
The Medicare Hospice Payment System: A Consideration of Potential Refinements

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The purpose of this article is to examine variation in resource utilization across and within patient stays in the context of Medicare's per diem payment system for hospice. Visit-level resource utilization data were linked to patient-level diagnosis and demographics covering more than 68,000 Medicare patients admitted in 2002 and 2003. Our findings suggest that case mix adjustment based on diagnosis and demographics does not improve our ability to explain variation in resource utilization across stays. However, we do find that there is substantial variation in resource utilization within stays that may not be captured in the current per diem payment system.

INTRODUCTION

There is increasing concern among policymakers and researchers that the current per diem payment methodology for hospice may create incentives for providers to select patients with particular diagnoses or longer expected length of stay (Huskamp et al., 2001; Medicare Payment Advisory Commission, 2002; Moon and Boccuti, 2002; Tibi-Levy, Le Valliant, and de Pourville, 2006). Policymakers and academics have proposed

changes to the payment methodology to address these concerns (Medicare Payment Advisory Commission, 2009). However, the lack of empirical evidence regarding how resource utilization varies across and within patient stays has undermined efforts to adjust the payment methodology. There is ample empirical evidence that end-of-life expenditures are substantial, but only qualitative evidence regarding how those expenditures vary across patients or within a patient's stay.

This study utilizes a proprietary dataset to examine resource utilization for each patient and patient-day. The focus on resource utilization rather than traditional measures, such as Medicare days and payments and the ability to look both across and within patient stays represent an advancement in our understanding of how resource utilization varies at end of life.

The Medicare payment system for hospice care has remained largely unchanged since per diem rates were instituted in 1983. These per diem rates vary based on the category of care provided: routine home care (RHC), continuous home care (CHC), inpatient respite care (IRC), and general inpatient care (GIC). Routine home care provides services at home for a range of ordinary days and comprises the vast majority of hospice days covered by Medicare (Medicare Payment Advisory Commission, 2006b). Continuous home care covers periods of patient crisis that can be accommodated at home. Inpatient respite care covers short

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periods to provide the primary caregiver with a break. And general inpatient care is used to treat symptoms that cannot be managed in another setting. Per diem levels have been updated for inflation, but, unlike other Medicare payment systems, hospice payments have not been adjusted for case mix, urban/rural location (apart from the wage index), costly outliers or other factors that could affect costs.

There is increasing concern that this payment methodology no longer accurately reflects costs because of changes in provider, patient, and service characteristics (Huskamp et al., 2001). This concern is compounded by the rapid expansion in the number of providers, beneficiaries, and Medicare expenditures. Since 1992, the number of providers has nearly doubled, the number of beneficiaries has quadrupled, and Medicare expenditures have increased five-fold (U.S. Government Accountability Office, 2004). And over the more recent period from 2002 to 2005, there has been a three-fold increase in the share of hospices that exceed the cap and a six-fold increase in payments exceeding the cap (Medicare Payment Advisory Commission, 2008). These developments have prompted interest in potential adjustments to the payment methodology (Medicare Payment Advisory Commission, 2002; 2004; 2006a; 2009). Until recently, the scope of Medicare data has limited efforts to examine patient-level service utilization and costs and to understand how these factors, in turn, affect the appropriateness of the payment structure. Despite calls for additional data collection (U.S. Government Accountability Office, 2004), there has been little evidence on what data might be useful in analyzing and adjusting the payment system.

Our analysis considers two fundamental elements of the debate: the use of case mix adjustment to explain variation across

stays and variation in resource utilization within a stay.

1. Does case mix adjustment improve our ability to explain variation in resource utilization across patients' stays?
2. To what extent does resource utilization vary within a patient's stay?

These questions had been raised in earlier literature by researchers and policymakers (Huskamp et al., 2001; Moon and Boccuti, 2002; Tibi-Levy, Le Valliant, and de Pourville, 2006; U.S. Government Accountability Office, 2004; Medicare Payment Advisory Commission, 2002; 2004; 2006a; 2009), but could not be examined empirically because Medicare data have not traditionally tracked resource utilization across or within patient stays.

