Simulating the impact of case-mix adjusted hospice rates

by Vincent Mor and Linda Laliberte

The Medicare hospice benefit prospectively reimburses hospices based on the inpatient status of the patient, whether or not the patient is at home, and whether the patient is receiving round-the-clock nursing. Using National Hospice Study data, two case-mix adjusters based on patient functioning and living arrangement were found to be significantly related to per diem cost. These were tested by simulating their impact on hospice revenues. Increasing per diem reimbursements 35 percent for nonambulatory patients living alone only increases hospice revenues by 4 percent; hospices with sicker patients benefit the most.

Introduction

The apparent success of a case-mix adjusted prospective payment system (PPS) strategy in reducing hospital stays has generated interest in applying similar approaches to other sectors of the health care system (Guterman and Dobson, 1986). Current efforts to test case-mix-based prospective reimbursement for nursing homes emerged as a reaction to the increasing cost of nursing home care and budget constraints at both Federal and State levels (Health Care Financing Administration, 1984; Smits, 1984; Cameron and Kanuf, 1982; Shanks et al., 1983; Stassen and Bishop, 1983; Cameron, 1985; Sulvetta and Holahan, 1986). Existing reimbursement systems that adjust for case mix are now being used in Illinois, West Virginia, Ohio, New York, Minnesota, and Maryland. Demonstrations with PPS have also recently been initiated in the home health care sector (Health Care Financing Administration, 1984).

The growth of the hospice movement during the past decade and the extension of the Medicare benefit to cover these services created a new class of Medicare provider. From the outset, Health Care Financing Administration (HCFA) staff charged with developing regulations to implement the hospice benefit legislation focused their examination of reimbursement options on PPS. The current system has prospective rates for types of days under hospice care: inpatient, home, respite, and continuous care. Evidence from the National Hospice Study (NHS) suggests that patient characteristics are significantly related to resource consumption (Birnbaum and Kidder, 1984; Mor and Kiddder, 1985). We also observed substantial between-hospice variability in patient characteristics on hospice admission (Mor, Wachtel, and Kidder, 1985; Greer et al., 1986). In view of these facts, we examined the feasibility of using case-mix adjusted rates to provide a more equitable method of reimbursement. Using data from the NHS demonstration project, we describe two approaches to measuring case mix in hospices and present the results of analyses that simulated the impact of those adjustments on the revenue that would accrue to participating demonstration hospices had they been in effect.

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Related literature

Case-mix is generally conceived of as the proportion of types of patients in a particular setting. In the acute care sector, diagnosis-related groups (DRG's) emerged as an effort to adjust for case mix to impose cost-control measures equitably across hospitals (Ament et al., 1982; Young, Swinkola, and Marn, 1982). The fundamental assumption of any case-mix adjusted reimbursement scheme is that the classification is related to patient resource needs. Facilities serving sicker patients logically devote more resources per patient. In the long-term care sector, a multitude of case-mix models have been formulated (McCaffree, Baker, and Perrin, 1979; Katz and Akpom, 1976; Jones, McNitt, and McKnight, 1973; Densen, Jones, and McNitt, 1976; Skinner and Yett, 1973; Shaughnessy et al., 1985; Caviola and Young, 1980; Fries and Cooney, 1984). The most widely used approaches are based on diagnosis and symptoms, functional status, and service use. Diagnostic-based categorizations in long-term care have met with only limited success. McCaffree (1979) found little relationship between patient diagnosis and staff time devoted to the patient. Fries and Cooney (1984) similarly found no relationship between diagnosis and variation in patient care needs.

Numerous studies have found a strong relationship between functional status and nursing care needs as well as morbidity and survival in the aged (Mor and Sherwood, 1981; Densen, Jones, and McNitt, 1976; Sutton, 1977; Shaughnessy et al., 1985). Measured in terms of ability to perform activities of daily living, longitudinal surveys of the aged, no matter what the setting, uniformly find that more functionally impaired persons have a greater risk of dying than those not so impaired (Whitelaw and Stewart, 1978; Katz et al., 1983). Similarly, patient care needs are related to the functional status approach (Foley and Schneider, 1980).

Ideally, a reimbursement system should reimburse for legitimate costs, encourage the efficient use of resources, ensure the provision of quality care that meets the needs of patients, allow the flexibility to adjust the supply of services to changing demand, and provide a simple method to assess, monitor, and enforce the system. PPS establishes payment rates prior to service delivery, thereby providing an incentive to keep costs within projected revenues. Without case-mix adjustment, a disincentive to provide care to high-cost patients exists, because reimbursements are lower than the true cost of their care.

As evidenced by the plethora of alternative approaches or adjustments to DRG's that have been proposed in the last several years, the validity of the case-mix measure is a major factor in determining whether case-mix adjusted reimbursement will be perceived to be equitable (Smits, 1984). Diagnoses and procedures are applied in the acute care sector, while measures of function and service use are proposed in long-term care. In the hospice arena, both patient functioning on admission as well as living arrangement have been associated with service costs, with those living alone using nearly twice the resources of those with family. Although a similar pattern was found among patients admitted to home care (HC) and hospital-based (HB) hospices,[1] the mix of patients served varied considerably even within hospice type,[2] suggesting that hospice reimbursement might also benefit from case-mix adjustment.

Hospice legislation and regulations

The Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) altered existing eligibility requirements for Medicare reimbursement of home and inpatient care. Under the legislation, a physician's determination of the patient's terminal prognosis substitutes for the usual Medicare requirements such as being homebound and in need of skilled care that is a continuation of hospital care to receive home health benefits. Under the hospice benefit, patients have up to three periods of hospice eligibility. The first two periods are for 90 days each, and the last period is for 30 days. If patients survive beyond the 210 days of eligibility, hospices must continue to care for them without reimbursement.

