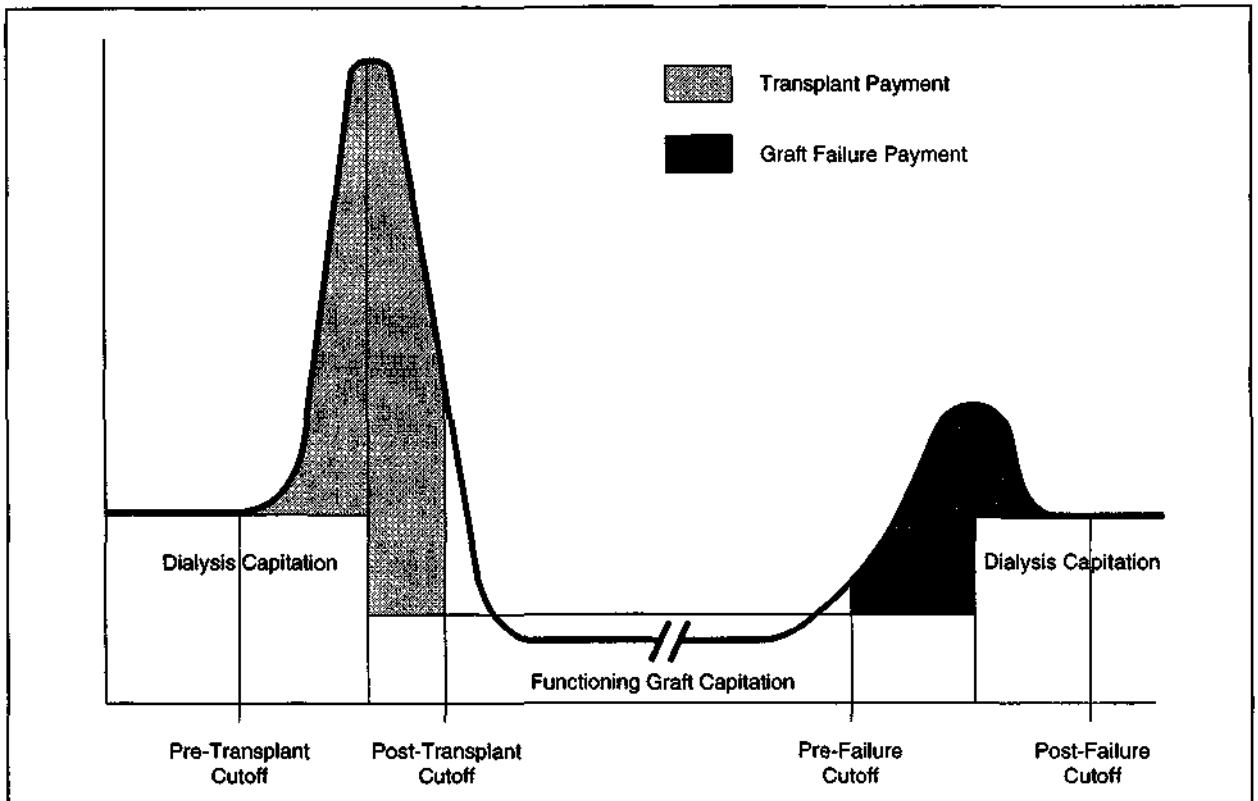
Most new Medicare ESRD beneficiaries are dialysis patients, but some patients change treatment modality over time. Some discontinue dialysis when a kidney transplant becomes available, and some of those with transplants experience graft failure, causing them to return to dialysis treatment. Dialysis patients also may change between hemodialysis and peritoneal dialysis. A conceptual diagram of patients' ESRD treatment status and expense profile over time, presented in Figure 1, highlights how health service expenses for ESRD patients vary with changing treatment modality. The four components of the ESRD modified capitation method are shown as they relate to each treatment status.