BACKGROUND

The increase in non-cancer diagnoses among the hospice population and changes in care for cancer patients have raised concerns that the per diem payment system may no longer track resource use (Huskamp et al., 2001; Moon and Boccuti, 2002; U.S. General Accounting Office, 2000a; 2000b; U.S. Government Accountability Office, 2004). Since 1992, the share of hospice patients with cancer diagnoses has fallen considerably, from 75 percent to 43 percent (National Center for Health Statistics, 2003) (Table 1). Research indicates that non-cancer hospice patients—including those with congestive heart failure, chronic obstructive pulmonary disease, Alzheimer's or stroke—differ from other patients in the intensity of services used, types of services used, and length of stay (U.S. General Accounting Office, 2000b; U.S. Government Accountability Office, 2004; Campbell et al., 2004). Patients with non-cancer diagnoses may also differ

Table 1
Hospice Patient Characteristics (2002-2003)

Category	Chain Provider		Medicare	
	Frequency	Percent	Frequency	Percent
Age Category				
Under 65	2820	4	60251	5
65 to 74	12221	18	249263	21
75 to 84	25405	37	447308	38
85 & over	28279	41	424434	36
Marital Status				
Divorced/separated/widow	40183	58	NA	NA
Married, living together	23000	33	NA	NA
Single	5542	8	NA	NA
Race				
Asian	691	1	6688	0
Black	7960	12	90425	8
Hispanic	7807	11	15541	1
Other	422	0	11417	0
White	51846	75	1053159	89
Sex				
Female	41077	60	680877	58
Male	27648	40	500379	42
Nursing Home				
Routine Home Care in Nursing Home	19746	29	NA	NA
Discharge Status				
Died	62355	91	978371	83
Diagnoses				
Cancer – Breast	1672	2	30248	3
Cancer – Colorectal	2720	4	34191	3
Cancer – Gynecological	1105	2	17988	2
Cancer – Hematological	1721	3	19284	2
Cancer – Kidney, Bladder	1254	2	23012	2
Cancer – Lung, Larynx, Pleura	6652	10	135228	12
Cancer – Other Gastroint.	3866	6	67417	6
Cancer – Other	2749	4	25601	2
Cancer – Prostate	1648	2	34194	3
Cancer (Medicare only)	NA	NA	105523	9
Cardiovascular	9768	14	150538	13
Cerebrovascular	5880	9	68981	6
HIV	415	0	5656	0
Ill-Defined Debility	6197	9	124469	11
Neurodegenerative	13602	20	163547	14
Other Diagnosis	4369	6	63392	5
Respiratory	5106	7	89163	8

NOTES: NA is not applicable. Differences are statistically significant at the 0.01 level except for other gastrointestinal cancer (0.05 level), and breast cancer, kidney cancer, and respiratory disease, which are not significantly different.

SOURCE: Nicosia, N., Reardon, E., Lorenz, K., M.D., Lynn, J., M.D., Beeuwkes Buntin, M., RAND Corporation, 2009.

in location of care (e.g., home versus nursing home). Finally, these patients may be older, implying an increased number of comorbidities and lower probability of a living partner who might act as a caregiver. These factors may affect service utilization and the costs of care; evidence suggests increasing use of more expensive elements of care such as drugs, nursing, social services, and durable medical equipment (U.S. Government Accountability Office, 2004).

A second concern about the payment system arises from changes in the treatment of cancer patients due to advances in medical technology such as new palliative drugs, chemotherapy, and radiation (U.S. Government Accountability Office, 2004). Advances in cancer treatments may alter the timing of entry into hospice as patients pursue “curative” treatment. Such changes can affect service utilization and the appropriateness of the payment structure by shortening length of stay and increasing the average intensity of care during the stay (Huskamp et al., 2001). The U.S. Government Accountability Office (2004) found that average length of stay decreased for cancer patients and for major non-cancer patient groups.