Hospices are certified if they have certain types of staff available, have access to inpatient beds, use volunteers, have an interdisciplinary team responsible for managing patients' care, and offer a bereavement program. Only 20 percent of all patient care days provided in a year can be spent in an inpatient setting. There is a spending cap of $6,500 per patient averaged over all patients served in a year. The reimbursement system stipulates rates for each of four types of days a patient is under the care of a hospice: inpatient, respite, continuous care, and regular home care. The mix of days patients receive is constrained only by the 20 percent inpatient day limit and the $6,500 average per patient cap. Expenditures and revenues generated are based on the distribution of types of days all patients experience during a calendar year. For a hospice to break even financially, it must keep its costs in line with revenue based on the types of patient days experienced.

In this article, we summarize our efforts to develop an approach to case-mix adjusted reimbursement for the hospice benefit under TEFRA and then to apply that approach to the existing data set of Medicare patients who participated in the NHS demonstration. We developed two approaches that related patient characteristics to the costs patients incurred during hospice. The findings of each of these analyses were considered and incorporated into simulation analyses. These analyses were undertaken to examine the revenue implications of two alternative reimbursement schemes for hospices that participated in the NHS demonstration, assuming that they would behave in the same way then as under the current system.

Methods

The NHS methods, sampling frame, data sources, and results have been described in detail elsewhere (Greer et al., 1983; Greer et al., 1986; Greer et al., 1984; Mor, Greer, and Kastenbaum, in press). The data analyzed in this article include bills for demonstration hospice services, the Medicare Bill History File for regular Medicare Part A services, and basic demographic, medical, functional, and nursing care needs data abstracted from hospice records.

Analyses were performed on a sample of 6,913 home care (HC) and 4,090 hospital-based (HB) Medicare demonstration hospice patients. A subsample of all admissions was further analyzed to simulate alterations in reimbursement and includes only those patients with complete cost data who had a known termination status (either death or discharge) from hospice by November 30, 1983. The total sample in terms of demographic, medical, and support measures is shown in Table 1. The larger sample is virtually identical to the smaller.

Definition of cost

To overcome the influence of demonstration hospices' geographic distribution on their costs as well as the effects of idiosyncratic differences in pricing policies, measures of patient cost were developed

[1]Hospices can be divided into two types based on the availability of inpatient beds. Hospices with control over inpatient beds (HB) used more of this resource than did hospices without beds (HC). HB hospices' patients were more than twice as likely to die in an inpatient setting and on average spent over three times as many days in an inpatient setting as did patients served in home care (HC) hospices (Mor and Kidder, 1985; Greer et al., 1986).

[2]There was substantial variation even within hospice type; differences in pattern of care were substantial partially because of management practices and differences in the mix of patients admitted (Mor and Kidder, 1985; Mor, Wachtel, and Kidder, 1985).

Table 1

National Hospice Study Medicare demonstration hospice cost sample at time of admission, by hospice type and patient characteristic: United States, October 1, 1980—September 30, 1982

Variable	Percent of patients	
	Home care (HC)	Hospital-based (HB)
Total	4,834	2,111
Age		
21–64 years	12.3	11.0
65–74 years	47.8	50.2
75 years or over	39.9	38.9
Sex		
Male	50.4	49.5
Female	49.6	50.5
Marital status[1]		
Currently married	62.1	53.6
Not currently married	37.9	46.4
Family income[1]		
Less than $9,999	55.6	62.4
$10,000-$49,999	43.0	37.0
$50,000 or more	1.4	0.6
Patient living arrangement[1]		
Alone	9.1	19.6
Not alone	90.9	80.4
PCP relationship[1,2]		
Spouse	55.8	48.2
Child	27.8	34.4
Other	16.4	17.4
Race		
White	94.1	93.8
Other	5.9	6.2
Diagnosis		
Colon	13.4	15.3
Lung	22.5	20.9
Breast	8.7	9.6
Prostate	7.4	8.4
Other cancer	40.8	40.3
Noncancer	7.1	5.5
Functional status[1,3] (mean)	8.6	9.6
Prior utilization: Percent of HCFA[4] inpatient days 2 months before hospice enrollment	11.9	15.4

[1] Notes a significant chi square of F test (of $p < 0.01$) that indicates that the distributional pattern for the variable by type of hospice (HB/HC) was different from what would be expected by chance. Amounts will not add to total because of rounding.
[2] PCP: primary care person.
[3] Modified Katz Activity of Daily Living Scale rates a patient's functional status on a scale from 1 to 14; higher scores indicate less ability to function.
[4] HCFA: Health Care Financing Administration.
SOURCE: National Hospice Study intake record data.

based on utilization.[3] National Medicare reimbursement rates from 1982 were applied to utilization measures to arrive at representative cost estimates. Per-patient cost was calculated as the sum of nonhospice and hospice inpatient and home care costs. (Physician Part B costs were not included, although outpatient clinic costs under Part A were included.)

Nonhospice inpatient routine costs were calculated at the 1982 average rate of $156 per day. Nonhospice inpatient ancillary charges were converted to costs by first adjusting for the hospital's differential average ancillary charge when compared to the national average, then multiplying the adjusted charge by the national average Medicare ancillary cost-to-charge ratio. Nonhospice Medicare-reimbursed nursing home and home health agency services were set equal to charges, since analyses revealed reimbursement to be almost always equal to billed charges.

Hospice home service costs were computed separately for each demonstration hospice based on special hospice Medicare cost reports filed with the Health Care Financing Administration's Office of Direct Reimbursement. Unit costs so derived were then multiplied by utilization to calculate total costs. Because of the high variation in hospice inpatient per diem costs, we chose to inflate the $156 used for nonhospice inpatient per diem by 16 percent (the average difference between the hospice's inpatient routine and the inpatient routine costs of nonhospice beds in the same hospitals). Hospice inpatient ancillary service charges were converted to costs using the hospice-specific average ancillary cost-to-charge ratio from the cost report.

Approach to deriving case-mix adjusters

The analytic approach separately analyzes HB and HC hospices, since the mix of patients admitted to each of the two types of hospices and the pattern of services provided to patients differ considerably. Bivariate and multivariate analyses were conducted on the two populations of patients to identify correlates of length of stay. We also examined patient correlates of cost both per stay and per day. Variables found to be related to length of stay in either HB or HC samples were related to the cost measures. Multiple regression analyses were performed to predict cost per patient and cost per day to reduce the redundancy in the set of independent variables. Based on these analyses, the most salient predictors were selected as possible case-mix adjusters.