Capitation payments are used as the foundation of the ESRD payment method, in order to retain as much as possible of capitation's efficiency incentives. Separate capitation rates are defined for groups of patients using different modalities if the groups are clearly identifiable, of stable composition, and have substantial differences in their service patterns and expected costs of care. Consistent with these criteria, we defined separate capitation rates for dialysis patients and patients with functioning grafts. We then decided how to define capitation rates for dialysis patients and how to structure payments for kidney transplants and graft failures.

One capitation rate could be established for all dialysis patients, or different rates could be used for those on hemodialysis and peritoneal dialysis. Hemodialysis and peritoneal dialysis patients have similar overall patterns of care and they can (and many do) switch between the two dialysis modalities, although peritoneal dialysis patients tend to be healthier and their total

Figure 1

Average Expenses and Capitation Payment Components for a Sequence of ESRD Treatment



SOURCE: Farley, D.O., Carter, G.M., Kallich, J.D., Lucas, T.W., and Spritzer, K.L., 1996.

costs may be lower. Lacking clear justification for separate groups, we defined one capitation rate for all dialysis patients. One rate would encourage use of peritoneal dialysis (which is less expensive) for patients who are clinically viable candidates. For hemodialysis patients, however, payments that were lower than under separate rates might affect quality. Risk adjustment could manage some of these cost differences by adjusting payments for differences in expected costs based on measurable patient characteristics.

Kidney transplantation is a single, high-cost event that can return a patient to normal kidney function. Transplantation is the preferred ESRD treatment modality because it offers patients better quality of life, and it has been found to be more cost effective than chronic dialysis (Eggers, 1992). A finite supply of donor organs will be the primary barrier to kidney transplantation for the foreseeable future. For those patients who have access to a new kidney, however, we want a payment method that will not influence patients and physicians in either direction with respect to their choice of transplantation as a treatment modality.

If payments for transplantations were included in the functioning graft capitation payments following a transplant, health plans would have an incentive to not use transplantation. They would be at risk for the extraordinary costs of transplants, for which they would receive payments only gradually over time. Because Medicare currently covers patients for only 3 years following transplant, which is shorter than the transplantation break-even point (Eggers, 1992), health plans

never could recover their transplantation costs. Plans with patients who moved to another plan or died soon after transplantation also would be underpaid compared with other plans.

Because some of the transplanted kidneys do not survive, the risk of graft failure costs also influences health plans' incentives. It is difficult to predict how including expected graft failure costs in a capitation payment might affect these incentives. Although graft failures are less costly on average than transplants, as discussed later, their costs vary widely and some are extremely expensive. Health plans might discourage transplantation if they perceived they were too much at risk for graft failure expenses. Conversely, clinical intervention or improved selection of transplant candidates may reduce graft failure frequency. If so, including graft failure expenses in a monthly capitation payment would give health plans a financial incentive to improve patient outcomes.

We chose to use separate, prospectively determined lump sum payments that cover the expected incremental costs of a transplant event or a graft failure event. This type of event payment retains some of the incentives of capitation payment while avoiding undue health plan risk created by fully capitating expensive events in a monthly payment. Because transplants of live donor kidneys are more expensive than those of cadaver donors, an argument could be made for establishing different event payments for each type of transplant to avoid discouraging live donor transplants.

Selection Bias and Financial Risk

One inherent problem of capitation payment is selection bias, where the average health care costs of the ESRD enrollees in a health plan differ from the expected expenses of the entire Medicare ESRD population. Although selection bias may be mitigated by risk-adjusting capitation payments to account for expected differences in health care costs across patients, risk adjustment methods have been able to predict very little of the variance in individual patients' costs (Eggers and Prihoda 1982; Beebe, Lubitz, and Eggers, 1985; Lubitz, Beebe, and Riley, 1985; Anderson, Steinberg, and Holloway, 1986; Ash, Porell, and Gruenberg, 1989; Newhouse, Manning, and Keeler, 1989). We tested risk adjustment of the capitation payments for dialysis patients.