While these issues have been recognized, Medicare claims and facility cost report data could not provide a comprehensive understanding of their impact on service utilization and costs. Traditionally, Medicare claims record the number and type of days billed and payments for those days, but not measures of resource utilization such as the number of visits, length of visits, disciplines of staff-members providing care, and timing of visits during the patient’s stay (though encounter data are now also being collected). Medicare cost reports record expenditures by category (e.g., drugs), but these costs cannot be allocated to

individual patients. Consequently, differences in service utilization and costs across diagnoses and variations in the intensity of care within each patient’s stay could not be examined directly.

METHODS

Data

This study relies on patient- and visit-level data from a major national hospice chain. During the analysis period, the chain operated more than two dozen hospices located primarily in urban areas and with a broad geographic distribution. The median hospice admitted more than 2000 Medicare patients during our analysis period, but the sample also included smaller and larger hospices. The analyses focus on 68,725 Medicare patients (approximately 6 percent of the Medicare hospice population) admitted in 2002-2003. The dataset includes substantial detail on patient-level service utilization and demographics: the exact date of each visit, the professional discipline of staff members involved in each visit, the length of visits, receipt of routine home care at a nursing home, primary diagnosis, age, race/ethnicity, sex, marital status/living arrangement, discharge status and location. By contrast, the Medicare claims data have traditionally provided information only on the days of care by type, diagnoses, age, sex, and race/ethnicity though in more recent years, encounter data have also been collected.

The data allow the construction of two measures of resource utilization. The number of visits for each patient is calculated by counting the number of visits by paid hospice staff received during a stay. This measure includes visits by paid hospice staff during inpatient stays, but excludes visits by volunteers and by

inpatient hospital staff. The number of visits is more informative than the length of stay because it captures the intensity of care provided during the stay. The second measure, visit labor costs, captures the wages associated with providing the visits and is based on the number of visits, length of visits, and discipline of staff-members involved. These factors are converted into dollars using average hourly earnings for each discipline from the Bureau of Labor Statistics and adjusted for geographic location using the Medicare wage index. In effect, this measure adjusts for the composition of visits: visits providing greater skilled care and more time with the patient will be more costly. Visit labor costs measure only the direct wage costs of staff time and comprise approximately one-fifth of total facility Medicare costs. We acknowledge that this measure does not capture all relevant costs such as the staff's transportation time, administrative overhead, employee benefits, and the non-labor costs of providing care. But it is not possible to allocate these other costs to individual patients using these data. For our purposes, our measure must simply be reasonably representative of the variability in costs. This is likely to be the case because: (1) direct labor comprises a substantial share of routine non-fixed costs, (2) any other indirect labor costs such as staff's travel time and benefits are likely to move in parallel with direct labor costs, and (3) visit labor costs reflect general patient needs and severity, which are likely to drive variation in other costs.

Approach

Our first analysis examines whether including patient characteristics improves our ability to explain the variation in resource utilization across stays over a model which simply relies on days of care

by type. The first specification estimated via OLS examines how well the per diem system reflects patients' resource utilization during a stay (Y) as measured by the number of visits and the labor visit costs. Our independent variables include the number of days by type (RHC, CHC, and GIC), fixed effects for the year to control for trends (g_t), and hospice fixed effects to control for time-invariant differences in the provision of care across hospices (g_h). IRC days were excluded because the provider did not provide such days. We expect that all three regressors will be positively associated with utilization, but we are primarily interested in the share of variation explained by the model.

$$(1) Y_{iht} = b_R RHC_{iht} + b_C CHC_{iht} + b_G GIC_{iht} + g_t + g_h + e_{iht}$$

To examine whether patient characteristics can be used to improve our ability to explain variation, our second equation evaluates the explanatory power of patient characteristics. The chain provider data contain a rich set of patient-level characteristics that may be useful in explaining patient utilization and informing potential adjustments to the current payment system. Specifically, the dataset includes the primary ICD-9 code, race/ethnicity, marital status/living arrangement, age, receipt of routine home care in a nursing home, discharge status, and hospice fixed effects. For parsimony, we aggregated the individual, clinically similar ICD-9 codes into nine cancer and seven non-cancer diagnosis categories hypothesized to have similar resource use (Table 1). We tested whether these variables were predictors of resource use both on their own and in conjunction with the per diem category variables.