Modified hospice prospective payment system

In contemplating the optional reimbursement systems that could be case-mix adjusted, we were

[3] See Birnbaum and Kidder (1984) for a complete description of the methods used to develop the cost coefficients for multiplying various types of utilization.

guided by general policy principles. The system should pay the true cost of serving the mix of patients intended to be served under the legislation. It should allow flexibility in the ways hospices meet patients' needs. It should be easy to administer and should not require additional bureaucratic control structures to process cost and quality control information. A related stipulation is that the reimbursement system not contain any obvious perverse incentives that would, in and of themselves, require an extensive quality-review mechanism to ensure that a "good" reimbursement system could not lead to bad care. Finally, it should not require a major reworking of the administrative and claims-processing structure now in place.

Three reimbursement approaches were considered. A capitation approach is consistent with legislation that mandates the hospice as the fiscal and clinical arbiter of patient care and would pay the hospice per enrollee or per eligibility period. This approach would revamp the current payment system (based on four types of days of service), but contains obvious incentives to enroll patients close to death (while still receiving complete payment), or to hasten death. An overall per diem rate would also revamp the current system but without the negative incentives; in this case, however, the length-of-stay distribution and patient mix become crucial determinants of both revenues and costs. Modifying the home day rate to include a case-mix adjuster wold require the least modification to the current system, potentially simplifying it by eliminating one of the day rates—continuous nursing care days. Given the potential negative implications of a capitation approach for a terminal patient population, only the latter two reimbursement approaches were examined.

Reimbursement simulations were conducted to estimate the impact of altering the current reimbursement system on the revenue that would have accrued to the NHS demonstration hospices had they been operating under current regulations. We first calculated estimated revenue per patient and per hospice using rates in effect in 1985—$271 for an inpatient day, $53.16 for a home care day or a continuous care day. Under this reimbursement system, the average HB patient day would have generated $102, while the average HC patient day would have yielded $82. Since hospice reimbursement rates were higher than 1982 costs, as determined from the NHS cost methodology, revenues for almost all of the hospices exceeded their costs. Consequently, all analyses simulating the effect of case-mix adjustment were based on the estimated revenues. Examinations of the impact across hospice types and individual hospices are relative.

Case-mix adjustment was done by increasing the estimated per-patient revenue for a given reimbursement option (e.g., total or home care costs per day) by a percentage designated as the differential cost of patients having the designated case-mix adjustment attributes versus the average patient. The existing reimbursement rate was inflated for any day associated with such patients. We did not reduce the rate for the average patient. Therefore, all case-mix adjustment simulations yield a net increase in estimated revenue. Implementation of either of the approaches reported here could proportionately adjust downward the base rate for the average patient in order to yield a zero-sum gain across all hospices. We then calculated the net increase in revenues that would accrue to each hospice under both models. Simulations reflect the length of stay skew that comes from weighting by patient days.

Results

Bivariate analyses relating hospice length of stay to patients' sociodemographic, medical and functional, and support characteristics were performed to reduce the pool of variables for further analysis. These analyses were performed separately for the population of HB and HC patients. Kendall's correlations of length of stay were in the range of .24 to .29 for functional measures such as walking, dressing, and transfer. Cancer-type dummies had correlations of between .02 and .05 with length of stay. Noncancer patients had longer-than-average hospice stays in HC settings but shorter than average stays in HB settings. In both cases, however, the correlation was only .02. Patient requirements such as oxygen and catheters were related to length of stay between .03 and .10. Among the "support" measures found to be related to an increased length of stay were the patient's living arrangement and relationship of his or her primary care person. However, the magnitude of the correlations was small (.03 to .08) and stronger in HB than in HC settings. The differences in the pattern of correlations between HB and HC settings is consistent with the differences shown in Table 1. HB patients were more likely to live alone, to have an employed primary care person, and to be physically more impaired and incontinent at the time of admission (Mor, Wachtel, and Kidder, 1985).

After eliminating measures with no relationship to length of stay, multiple regression analysis was conducted, based on those measures related to prediction of length of stay at the univariate level in either the HB or the HC samples. We chose to retain parallel models, despite some of the differences in the characteristics of the two populations, because any reimbursement adjustment scheme would be likely to be common for both models. Results are presented in Table 2. In view of the substantial skew in the dependent variable (the small number of very-long-stay patients), a logarithmic transformation was performed prior to conducting the multiple regression analyses. These equations yielded relatively poor predictive power, even after the length-of-stay measure had been transformed. The R^2 for the HB equation is .18, while the R^2 for the HC equation is .17. Comparing the pattern of coefficients across the two models, we found that functional impairment measures were significant in both equations, while measures of disease type were moderately significant

Table 2

Results of a multivariate analysis of the logarithmic transformation of length of stay: National Hospice Study, 1984

Variables in equation	Standardized regression coefficient
Hospital-based	
Functional assessment: Bathe self	*** -.10488
Patient care requirement: Colostomy, ileostomy	.04805
Pancreatic cancer	-.04303
Patient care requirement: Intravenous	-.03655
PCP currently employed	-.00384
Patient age	.02997
Noncancer	-.01459
Patient care requirement: Oxygen, respiratory equipment	* -.07922
Male patient	-.04638
Patient disorientation	-.03628
Patient lives alone	.00758
Functional assessment: Bowel, bladder	*** -.19750
Functional assessment: Walk	* -.13077
Home care	
Functional assessment: Bathe self	*** -.14128
Patient care requirement: Intravenous	-.02023
Pancreatic cancer	** -.06580
Male patient	* -.05783
Patient age	.05092
Patient care requirement: Colostomy, ileostomy	*.04327
Patient care requirement: Oxygen, respiratory equipment	*** -.07147
PCP currently employed	.02182
Noncancer	***.08102
Patient lives alone	.00646
Patient disorientation	*** -.10186
Functional assessment: Bowel, bladder	*** -.11806
Functional assessment: Walk	*** -.14599

*$p < .05$
**$p < .01$
***$p < .001$

NOTES: PCP is primary care person. For hospital-based variables, R^2 is .18; for home care variables, R^2 is .17.

only in the HC equations. These analyses reconfirm the complexity of predicting survival using a standard regression approach (Mor et al., 1984).