Health plans also are at risk for patients who incur extraordinary expenses that cannot be predicted in advance. A payment system that provides reinsurance to mitigate risks of such catastrophic costs may be more attractive to health plans. This mechanism could be especially important for health plans with small total enrollments, which would have limited capacity to absorb extraordinary costs for a few ESRD beneficiaries who experienced complications.

An alternative approach that might address issues of both risk selection and high cost patients is to use some form of partial capitation that bases payments partly on the capitation rate and partly on a health plan's actual service use experience (Wallack, Tompkins, and Gruenberg, 1988; Newhouse 1994). For example, using a blended rate payment, Medicare might pay a health plan 60 percent of the capitation rate for a dialysis patient plus 40 percent of the FFS payments for the services that actually were provided to the patient. Such a payment approach would seek a balance between cost-control incentives and protection from risk selection or health plan financial risk. We did not use partial capitation for the ESRD modified capitation method because we sought an alternative that preserved as much as possible of capitation's incentives. Such meth-

ods merit consideration as more experience in their use is gained.

METHODS AND DATA

Both clinical information on the treatment processes and data on actual payment patterns were used to develop the modified capitation payment method. An advisory committee of individuals who are experienced in ESRD service delivery helped make the payment design responsive to how health care is delivered for ESRD patients. Medicare expenditures data were used to analyze patterns of actual FFS expenses for ESRD beneficiaries and to estimate each of the components of a capitated payment method. The methods we used, which are summarized here, are described in detail in the study report (Farley et al., 1994).

The Data and Sample

The payment data used were 1990 Medicare claims data for all ESRD patients who had Medicare as primary payer for at least part of 1990 and were not enrolled in health maintenance organizations (HMOs) during the year. Information on patient characteristics and ESRD entitlement was obtained from the master ESRD beneficiary records. Kidney acquisition costs were estimated using the average 1990 pass-through reimbursement per kidney for each transplant hospital, which had been estimated by HCFA.

Because use patterns and payment methods for erythropoietin (EPO) treatment for dialysis patients still were evolving in 1990, EPO expenditure data for that year were not representative of current EPO expenses. An average monthly EPO payment amount per dialysis patient was estimated using 1992 data, which was the most recent available data. The price per unit of EPO was the same in 1990 and 1992, so we used the expense data without correction for inflation.

The payment amount estimated was the total payment that included both the Medicare and beneficiary (deductibles and copayments) shares. This amount is comparable to the allowed charges used for Part B FFS claims, of which beneficiaries pay a percentage. Separate policy would determine the beneficiary share of a capitation payment rate, which might differ from that for the FFS sector. Payments for Part A and Part B services were estimated separately because their sources of funds are separate. Part A services are paid from the Medicare Hospital Insurance Trust Fund, and funds to pay for Part B services come from premiums paid by beneficiaries and general revenues.

We simulated payments for physician services and inpatient hospital services as they would be under current Medicare policy and average 1990 payment rates. We used actual payments reported in the Medicare claims for the remaining services. All analyses were performed using payments that were standardized for input prices to national average constant dollars. For hospital inpatient service payments, adjustments for urban location and teaching or disproportionate share hospitals also were removed.[2]

The total sample was 171,745 ESRD beneficiaries, from which two patient groups were established. The first group was 142,261 patients who used dialysis services in 1990. The second group was 34,839 patients who had functioning grafts during that year. Included in both groups were 5,355 patients who either

[2]Payments for physician services were simulated using procedure codes reported in Medicare claims and published Medicare fee schedule relative value units and geographic adjusters. Payments for hospital inpatient stays were simulated using MedPAR data, published diagnosis-related group (DRG) weights, and other adjustments provided by HCFA. Details of these methods are described in the study report (Farley et al., 1994).

received a kidney transplant or experienced graft failure in 1990, and who therefore used dialysis treatment and had functioning grafts during different portions of the year.