The regressors include the primary diagnosis (D) and a number of other

patient characteristics (X) including age categories, race/ethnicity, sex, marital status/living arrangement, receipt of routine home care in a nursing home, and discharge status as well as hospice (g_h) and time fixed effects (g_t). Because we do not have secondary diagnoses and comorbidities, we expect that the coefficients on the age categories and receipt of routine home care in a nursing home will proxy in a limited way. In addition, we interact receipt of routine home care in a nursing home with the age categories on the assumption that younger patients already residing in a nursing home are likely to have different care needs. We first examine the explanatory power of the diagnosis and demographics independently and then add them to the model that contains days of care by type to determine whether or not CMS could use these particular characteristics to improve the accuracy of the payment methodology. As before, the focus of the analysis is on the share of variation in utilization explained by the model.

$$2) Y_{iht} = b_R RHC_{iht} + b_C CHC_{iht} + b_G GIC_{iht} + d_D D_{iht} + d_X X_{iht} + g_t + g_h + e_{iht}$$

The previous analyses attempt to explain variation in resource utilization across patients' stays. But the data from the chain provider also record the admission date, discharge date, and the date of each visit, allowing us to examine measures of the distribution of visits and costs within each patient's stay to assess how well a constant per diem rate reflects the resource use throughout a stay.

To determine whether the beginnings and ends of hospice stays more intensive, we examine the number of visits *per day* and visit labor costs *per day* (Y). Given that the typical length of stay is 13 days,

we compare intensity during the last three days (L), first three days (F), and middle days (M). Each patient has up to three time periods: first, middle and last days. Because many stays are 6 days or less, we had to prioritize the allocation of days. Visits during stays of 3 days or less are allocated to the last 3 days. Patients with stays of 3 days or less do not have first or middle days. Visits during stays of 6 days or less are allocated to the first and last 3 days with priority to the last 3 days. These patients have no middle days and have up to 3 first days.

A simple regression of the pooled visits (and costs) per day on indicator variables for whether the visits (costs) per day occur during the first 3 days, last 3 days, and middle days will recover the means in the sample. The first 3 days is the excluded category and is captured by the coefficient on the constant term (b_1). The regressions also allow us to use robust standard errors clustered at the patient-level to demonstrate statistical significance. For this analysis, our focus is on the size and significance of the coefficients b_1 , b_2 , and b_3 .

$$3) Y_{it} = b_1 + b_2 M_{it} + b_3 L_{it} + e_{it}$$

RESULTS

The chain provider's patient population differs somewhat from the Medicare population (Table 1). Only one-third of patients at the chain provider had a primary diagnosis of cancer compared to 43 percent among all hospices. The chain provider had a greater share of neurodegenerative, cerebrovascular, and cardiovascular patients. The patients are also significantly older, reflecting the differences in diagnoses. They are also more likely to be non-White and Hispanic potentially due to the location of the chain provider's hospices. For the chain provider, nearly 29

percent of patients in the sample received at least some care in a nursing home during their hospice stay. Although these differences are statistically significant due to the large sample size, many of the differences are not substantial.

Because of the limitations of the Medicare data, it is not possible to compare how these sample differences translate into differences in service utilization except with respect to the number of days enrolled (Table 2). Overall, the mean patient at the chain provider was enrolled in hospice care for a greater number of days, but the median patient for fewer days. This implies that the chain provider has a greater incidence of longer stays, driven in part by differences in case mix and in part by longer stays among

cardiovascular, cerebrovascular, ill-defined debility, neurodegenerative, and respiratory patients. The vast majority of days billed are routine home care days for the chain provider (90 percent) and the Medicare population (93 percent). But the chain provider uses more inpatient care and does not use any respite care. More than two-fifths (43 percent) of the chain provider's routine home care days were provided in nursing homes (not shown).