Functional status and use of patient care procedures provide some statistical and meaningful understanding of how long patients stay in a hospice. Whether patients could walk independently was a strongly significant predictor of length of stay, followed by continence probability and living alone. Measures of functional status are indicators of the patients' proximity to death, since patients tend to proceed through a reasonably predictable process during the terminal stages of their illnesses (Morris et al., 1986).

Characteristics related to resource use

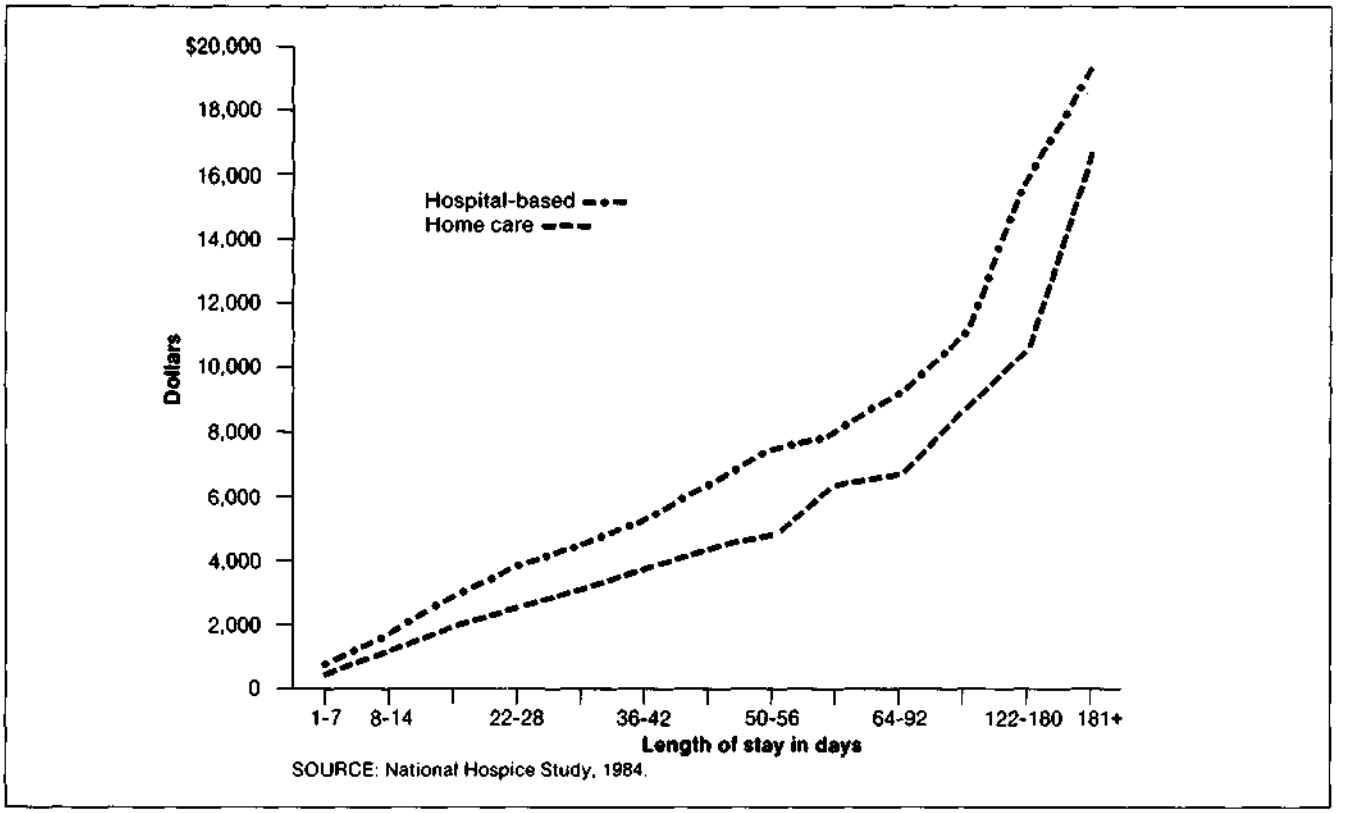
The relationship between length of stay and two measures of resource consumption is depicted in Figures 1 and 2 for both HB and HC hospice patients. Total cost per patient was significantly correlated with length of stay for both HB ($r = .61$) and HC ($r = .64$) hospices. The opposite relationship was served for cost per day, which was negatively correlated with length of stay for HB ($r = -.20$) and HC hospices ($r = -.17$). Patients with shorter lengths of stay had greater costs per day, and those with longer lengths of stay had lower costs per day. Examinations of costs over each of the last 6 months of life reveal that higher-functioning patients enter hospice earlier in the terminal phase; they require fewer services during the initial period of their hospice stay and incur relatively low costs per day (on average), although for a longer period of time than do lower-functioning patients (Mor and Kidder, 1985; Greer et al., 1986). Patients who function well on admission generally incur higher costs for their stay in hospice because their good function means they will have a longer survival than is the case with short-stay, intensive-service-use patients.

Multiple regression analysis was performed to examine those measures contributing to the prediction of cost per day. Cost per day was weighted according to the number of days each patient stayed in the hospice. The models included functional, medical, and support measures as was the case in predicting length of stay. The results are presented in Table 3. The proportion of variation in costs per day explained by the equations is small (R^2 of .06 and .02 for HB and HC, respectively). Clearly, patient characteristics alone do not determine daily intensity of care as measured by costs per day. Functional-status measures and patient care procedures were consistently significantly related to cost per day in both equations. Of the functional measures tested, ability to walk had the highest standardized regression coefficients in both the HB and HC equations. A measure defined as the interaction of living alone and dependency in ambulation (frail) was also significantly related to costs per day in both models. A patient was "frail" if he or she both lived alone and was dependent in ambulation. Once this indicator was included, the effect of living alone among HC patients was not significantly related to costs per day in the HC model, although "alone" continues to be significantly related to costs per day in the HB model. The strongest predictor of per diem costs is walking, and the second strongest predictor is an interaction term containing walking dependence and living alone.