Calculating the Payment Components

The unit of analysis was payments per person-month of entitlement with Medicare as primary payer. Because patients were Medicare beneficiaries for varying portions of the year, we defined a service period for each patient as the period of time that the patient was "at risk" of using health care services. This was done by identifying the first and last dates of service during 1990 where Medicare was primary payer, using dates of service and primary payer status reported on claims and dates of ESRD eligibility.[3] Primary payer status is reported on each claim. We included in the analysis only claims for which Medicare was identified as primary payer.

To estimate the capitation payment components, we defined separate service periods for dialysis treatment and functioning graft status, and then we assigned the service claims for each patient to the relevant service period. For those who always were dialysis patients, or always had functioning grafts, their entire service periods were identified for the relevant group.

For those who had a transplant or graft failure during the year, their service periods were divided into a dialysis service period and a functioning graft period by defining cutoff dates based on dates of transplantation or graft failure. Dialysis periods were defined to begin 30 days after a graft failure or end 30 days before a transplant. These cutoffs were selected so that expenses associated with transplantation or graft failure were not included in a dialysis capitation payment.[4] The functioning graft periods began 15 days following a transplant event or ended 30 days before a graft failure event. These cutoffs include in the functioning graft payment a portion of the expenses of transplant complications or graft failures, to encourage clinical intervention to reduce the frequency of transplant complications and graft failures.

After service claims were assigned to patients' dialysis and functioning graft service periods, we estimated monthly capitation payment amounts for each group. We then estimated the lump sum transplant and graft failure event payments using the balance of patients' claims not already assigned to dialysis or functioning graft service periods.

ESTIMATED PAYMENT COMPONENTS

Reported here are expected expenses that were estimated for each of the four components identified for this modified capitation method: monthly per capita expenses for dialysis and functioning graft patients, and expected lump sum expenses for the events of kidney transplant and graft failure. In addition, findings are presented regarding methods developed for risk adjustment of capitation payments for dialysis patients and outlier payments for unusually expensive patients. Although we did not test risk adjustments for functioning graft capitation payments, our analysis indicates that risk adjustment could be as important for this patient group as for dialysis patients. We found that functioning graft patients are almost as heterogeneous as dialysis patients, and their average monthly expenses vary by patient characteristics.

[3]The first date of service was defined as the latest of: the first service claim for which Medicare was coded as primary payer, the date of ESRD eligibility, or the first day of 1990. The last date of service was the earliest of: the date of death, date of termination of entitlement, or the last day of 1990.

[4]Physicians on the advisory committee indicated that the 30-day cutoff before kidney transplant may be farther from the event than necessary, because service levels remain fairly stable until shortly before hospitalization for transplant surgery. We found that use of a shorter cutoff (e.g., 15 days) would have little effect on estimates of average monthly payments.

The modified capitation payment method developed in this study explains 25 percent of the variance in annual service expenses per ESRD patient before adding outlier payments.[5] Payment elements that contribute to this explanatory power are the separate capitation payments for dialysis and functioning graft patients, risk adjustment of dialysis capitation payments, and the use of lump sum payments. The percentage of variance explained would increase if functioning graft payments also were risk adjusted.

Estimation of Monthly Capitation Payment Rates

Means and standard deviations for Part A and Part B monthly expenditures for dialysis patients and functioning graft patients are presented in Table 1. Total expected monthly expenses (the sum of Part A and Part B) were $3,715 for dialysis patients and $908 for functioning graft patients. All but a small percentage of total Part A expenses were for hospital inpatient services. Almost 58 percent of the Part B expenses for dialysis patients was for routine dialysis treatment services, while most of the Part B expenses for functioning graft patients was for other outpatient services. The expected expense for EPO treatment was 8.9 percent of total estimated monthly expenditures (Part A + Part B + EPO) for dialysis patients.