There is substantial variation across diagnoses in the number of days enrolled. The average stay for cancer patients is shorter than for patients with cardiovascular, cerebrovascular, ill-defined debility, and neurodegenerative diagnoses. This variation is also evident in other measures of service utilization. Cancer patients

Table 2
Days of Care by Diagnosis

Diagnosis	Chain Provider		Medicare	
	Mean	Median	Mean	Median
Cancer – Breast	54.5	17	48.5	22
Cancer – Colorectal	53.2	19	48.3	24
Cancer – Gynecological	44.7	17	43	22
Cancer – Hematological	32.4	9	34.3	13
Cancer – Kidney, Bladder	43.3	14	40.5	18
Cancer – Lung, Larynx, Pleura	41.4	14	40.1	19
Cancer – Other Gastrointestinal	39.4	14	37.3	19
Cancer – Other	40.2	15	43.7	22
Cancer – Prostate	48.3	16	48.5	23
Cancer – (Medicare Only)			40.6	19
Cardiovascular	62.5	11	52.7	17
Cerebrovascular	48.5	8	35.4	9
HIV	33.3	8	27.7	8
Ill-Defined Debility	94.7	23	54.5	18
Neurodegenerative	88.8	16	61.3	20
Other Diagnosis	26.8	6	28.5	9
Respiratory	62	9	50.4	15
Average	60.4	13	46.5	17

SOURCE: Nicosia, N., Reardon, E., Lorenz, K., M.D., Lynn, J., M.D., Beeuwkes Buntin, M., RAND Corporation, 2009.

received fewer visits and incurred lower visit labor costs than patients with ill-defined debility and neurodegenerative disease, in part because of their shorter length of stay.

Does case mix adjustment improve our ability to explain variation in resource utilization across patients?

Model 1 of Table 3 shows the share of the variation in visits and visit labor costs explained by the number and type of day billed for each patient. The adjusted R-squared is approximately 90 percent for both regressions, indicating these resource use measures are well explained by the per diem payment system. The results are surprisingly similar given the differences in the aspects of care captured by these two measures. All three regressors are statistically significant predictors. The regressions are estimated without a constant, but including a constant does not appreciably change the amount of variation explained. As expected, both visits and visit labor costs increase with routine home care days, general inpatient days, and continuous home care days. The coefficients indicate that continuous home care days increase utilization the most dramatically while routine home care days the least. To acknowledge the skewness of the data, the regressions were re-estimated in log form, but the results were not sensitive to this transformation.

There are two possible explanations for the fact that the days of care by type variables explain nearly all of the variation in utilization. First, dying patients may have similar clinical needs within the four levels of care corresponding to the per diem categories. Two physicians on our team specializing in hospice and palliative care felt that this was a plausible explanation. Alternatively, the regression results may simply reflect that the chain provider

responded to the structure of the per diem system by delivering a level of care that can be supported by the payment levels generated by the system. It is not possible to distinguish between these alternative explanations without other information such as unmet need or overutilization of services. The columns for Model 2 show the results of the regressions when only patient-level demographics and diagnoses are included in the model (Table 3). Service utilization was higher for patients who were younger, African-American, female, currently or formerly married (or living with a partner), receiving at least some routine home care in a nursing home, and those discharged alive. Cancer and HIV patients had significantly fewer visits and lower visit labor costs, while neurodegenerative and ill-defined debility patients had more visits and higher costs. Although many of the demographic variables and diagnosis categories were statistically significant, these factors explained only 11 percent and 8 percent of the variation in the number of visits and visit labor costs, respectively. Increasing the number of diagnosis categories did not improve the explanatory power of the model.