Selecting a per diem adjustment

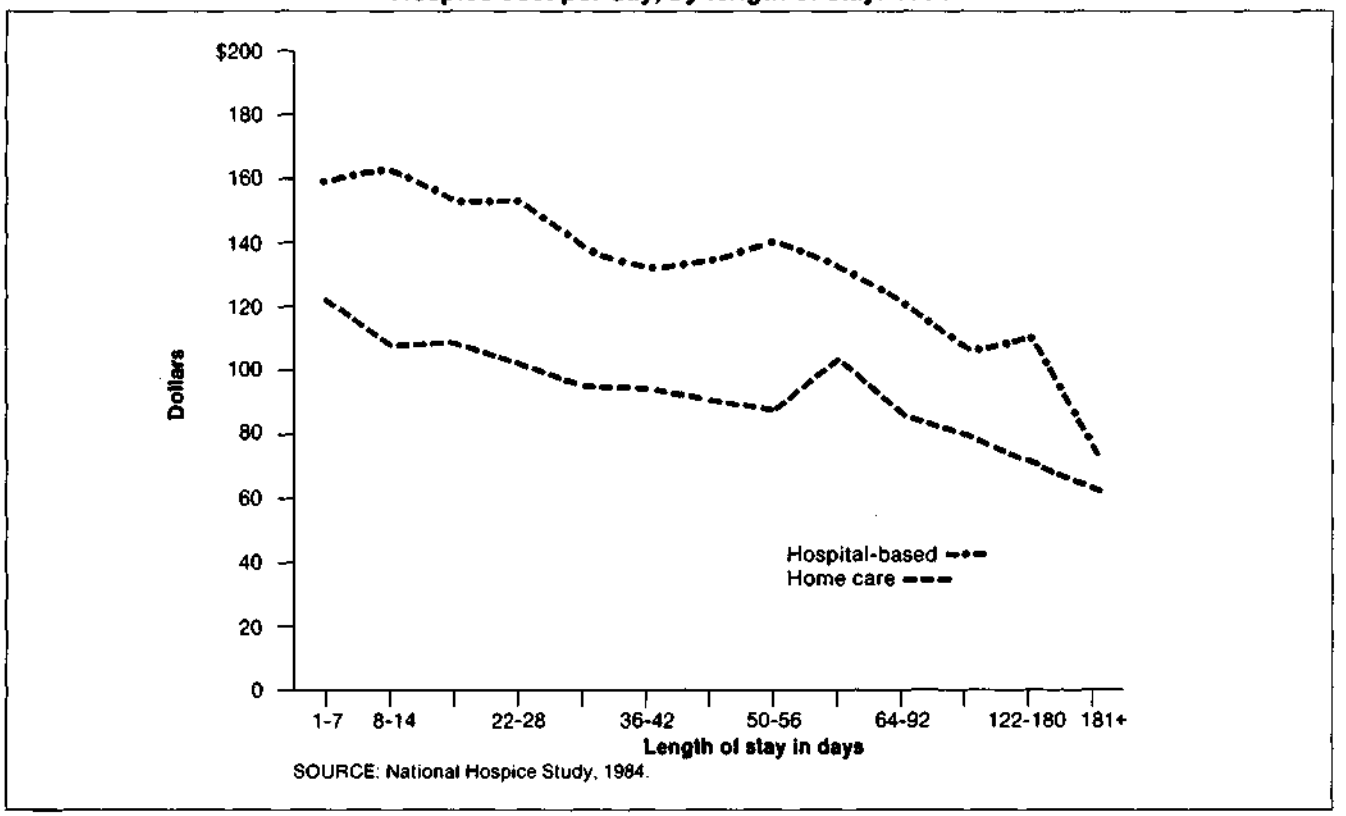
We have seen that cost per patient depends on length of stay and service intensity and that certain patient characteristics are related to cost per diem as well as cost per stay. In reviewing the observed pattern of relationships, we were acutely aware of the

Figure 1
Hospice cost per stay, by length of stay: 1984



SOURCE: National Hospice Study, 1984.

Figure 2
Hospice cost per day, by length of stay: 1984



SOURCE: National Hospice Study, 1984.

Table 3

Results of multivariate analysis of cost per day weighted by length of stay for patients in hospital-based (HB) and home care (HC) hospices: National Hospice Study, 1984

Variables in equation	Standardized regression coefficient
Hospital-based	
Frail	***-.10736
Noncancer	-.02797
Patient age	-.02872
Pancreatic cancer	.00595
Patient care requirement: Oxygen, respiratory equipment	***.08735
Patient care requirement: Colostomy, ileostomy	-.01111
Patient care requirement: Intravenous	***.12966
Patient disorientation	.00165
Male patient	-.00052
Patient lives alone	***.09545
PCP[1] currently employed	***.07948
Functional assessment: Bowel, bladder	.04122
Functional assessment: Bathe self	.03181
Functional assessment: Walk	***.19292
Home care	
Frail	***-.07382
Noncancer	***-.04790
Patient age	.00488
Pancreatic cancer	.00237
Patient care requirement: Oxygen, respiratory equipment	**.02812
Patient care requirement: Colostomy, ileostomy	**.03500
Patient care requirement: Intravenous	.00837
Patient disorientation	**.03610
Male patient	***.07424
Patient lives alone	-.00763
PCP currently employed	*.03481
Functional assessment: Bowel, bladder	.00168
Functional assessment: Bathe self	***.06105
Functional assessment: Walk	***.12690

*$p < .05$
**$p < .01$
***$p < .001$
NOTES: PCP is primary care person. For hospital-based variables, R^2 is .06; for home care variables, R^2 is .02.

need to arrive at a measure of case mix applicable to all patients, regardless of their choice of setting. Based on the regression models, walking and a composite measure of walking and living alone were selected as indicators of case mix to be used to adjust revenues. Although certain patient care requirements were also significantly related to cost per diem in our regression models, providing such services to a patient can be influenced by reimbursement considerations as well as perceived clinical need. As such we felt that these measures were more subject to manipulation.