Risk Adjustment of Dialysis Capitation Rates

The method we tested for risk adjusting capitation payments for dialysis patients used weighted regression models to predict expected Part A and Part B monthly expenses per patient. As discussed, separate Part A and Part B models were estimated to conform with separate Medicare trust fund requirements.[6] Additive models were used in which the dependent variables were the standardized monthly expenses for each dialysis patient. Patient characteristics were used as risk factors for service usage, and patients' expenses were weighted by their dialysis service periods. The predicted values from these models are the risk-adjusted dialysis capitation payments. Risk factors found to be statistically significant (usually $p < .001$) were retained in the final formulas.

In specifying the regression models, we tested both additive and log linear models, and we also tested how outlier patients with unusually large monthly expenses affected the models. We found that the additive and log linear models performed similarly. Outlier patients had little effect on the estimated risk factors, although excluding outliers increased the percentage of variation explained by the models. We chose an additive model because it would be easier to understand and administer than a log linear model, particularly the simplicity of its risk adjustment calculations. On the other hand, we erred toward comprehensiveness in selecting variables for the models reported here, to provide detailed information on how various patient characteristics affect expected monthly expenses. A smaller set of adjusters would be advisable for implementing such a risk adjustment, for both parsimony and administrative simplicity.

The risk factor coefficients for the Part A and Part B risk-adjustment models are given in Table 2. Diabetes was the strongest risk factor for both Part A and Part B expenses, and very young or very old age

[5]This estimate is based on Efron's R-square, which is equal to 1-variance(predicted-actual)/variance(actual). In this case, the predicted is the total payments per ESRD patient that would have been made in 1990 under this method (the sum of all risk-adjusted monthly capitation payments and any lump sum payments for transplant or graft failure) and the actual is the total 1990 expenses per patient.

[6]Risk adjusters could be developed for the sum of Part A and B payments, but it would be necessary to identify the Part A share of the final risk adjusted payment.

Table 1.

Estimated Average 1990 Monthly Standardized Expenditures for Dialysis and Functioning Graft Patients, by Service Category

	Dialysis Patients			Functioning Graft Patients		
Service Category	Mean	Standard Deviation	Percent	Mean	Standard Deviation	Percent
Hospital Inpatient Stays	$1,297	$2,630	96.5	$459	$1,656	97.2
Post-Hospital Services	47	222	3.5	13	108	2.8
Total Part A	1,344	2,683	100.0	472	1,677	100.0
Outpatient Dialysis	1,180	538	57.6	18	156	4.1
Physician Dialysis Supervision						
Routine Monthly (MCP)	125	135	6.1	2	23	0.5
Other Outpatient	5	66	0.2	<1	4	0.0
Inpatient	55	125	2.7	3	36	0.7
Other Physician Services						
Outpatient	86	142	4.2	77	102	17.7
Inpatient	228	548	11.1	93	281	21.3
Other Outpatient Services	370	538	18.1	243	413	55.7
Total Part B	2,049	1,096	100.0	436	644	100.0
Erythropoeitin Treatment	322	—	—	—	—	—
Total Standardized Payment	3,715	—	—	908	—	—

NOTE: Averages are weighted using patient period of service. MCP is monthly capitation payment.

SOURCE: Analysis by the authors using 1990 data from the Medicare Master file for end stage renal disease beneficiaries, 100 percent claims for Part A and Part B services, and estimates of erythropioetin and kidney acquisition costs provided by the Health Care Financing Administration.

were important factors for Part A expenses. The significant continuous variable for age, combined with categorical age variables, indicate that Part A expenses increase with age within each age category. The base payment of $1,336 per month for Part B services was the majority of the payment, reflecting the dialysis treatment expenses that are a large fraction of Part B payments.

The Part A risk-adjustment model controls for the higher costs incurred by patients who received Medicare coverage, with Medicare as primary payer, within 30 days of renal failure. The coefficient for this variable, when multiplied by the average number of months of service per new patient, is equivalent to a one-time adjustment of $6,777. Including this payment in the model avoids overpaying for established patients who have lower costs, but health plans should not be paid such an adjustment. Plans could game the payments by enrolling new patients after they are discharged from a hospital stay in which renal failure occurred, thus obtaining higher payments while avoiding hospitalization costs.