Given the interest in using such variables to increase the precision of the payment methodology, it is important to determine whether the variation explained by these characteristics would increase the explained variation over and above the four payment categories. When added to the model that already contains the days by type, the demographic and diagnoses variables do not add explanatory power based on the adjusted R-squared (Model 3, Table 3). We also re-estimated the model with the interactions between receipt of routine home care in a nursing home and age categories to proxy for secondary diagnoses and comorbidities. The negative and significant coefficients

Table 3
Service Utilization Regressions

		Model 1		Model 2		Model 3		Model 4	
		Visits	Costs	Visits	Costs	Visits	Costs	Visits	Costs
Days of Care	Continuous Care	3.96***	300.21***	—	—	3.82***	295.27***	3.81***	295.17***
	General Inpatient Care	1.13***	34.52***	—	—	0.99***	27.32***	0.99***	27.23***
	Routine Home Care	0.57***	10.91***	—	—	0.57***	10.79***	0.57***	10.73***
Age	65-74	—	—	-9.83***	-463.31***	0.76	-46.59**	1.61**	-10.85
	75-84	—	—	-8.39***	-459.19***	1.13*	-58.03***	2.37***	-15.92
	85 & over	—	—	-12.00***	-640.21***	0.42	-95.72***	2.06***	-40.07
Race	Asian	—	—	-2.42	-76.47	-2.59**	-52.28	-2.59**	-52.16
	Black	—	—	4.48***	141.24***	1.09***	17.35	1.09***	17.66
	Hispanic	—	—	0.93	61.67	1.44***	15.78	1.45***	16.01
	Other	—	—	6.06	226.94	0.52	35.92	0.51	35.61
Marital Status	Married	—	—	4.96***	232.17***	0.72	27.02*	0.85*	30.82*
	Widowed, Div., Sep.	—	—	3.50***	166.52***	0.3	15.32	0.37	17.37
Sex	Female	—	—	9.73***	351.13***	0.36	26.03***	0.42*	27.76***
Nursing Home	RHC in NH	—	—	34.52***	1038.56***	7.22***	148.29***	13.36***	362.79***
	RHC in NH*Age 65-74	—	—	—	—	—	—	-3.96***	-171.00***
	RHC in NH*Age 75-84	—	—	—	—	—	—	-6.12***	-208.33***
	RHC in NH*Age 85+	—	—	—	—	—	—	-7.17***	-245.85***
Discharge	Alive (Not extended)	—	—	8.55***	-267.34***	-3.86***	-101.31***	-3.89***	-102.17***
	Prognosis Extended	—	—	113.13***	1507.03***	-10.47***	-355.99***	-10.55***	-358.88***
Diagnosis	Cancer – Breast	—	—	-3.06	73.16	1.66**	58.21**	1.68**	59.09**
	Cancer – Colorectal	—	—	-2.07	85.09	-0.71	22.63	-0.64	24.88
	Cancer – Gynecological	—	—	-6.97***	-4.22	1.21	41.07**	1.29	43.51
	Cancer – Hematological	—	—	-13.31***	-368.37***	1.57**	6.52	1.59**	7.25
	Cancer – Kidney, bladder	—	—	-5.47**	-54.54	0.68	17.52	0.74	19.1
	Cancer – Lung, larynx, pleura	—	—	-7.69***	-134.07**	-0.18	7.17	-0.11	9.23
	Cancer – Other Gastroint.	—	—	-7.33***	-58.35	0.79	28.37	0.88	30.92
	Cancer – Other	—	—	-6.52***	55.23	1.73***	80.39***	1.75***	81.05***
	Cancer – Prostate	—	—	0.4	148.94*	1.33	36.06	1.38*	37.4
	Cardiovascular	—	—	0.35	14.94	1.13**	-4.17	1.11**	-4.87
	Cerebrovascular	—	—	-9.02***	-321.77***	2.35***	-44.34**	2.30***	-45.85**
	HIV	—	—	-21.89***	-730.16***	0.32	2.83	0.33	3.09
	Ill-defined/Debility	—	—	10.18***	289.98***	1.23**	-45.75**	1.30**	-43.58**
	Neurodegenerative	—	—	11.56***	229.94***	4.06***	10.48	4.06***	10.6
Other Diagnosis	—	—	-21.52***	-697.37***	0.93	-31.79	0.95	-30.93	
Intercept	Constant	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Year Indicator Variables	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Hospice Fixed Effects	Hospice Indicator Variables	No	No	Yes	Yes	Yes	Yes	Yes	Yes
R-squared		0.914	0.906	0.111	0.075	0.891	0.879	0.891	0.879
Sample		68725	68725	68725	68725	68725	68725	68725	68725