To examine the implications of using these two indicators as case-mix adjusters, we compared the weighted-average cost per day of groups of hospice patients. Among HB patients who were ambulatory, those who lived with someone had average daily costs of $91.55, whereas those who lived alone had costs of $115.71. Among HB patients unable to walk, the differential as a result of living alone, was not present ($130.93 versus $129.48). Among HC patients, the differential as a result of both ambulatory status and living arrangement, is present—ambulatory patients living with someone incurred average daily costs of $71.56, but those living alone had daily costs of $77.59. Inability to walk results in large increase in average daily costs, regardless of living arrangement, but the differences in costs remain—$88.16 living with someone versus $97.24 for those living alone.[4]

These figures pertain to living arrangement and ability to walk at the time of hospice admission. HB patients unable to walk probably did not spend many days in the community, whether or not they lived alone at the time of hospice admission. On the other hand, in the HC setting, patients who lived alone and were unable to walk had per-day costs that were over 30 percent higher than those of ambulatory patients living with others.

This group of nonambulatory patients living alone (frail) is most likely to require inpatient care and/or substantial home care assistance. Consequently they should be highlighted as a high-resource consumption group requiring supplemental reimbursement. An adjustment factor to differentiate the reimbursement that such high-need patients require from that of the average patient was calculated based on the percent difference between average cost per hospice day of frail patients and the overall average. This difference was calculated to be 35 percent for both types of hospices.

Selecting a home-day adjustment

A second approach to adjusting hospice reimbursement was also explored using a case-mix approach. In this case, however, we chose to alter only the current approach to detemining the home care day rate. In general, a higher home-day rate creates an incentive to keep the patient at home, particularly as hospices approach the average annual per patient cap on the inpatient day ceiling.

We examined the relationship between selected patient characteristics and patients' average home care costs per day. Once again, whether a patient was ambulatory on admission was strongly related to home care cost per home day ($p < .001$). However, the number of patient days spent at home among those who were both unable to walk and living alone was, logically, very small. Consequently a case-mix indicator focusing solely on walking was devised.

[4]Other measures of functioning such as transfer and bathing were substituted for walking in performing these weighted average comparisons. The directions of the relationships were similar, but "walking" appeared to differentiate patient groups most clearly.

Ambulation is more strongly related to average cost per day spent at home for both HC and HB patients than any other functional-status measure. The difference between ambulation and dependence represents a cost per day of $12 to $15. HB ambulatory patients' home care costs per home day were $44.55, and those for HC ambulatory patients were $43.92. Among those unable to walk, the costs for HB and HC were $56.43 and $60.77, respectively. Thus, even excluding inpatient costs from consideration, poor ambulation predicted higher use of care at home. An adjustment factor was developed to increase revenues associated with the percent difference in the cost per home day of patients unable to walk versus the overall average. For HC hospices, this differential was 35.6 percent, and for HB hospices it was 25 percent.

Simulating impact on hospice revenues

The relevant hospice day, revenue, and adjustment data for each demonstration HC and HB hospice, respectively, are presented in Tables 4 and 5. Patient days associated with frail patients, those unable to walk and living alone or having a working primary care person, were estimated to be 35 percent more costly than the average day. This adjustment was made to the estimated revenue generated by a patient, using 1985 hospice rates and the current prospective payment rate for given types of days.

Examining HC sites in Table 4 reveals that frail days as a percentage of total hospice days vary from 0.0 percent to 3.0 percent. Frail patients spend a majority of their days in an inpatient setting, perhaps accounting for the fact that their daily costs are higher than the average. Indeed, the average length of stay of frail patients is significantly lower than that of the average patient, meaning that their costs per day are higher for the short period of time that they are under hospice care. Estimated revenue per patient day under the current reimbursement system also varies from $74.34 to $91.84 among HC hospices, again reflecting the heterogeneity of day mix and presumably service mix. The additional revenue generated with the case-mix adjuster is small; in no instance is the percent increase as high as 2.0 percent of total hospice revenue.

A similar pattern is revealed in Table 5, with only 4.1 percent of patient days attributable to patients entering an HB hospice living alone and being nonambulatory. Several hospices of both types had almost no frail patients. The majority of patient days pertaining to those entering a hospice in a frail condition occurred in an inpatient setting (59.9 percent). As with the HC sites, the amount of additional revenue that would be generated by the premium for frail patients' days is small. The percent increase in total revenue across all sites is 1.4 percent, and in only one site was the increase as high as 2.4 percent.

Our second approach to adjusting hospice reimbursement modified only the home-day rate. A higher home-day rate improves the incentive to keep the patient at home. It should also be an incentive to admit patients who are already impaired and to work with the family to keep them at home as long as possible, as opposed to having them spend all of their time in an inpatient hospice setting. Patients' ability to ambulate independently is an important determinant of home care cost per day for both HB and HC hospices. Based on the differential cost associated with being nonambulatory, two percentage

Table 4

Revenue implications of frail case-mix adjustment factor for total patient days in home care hospices: National Hospice Study, 1984