The models created sizable variations in payment rates among groups of dialysis patients, even though they did not explain much of the total variation in expenses. We found that the total variation was influenced by a relatively small number of high cost patients. A reinsurance method that protects health care plans from these extremely expensive patients could further mitigate health plan financial risk.

Estimation of Transplantation and Graft Failure Event Payments

The prospective lump sum event payments were estimated as the average incremental payment amounts for the groups of patients who had only one event (either transplant or graft failure) during 1990. The estimated average net expenditures for these events, which would serve as the basis for the event payments, are reported

Table 2

Estimated Risk Adjustment Factors and Coefficients for Dialysis Patients

Measure	Part A Coefficient	Part A Standard Error	Part B Coefficient	Part B Standard Error
Base Payment (Intercept)	742	57	1,336	23
Years Since Renal Failure	11	7	134	4.5
Years Since Failure-Squared	—	—	-4.3	0.2
Patient Is Male	-108	14	-87	6
Patient Has Diabetes	759	77	289	32
Patient Has Failed Transplant	115	30	44	13
Patient Age in Years	5.8	1.1	6.5	0.4
Age Group 0-3 Years	986	287	—	—
Age Group 4-18 Years	167	85	—	—
Age Group 65+ Years	—	—	115	12
Age Group 65-74 Years	223	29	—	—
Age Group 75+ Years	335	39	—	—
Old Age Medicare Eligibility	80	28	142	11
Disability Medicare Eligibility	278	18	191	7
Interactions				
Patient Age and Diabetes	-9.4	1.2	-2.2	0.5
Patient Age and Years With ESRD	-0.7	0.1	-1.1	0.1
Years With ESRD and Diabetes	41.5	6.9	18.9	2.9
Renal Failure in Past 30 Days**	1155	145	—	—
R-square	0.0354		0.0301	

**This coefficient is converted into a one-time adjustment of $6,777 by multiplying the coefficient by the average period of service for patients with renal failure occurring in the past 30 days.

NOTE: ESRD is end stage renal disease.

SOURCE: Analysis by the authors using 1990 data from the Medicare Master file for end stage renal disease beneficiaries, 100 percent claims for Part A and Part B services, and estimates of erythropioetin and kidney acquisition costs provided by the Health Care Financing Administration.

in Table 3. Graft failure expenses vary more relative to their mean than do transplant expenses. Some of the apparently smaller variation in transplant expenses is due to the use of hospital-average transplant costs in estimating payments. Some also is because the type and quantity of medical interventions involved with graft failures vary more than those for transplant procedures, depending on the severity of complications.

Outlier Payments for High-Cost Patients

As discussed, risk adjustment of capitation payments has a limited effect on the financial impact of unusually expensive ESRD patients on health plans. Various reinsurance mechanisms might be used in a payment system to protect health plans from undue financial risk from these patients, which in turn could protect patients' access to quality care. These include, for example, private stop-loss insurance on an individual or aggregate basis, outlier payments that would be administered by Medicare, or other forms of partial capitation payment methods.

We developed and tested an outlier payment option that is analogous to cost outliers under Medicare prospective payment system (PPS). When a health plan's expenses for a particular patient exceeded a threshold, Medicare would reimburse the plan for a specified fraction of all expenses incurred in excess of the threshold. This insurance fraction can be used to balance the benefits of insurance (protection against financial risk to the plan, mitigation of access and under service problems for costly patients) against

Table 3

Estimated Lump Sum Incremental Standardized Expenditures for Kidney Transplants and Graft Failures

Status	Part A	Part B
Kidney Transplant		
Mean	$33,971	$3,948
Standard Deviation	28,479	3,889
Graft Failure		
Mean	8,958	3,167
Standard Deviation	19,433	3,780

SOURCE: Analysis by the authors using 1990 data from the Medicare Master file for end stage renal disease beneficiaries, 100 percent claims for Part A and Part B services, and estimates of erythropoietin and kidney acquisition costs provided by the Health Care Financing Administration.

moral hazard (overconsumption of insured services). Use of a lower threshold or higher insurance fraction would increase protection from risk for health plans. The capitation rate would be reduced by some percentage to set aside funds as an outlier pool.