NOTES: Reference (excluded) group is White males aged under 65 with respiratory diagnosis that died in 2003. Significant at 1% (***), 5% (**), and 10% (*) level.

SOURCE: Nicosia, N., Reardon, E., Lorenz, K., M.D., Lynn, J., M.D., Beeuwkes Buntin, M., RAND Corporation, 2009.

confirm that younger individuals already residing in a nursing home are likely to have greater utilization relative to older individuals (Model 4, Table 3). But there is no improvement in the explanatory power of the model, which suggests that these factors may not be useful for payment adjustments. However, it is also possible that these factors are simply correlated with days, which suggests future work might consider whether patient characteristics explain variation in resource utilization per day (rather than per stay). This finding also does not preclude the use of other potential, but not yet available, adjusters measuring functional limitations or comorbidities.

To what extent does resource utilization vary within a patient's stay?

Hospice providers have acknowledged variation in patient needs and resource utilization within stays (Huskamp et al., 2001; Tibi-Levy, Le Valliant, de Pourville, 2006). Our data confirm that the first

and last 3 days of stays are more intensive than days falling into the middle of a stay.

The median length of stay in the sample is 13 days and the median number of visits received is 18; the median number of visits received per day is 1.1 (Table 4). At the median, patients receive twice as many visits during the last 3 days as they do in the “middle” days. To test the sensitivity of our findings, we also examine whether the intensity of middle days varied among those with longer stays. We find that the pattern is even more definitive. Among patients with stays longer than 6 days, we find that the average number of visits per middle day declines steadily with length of stay from 1.6 for the first quartile above 6 days, to 1.3 for the second quartile, to 0.9 for the third quartile, and to a low of 0.7 for the fourth quartile (not shown). Visit labor costs per day show a similar pattern of decline with respect to length of stay.

Because the beginning and ends of stays are relatively more resource intensive, a constant per diem reimbursement may

Table 4
Timing of Visits and Visit Labor Costs

	Mean	Median
Days Enrolled	60.4	13
Number of Visits	48.6	18
Number of Visits per Day	1.5	1.1
Number of Visits per Day – First 3 Days	1.3	1
Number of Visits per Day – First 3 Days (including pre-admission visits)	1.4	1
Number of Visits per Day – Middle Days	1.1	0.8
Number of Visits per Day – Last 3 Days	2.0	1.7
Number of Visits per Day – Last 3 Days (excludes those discharged alive)	2.1	1.7
Visit Labor Costs	\$1,731.06	\$645.93
Visit Labor Costs per Day	\$69.28	\$37.20
Visit Labor Costs per Day – First 3 Days	\$53.84	\$33.80
Visit Labor Costs per Day – First 3 Days (including pre-admission visits)	\$57.20	\$36.72
Visit Labor Costs per Day – Middle Days	\$54.56	\$20.11
Visit Labor Costs per Day – Last 3 Days	\$113.86	\$47.89
Visit Labor Costs per Day – Last 3 Days (excludes those discharged alive)	\$122.60	\$54.37

NOTE: Averages are stay-weighted rather than day-weighted.