Home care (HC) hospice site	Total revenue (TEFRA[1])	Total number patient days	Revenue per patient day	Total days for patients unable to walk and living alone	Percent of total days for patients unable to walk and living alone	Additional revenue from case-mix adjustment[2]	Percent increase in revenue
Total	$19,832,684	241,625	$82.08	1,991	(0.8)	[3]$56,216	0.3
HC-1	705,407	8,077	87.34	23	(0.3)	703	0.1
HC-2	324,168	4,232	76.60	128	(3.0)	3,432	1.1
HC-3	868,429	9,457	91.83	50	(0.5)	1,607	0.2
HC-4	787,098	9,287	84.75	144	(1.6)	4,271	0.5
HC-5	2,608,296	32,926	79.22	154	(0.5)	4,270	0.2
HC-6	2,128,778	24,651	86.36	3	(0.0)	91	0.0
HC-7	2,972,269	36,741	80.90	814	(2.2)	23,048	0.8
HC-8	383,406	4,928	77.80	3	(0.0)	82	0.0
HC-9	1,202,025	15,134	79.43	255	(0.0)	7,089	0.6
HC-10	421,338	5,163	81.61	23	(0.0)	657	0.2
HC-11	2,114,510	28,444	74.34	231	(0.8)	6,010	0.3
HC-12	2,094,805	22,838	91.72	91	(0.4)	2,921	0.1
HC-13	2,334,815	28,645	81.51	38	(0.1)	1,084	0.0
HC-14	887,340	11,102	79.93	34	(0.3)	951	0.1

[1]Tax Equity and Fiscal Responsibility Act of 1982.
[2](Revenue per patient day × 0.35) (number of days by patients who were unable to walk and who lived alone at the time of their admission to hospice).
[3]This total represents the sum of additional revenue from individual sites. Because of rounding, calculations based on the formula in footnote will not add to total.

Table 5

Revenue implications of frail case-mix adjustment factor for total patient days in hospital-based hospices: National Hospice Study, 1984

Home based (HB) hospice site	Total revenue (TEFRA[1])	Total number of patient days	Revenue per patient day	Total days for patients unable to walk and living alone	Percent of total days for patients unable to walk and living alone	Additional revenue from case-mix adjustment[2]	Percent increase in revenue
Total	$10,456,772	102,849	$101.67	4,270	(4.2)	[3]$148,239	1.4
HB-1	1,200,879	10,302	116.57	214	(2.1)	8,731	0.7
HB-2	3,055,734	32,208	94.88	1,582	(4.9)	52,535	1.7
HB-3	807,676	8,526	94.73	559	(6.6)	18,534	2.3
HB-4	431,882	5,051	85.50	229	(4.5)	6,853	1.6
HB-5	537,371	5,936	90.53	339	(5.7)	10,741	2.0
HB-6	620,175	4,893	126.75	11	(0.2)	488	0.1
HB-7	584,639	5,778	101.18	36	(0.6)	1,275	0.2
HB-8	998,826	9,332	107.03	431	(4.6)	16,145	1.6
HB-9	362,737	3,304	109.79	290	(8.8)	11,144	0.3
HB-10	552,334	5,434	101.64	118	(2.2)	4,198	0.8
HB-11	811,025	7,308	110.98	345	(4.7)	13,401	1.7
HB-12	493,494	4,777	103.31	116	(2.4)	4,194	0.8

[1]Tax Equity and Fiscal Responsibility Act of 1982.
[2](Revenue per patient day × 0.35) (number of days by patients who were unable to walk and who lived alone at the time of their admission to hospice).
[3]This total represents the sum of additional revenue from individual sites. Because of rounding, calculations based on the formula in footnote will not add to total.

Table 6

Revenue implications of case-mix adjustment factor for home days in home care hospices: National Hospice Study, 1984

Home care (HC) hospice site	Total home day revenue (TEFRA[1])	Number of home days	Percent of home days patients unable to walk	Additional revenue[2]	Percent increase in revenue per home day	Percent increase in total revenue
Total	$11,309,684	212,748	19.7	[3]$793,432	7.0	4.0
HC-1	417,147	7,847	30.2	44,848	10.8	6.4
HC-2	211,205	3,973	20.0	15,037	7.1	4.6
HC-3	417,093	7,846	09.0	13,364	3.2	1.5
HC-4	427,832	8,048	18.1	27,568	6.4	3.5
HC-5	1,553,601	29,225	20.3	112,276	7.2	4.3
HC-6	1,119,549	21,060	19.1	76,125	6.8	3.6
HC-7	1,722,384	32,400	24.3	149,000	8.7	5.0
HC-8	235,392	4,428	11.7	9,805	4.2	2.6
HC-9	712,185	13,397	18.7	47,412	6.7	3.9
HC-10	243,260	4,576	10.5	9,093	3.7	2.2
HC-11	1,385,137	26,056	16.8	82,842	6.0	3.9
HC-12	1,007,276	18,948	28.5	102,198	10.1	4.9
HC-13	1,331,977	25,056	16.3	77,292	5.8	3.3
HC-14	525,646	9,888	14.2	26,572	5.1	3.0

[1]Tax Equity and Fiscal Responsibility Act of 1982.
[2](53.16 × .356) (number of days by patients who were unable to walk).
[3]This total represents the sum of additional revenue from individual sites. Because of rounding, calculations based on the formula in footnote will not equal this total.

adjusters in home care revenue were created, one for each hospice type. For HC hospice patients, the home care day rate was increased by 35 percent, while for HB patients, it was boosted 25 percent.

The HC site-specific results of applying this adjustment to the home care day rate of $53.16 set by Congress in September of 1984 are presented in Table 6. Hospices vary substantially in the proportion of patient days associated with patients who were nonambulatory at the time of admission. In some hospices, nonambulatory patients account for over 30 percent of the patient days at home, while in others less than 10 percent of home days are associated with such patients. The impact of increasing the home care day rate by 35 percent for nonambulatory patient days is not dramatic. Not a single HC hospice has an increase in estimated home care revenues of greater than 11 percent. Impact on total estimated revenues is also small.

Similar information for the HB sites is shown in Table 7. Once again, we see substantial intersite variation in the proportion of home days associated with patients who were impaired at the time of admission. In some HB settings, home days constituted 81 percent of all patient days, while in others, home days were less than half (43 percent) of all patient days. Nonambulatory patients admitted to HB settings were frequently already in an inpatient setting in the acute care sector of the hospital. Although HB patients are more likely to be impaired at hospice admission, most HB sites do not care for those patients in their homes. Impaired HB patients are more likely to spend their time as hospice patients in an inpatient setting. After applying the 25 percent adjustment factor to increase the home care day rate, the average increase in home care reimbursement was 6.1 percent, with a range of 1.0 percent to 9.6 percent among HB sites. In no case was the impact of case-mix adjustment on total revenues as high as 5 percent, and in most hospices it yielded less than a 2-percent increase.