The outlier policy we selected is a fixed loss policy that would pay 75 percent of the loss for cases that experience an annual loss of a standardized value of $50,000 or more. Loss was calculated as the difference between a patient's total actual expenses for 1990 and total estimated payments under the modified capitation method. For any fixed total amount of outlier payments, this policy minimizes the standard deviation of losses across patients and therefore maximizes insurance (subject to certain constraints; see Keeler, Carter, and Trude, 1988). The $50,000 threshold was chosen to provide outlier payments for approximately 1 percent of patients. The threshold was adjusted for geographic variation in costs. For each outlier case, we allocated the outlier payments to Part A and Part B based on standardized expenses.

In selecting this design, we observed the distribution of estimated losses for ESRD patients in the sample and chose a level of risk protection. An estimated 4.5 percent of total Part A payments and 1.3 percent of total Part B payments went to outlier payments. Other choices could be made, depending on how much risk protection was desired.

To examine the effects of this outlier payment policy on health plan financial risk, we simulated modified capitation payments with and without outlier payments. Financial risk was defined as the expected standard deviation of a health plan's annual profit, expressed as a percentage of revenues, using the methodology developed in Keeler, Carter, and Trude (1988). The numerator represents the greater risk created for health plans by uncertain profit, while the denominator reflects the effect of a larger revenue base on lowering health plan risk. This measure assumes that plans have a random draw of patients, and plan profits for those patients are normally distributed. Thus, for an estimated risk of 7 percent, 16 percent of health plans (at one standard deviation of profit) would have losses that exceeded 7 percent of revenues. Similarly, 5 percent of plans would have losses that exceeded 11.5 percent (1.64 x 7) of revenues.

The addition of outlier payments was estimated to reduce health plan risk by about 15 percent for all plan sizes (for example from 2.58 percent to 2.21 percent for plans with 1,000 enrollees), as shown in Table 4. Outlier payments reduced risk slightly more for urban than rural locations. Health plan risk is smaller for larger enrollments because a health plan's revenue base is larger relative to the standard deviation of its profit. For any given enrollment size, plans serving urban areas are estimated to have higher risk than those in rural locations.

DISCUSSION

This study designed and tested a modified capitation payment option for ESRD patients that is intended to create financial incentives compatible with ESRD clinical

Table 4

Estimated Health Plan Risk by Size of Patient Enrollment, by Urban and Rural Location

Size of Plan Enrollment	All Patients	Urban	Rural
Without Outlier Payments		Percent	
100	8.2	8.4	7.4
500	3.7	3.8	3.3
1,000	2.6	2.7	2.3
5,000	1.2	1.2	1.1
With Outlier Payments			
100	7.0	7.1	6.7
500	3.1	3.2	3.0
1,000	2.2	2.2	2.1
5,000	1.0	1.0	0.9

NOTE: Risk is measured as the standard deviation of profit as a percentage of total revenue.

SOURCE: Analysis by the authors using 1990 data from the Medicare Master file for end stage renal disease beneficiaries, 100 percent claims for Part A and Part B services, and estimates of erythropioetin and kidney acquisition costs provided by the Health Care Financing Administration.

treatment protocols. Our advisory committee helped to verify its face validity through clinical review of the payment design and components. Findings that the payment method explained over 25 percent of the variance in ESRD patients' total expenses, and that addition of outlier payments could mitigate risk by 15 percent, also suggest its potential to achieve this purpose.

This work is but one step in the development of a new capitation method for the ESRD program. Further design work remains to be done for this model, and other options also should be explored as experience with capitation payment is gained in the ESRD community. The technical and administrative feasibility of any capitation method ultimately must be tested in field applications. An ESRD capitation demonstration project currently is being initiated to do so. Among the factors that such a project should assess are the ease of use of a payment method, how well payments reflect health plan costs for their ESRD enrollees, effects on choice of treatment modality, and effects on quality or access to care.