SOURCE: Nicosia, N., Reardon, E., Lorenz, K., M.D., Lynn, J., M.D., Beeuwkes Buntin, M., RAND Corporation, 2009.

create incentives for providers to seek patients with longer lengths of stay. The last 3 days are significantly more intensive than the first 3 days and the middle days are significantly less intensive (Table 5). It is possible that the differences are driven in part by diagnoses that drive shorter lengths of stay. We restrict our sample to only patients that have a length of stay of greater than 6 days because they will have at least 1 middle day. The estimated coefficients and statistical significance are remarkably similar.

DISCUSSION

Policymakers, researchers and industry have discussed potential refinements to Medicare’s hospice payment system. But traditional analyses of Medicare data do not provide any insight into how resource utilization (as opposed to Medicare payments and length of stay) varies across patients and within a stay. Using proprietary data from a large chain provider, we constructed resource utilization per patient-stay and per patient-day and assessed two issues: whether case mix adjustments improve our ability to explain variation across stays and the extent to which intensity of care varies within stays. While our analysis sample is not entirely representative of the general Medicare population, our sample

size and set of potential case mix adjusters are both large. Likewise, detailed data on visits provide the opportunity to examine more precise measures of individual service utilization.

Our analyses show that the payment system variables—the number of days of each type billed for a patient—explain most of the variation in the number of visits and labor visit costs at the patient level. This indicates that the payment system still reflects our measures of resource use during the stay. It is not possible to distinguish whether this relationship follows from the appropriateness of the payment structure or from the hospice provider responding to the system’s financial incentives without additional data, for example, on unmet need or overutilization. Patient diagnosis and demographic characteristics did not add substantial explanatory power to the model conditional on days of care by type, but these results do not preclude the utility of alternative adjusters that may be more closely related to patient needs such as functional limitations or comorbidities. Moreover, we caution that this finding may also simply reflect a correlation between days of care received and patient characteristics. Future work might consider whether these patient characteristics explain visits per day or costs per day rather focusing on the stay as the unit of analysis.

Table 5
Variation Within Stays: Number of Visits and Visit Labor

	Visits Per Day Full Sample	Visits Per Day Stays Greater Than 6 Days	Costs Per Day Full Sample	Costs Per Day Stays Greater Than 6 Days
Constant	1.38***	1.31***	57.19***	53.48***
Middle Days	-0.26***	-0.19***	-2.63***	1.08***
Last Days	0.62***	0.75***	56.67***	71.52***
R-squared	0.1	0.12	0.08	0.1
Sample	171201	137238	171201	137238

NOTE: Robust standard errors are clustered at the patient level. Significant at 1% (***) level.

SOURCE: Nicosia, N., Reardon, E., Lorenz, K., M.D., Lynn, J., M.D., Beeuwkes Buntin, M., RAND Corporation, 2009.

Our analyses support a common qualitative finding in the literature: there is variation in the intensity of care during a stay. Patients receive a greater number of visits and incur greater visit labor costs at the beginning and end of their stays; as a result, longer stay patients would have a lower average cost, all else equal. Higher service utilization at the beginning and end of stays combined with a constant per diem payment system might create incentives for providers to lower their average daily costs by seeking patients with longer stays. Medicare Payment Advisory Commission has recently published additional research which shows that profit margins increase with length of stay (Medicare Payment Advisory Commission, 2008). Adjusting per diem amounts to reflect greater resource use at the beginnings and ends of stays could be warranted. However, higher payments should reflect actual costs differences in order to make providers indifferent to patient's length of stay.

Our findings would be strengthened by the examination of a more representative sample of hospices and patients. Future work might also consider whether the variation observed within patient stays (e.g., cost per day) is consistent across patients with various diagnoses and characteristics. The collection of more detailed information on service utilization such as the number of visits, timing of visits, length of visits, site of visit, and type of discipline would be useful in refining our understanding of how well payments continue to reflect costs as the industry, patient populations, length of stay and costs continue to evolve. Indeed, encounter data are now being collected, but resource use of non-labor inputs such as drugs and medical equipment would also improve our understanding. Finally, factors more directly related to necessary care such as

functional limitations and comorbidities might also be considered.

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