Summary

In this article, we have examined data from the National Hospice Study for the purpose of developing measures of patient case mix that might be used to adjust the Medicare hospice prospective rates. We found that functional status and family support potential, as measured by ability to walk and living arrangement, were significantly related to patient costs. We simulated the effect of adjusting the revenue that hospices would accrue based on the proportion of patient days associated with persons having the characteristics related to high resource consumption.

Our analyses confirm the relationship between length of stay in hospice and per-patient cost. Many variables are related to survival; however, our ability to forecast survival, particularly among the long-stay patients, is relatively poor. Performance status and the availability of supportive living arrangements are related to total costs incurred while in hospice, because they independently predict resource requirements and survival. Patients living alone will be very unlikely to remain in the community unless they enter hospice while still functioning well. Patients living with family are more likely to remain at home, use fewer inpatient days, and receive fewer home care services than if there were no family caregivers. Poor functioning is a reflection of the advance of the disease and provides an indication of the proximity of death (Mor et al., 1984). As such, more functional patients will incur higher total costs, because they are alive longer to make more demands for service, whether in an inpatient or an outpatient setting.

Table 7

Revenue implications of case-mix adjustment factor for home days in hospital-based hospices: National Hospice Study, 1984

Hospital-based (HB) hospice site	Total home day revenue (TEFRA[1])	Number of home days	Percent of home days patients unable to walk	Additional revenue[2]	Percent increase in revenue per home day	Percent increase in total revenue
Total	$3,599,731	67,715	2.6	[3]$123,586	3.4	1.2
HB-1	377,861	7,108	25.7	24,278	6.4	2.0
HB-2	856,195	16,106	26.3	56,295	6.6	1.8
HB-3	353,355	6,647	15.3	13,516	3.8	1.7
HB-4	229,492	4,317	31.0	17,786	7.8	4.1
HB-5	265,056	4,986	6.6	4,373	1.6	0.8
HB-6	191,589	3,604	0.4	192	0.1	0.0
HB-7	231,459	4,354	0.2	116	0.1	0.0
HB-8	334,323	6,289	4.3	3,594	1.1	0.4
HB-9	76,019	1,430	1.9	361	0.5	0.1
HB-10	233,638	4,395	0.4	234	0.1	0.0
HB-11	264,418	4,974	3.1	2,049	0.8	0.3
HB-12	186,326	3,505	1.7	10,792	0.4	0.2

[1]Tax Equity and Fiscal Responsibility Act of 1982.
[2](53.16 × 0.25) (number of days by patients who were unable to walk).
[3]This total represents the sum of additional revenue from individual sites. Because of rounding, calculations based on the formula in footnote will not add to total.

Patients functioning poorly at admission may be seeking assistance with hospice as the last resort of the health care system and generally survive for only short periods of time. These patients incur relatively low costs since they are in the hospice for such a short time.

Functional status and living arrangements were also found to be significantly related to cost per day. The more impaired patients were at the time of admission, the higher the daily cost. If patients lived alone on admission, they had even higher costs per day. In the HC setting, patients living alone incurred even higher costs if they were also functionally impaired at the time of admission. This is because they were less likely to spend many days at home, since they required the support of an inpatient setting to receive care. If there is to be any incentive for serving the small number of patients with limited social support and functional capacity, some adjustment in the level of reimbursement a hospice receives for such patients is probably necessary.

In testing the revenue implications of adding a case-mix adjusted increment to hospice reimbursement, two different approaches were examined. First, a 35-percent increment to daily reimbursement was applied to patient days of patients unable to walk and living alone. Second, a revenue increment was applied to home days of nonambulatory patients. The impact of these increments on the total estimated revenue for a given hospice is small. Though some hospices would have gained as much as 10 percent more home care revenue when the home-day adjuster was applied, others showed no change.

There are several reasons for the apparent lack of impact of the case-mix adjusters on estimated revenue. The case-mix measures selected on the basis of statistical significance may not adequately differentiate between high- and low-cost patients. However, alternate measures of patient functioning did not improve on ambulation, and other measures such as diagnosis or demographic characteristics were largely unrelated to costs per day. Indeed, despite the small percentages of variance explained by the regression models, we found that days of patients with the selected case-mix characteristics cost substantially more than those of the average patient. Nonetheless, there were relatively few days associated with patients having the selected characteristics. For precisely this reason, we saw only a relatively small effect of incrementing reimbursement for such patient days. Indeed, it is these types of patient days that are truly more resource-intensive. Almost all hospice patients have these needs as death approaches. However, for the short-lived patient, the hospice does not have the opportunity to accrue revenue for no-care days.

It is for this small minority of patient days that a special increment may be required to make reimbursement more equitable. Even though such days may be attributable to as many as 25 percent of patients in a hospice, they rarely account for as much as 10 percent of patient days because such patients do not live long. Our simulations only increased payments to hospices, rather than balancing out total payments, by reducing estimated reimbursement to hospices with few high-need patients. Were we to do so, the revenue differential would appear greater, with those hospices having 5 percent or more high-need patient days gaining revenue, relative to those with nearly none, who would lose revenue proportionately in a zero-sum approach.

Informed policy analysis is enhanced by having information concerning the possible effects of decisions before they are made. The simulations described in this article cannot claim to have substantial predictive meaning, because the behavior of the demonstration hospices did not occur within the context of a prospective payment system. However, it is fair to assume that the actual behavior of the demonstration hospices reflects the way in which hospices in general would like to behave to achieve their organizational and clinical objectives. From this perspective, the findings provide an estimate of how hospices, trying to behave as if they were in an unrestricted reimbursement environment, would fare under alternate reimbursement structures.

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