Using Medicare claims data, we were able to develop a payment method based on actual expenditure experience for ESRD patients. These data provide rich information on patterns of care that helped to inform our payment design decisions. They have some limitations, however, that can influence payment estimates. For example, we found some patients who appeared to have incomplete claims information. The 2-year delay before complete claims data are available is one reason for incomplete data, and old data make it difficult to estimate current costs accurately, particularly for a rapidly changing technology such as EPO treatment. It also is difficult to accurately assign claims for services to separate service episodes that occur close together in time, such as services related to kidney transplantation and subsequent services for a patient with a functioning graft. In addition, the types of clinical information reported on claims are limited, which restricts the choice of adjusters for risk-adjustment methods.

The payment estimates for this capitation method reflect existing payment levels for individual services because they were developed so that total capitation payments for ESRD enrollees would be budget neutral to those Medicare would have made under its current payment system. The ESRD community has expressed concern for some time that low payments for dialysis treatments are contributing to inadequate care for ESRD patients. This is an important issue for both FFS and capitation payment methods. If it was decided to increase dialysis treatment payments to reflect higher service costs, this could be done readily for either payment system.

We identified several design and technical issues to be resolved before this modified capitation payment method could be introduced effectively.[7] One of these is the use of time cutoffs for defining payment component service periods. These cutoffs

[7]Additional issues were identified that are not discussed here in the interest of brevity. Refer to Farley et al. (1994) for a comprehensive discussion of these issues, including refinement of payment estimates with more current data, methods to define patient groups, size of reinsurance protection, and geographic adjustment methods to establish actual local payment rates.

create boundaries between different service episodes that require clinical judgements on when an episode begins and ends. For ESRD patients, our choice of cutoffs created payment subsidies across patient groups, partly by design and partly because of the timing of individual service claims. For example, we selected the cutoffs for the functioning graft service period to average part of the incremental expenses associated with transplant complications or graft failures across all patients with functioning grafts. Thus, while this approach could stimulate proactive treatment to reduce transplant complications and graft failure, it also could discourage health plans from using kidney transplants because it underpays for transplants.

Another issue is risk adjustment. We found that risk adjustment of payments for dialysis patients captured variations in costs across patient groups, although it explained only a small percentage of the variation across individuals. Additional risk factors for comorbidities could improve its explanatory power. Expenses for functioning graft patients also varied widely, suggesting that their monthly capitation payments should be risk-adjusted.

Design of event payments for transplants and graft failures that occur close together also should be undertaken as a refinement to the payment method. We estimated expected expenditures for transplant and graft failure events that are not accompanied by another event, so we could isolate the costs of each event. Costs probably are higher for combined events than for just one event, although they may not reach the sum of the costs for two separate events.

Any payment methods that involve sharing or assumption of financial risk by health plans involve risks of negative consequences for enrollees due to the cost control incentives created for health plans. Such payment systems usually establish policies to provide enrollee protections. The Medicare risk program, for example, requires access to enrollment in all plans, beneficiary information on any restrictions that plans place on choice of health care providers, quality assurance programs, grievance and appeals procedures, and plan performance and financial solvency standards.

Although enrollee protection policies for the ESRD enrollees would be similar to those for other Medicare beneficiaries, these policies may be yet more important for ESRD enrollees. These chronically ill patients tend to have multiple comorbidities, complex health care requirements, and high costs of care. They, therefore, may be especially vulnerable to reductions in access or quality resulting from cost cutting actions by plans. Because this article is limited to the design of a capitation payment method, we do not address the many decisions involved in establishing beneficiary protection policies for a Medicare ESRD capitation payment system. Their importance to the ultimate success of such a system for ESRD patients, however, cannot be overstated. Provisions should include standards for internal quality assurance programs by plans and external monitoring of access to care, clinical quality, and patient satisfaction.

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