Risk Adjustment for Health Plans Disproportionately Enrolling Frail Medicare Beneficiaries

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There is concern about the adequacy of diagnosis-based risk adjusters for paying health plans that disproportionately enroll frail Medicare beneficiaries. The Medicare Current Beneficiary Survey (MCBS) was used to examine the ability of two risk-adjustment models to predict Medicare costs for groups defined by institutional status and difficulty with activities of daily living (ADLs). Both models underpredicted average costs for non-institutionalized frail beneficiaries; however, the models slightly overpredicted expenses for most frail individuals and severely underpredicted for a minority. Further refinements are needed if diagnosis-based models are used to pay plans that disproportionately enroll frail beneficiaries.

INTRODUCTION

Beginning in the year 2000, Medicare is incorporating diagnostic information into its payment system for managed care plans under the Medicare+Choice program. This reform of the payment system is in reaction to research showing that the adjusted average per capita cost (AAPCC), which uses demographic information to adjust payments for individual plan enrollees, is inadequate for risk adjustment (Riley et al., 1996; Physician Payment Review Commission, 1996; Brown et al., 1993). Initially, payments will be adjusted through the Principal Inpatient Diagnostic

Cost Group (PIPDCG) system, which uses demographics and diagnoses associated with inpatient hospital stays occurring in the year prior to payment (Ellis et al., 1996). Other diagnosis-based risk-adjustment systems may be implemented in the future when additional types of encounter data become available from plans (Weiner et al., 1996; Pope et al., 1999; Carter et al., 1997). In general, diagnosis-based risk adjusters have been shown to be significantly better than the AAPCC in their ability to predict Medicare expenses.

There is currently concern among policymakers about the ability of diagnosis-based risk adjusters to appropriately set payments for health plans that disproportionately enroll frail, functionally impaired beneficiaries. Such plans include Program of All Inclusive Care for the Elderly (PACE); Social Health Maintenance Organization (S/HMO); Minnesota Senior Health Options (MSHO); and programs proposed by individual States to integrate Medicare and Medicaid services for frail dually eligible persons. As demonstration projects, most of these plans are paid a capitation rate based on the AAPCC, with a separate adjustment for enrollees who reside in the community and are nursing home certifiable (NHC) as defined by their State's Medicaid program. Under the Balanced Budget Act of 1997 (BBA), changes are expected to the payment methodologies for many of these projects. For example, PACE plans may be paid in the same manner as Medicare+ Choice plans, with an adjustment for the

comparative frailty of their populations; the Department of Health and Human Services must also prepare a report on transitioning S/HMOs and similar plans to the Medicare+Choice program. This raises the question of whether PIPDCGs and other currently available risk adjusters are appropriate for specialized programs serving frail enrollees.

Previous research suggests that diagnosis-based risk adjusters tend to significantly underpredict Medicare expenses for some expensive subgroups of Medicare beneficiaries, including persons with functional impairments living in the community (Pope et al., 1998, 1999; Gruenberg et al., 1999; McCall and Korb, 1998). These studies have also found that diagnosis-based adjusters tend to overpredict expenses for some low-cost subgroups, including persons without functional impairments. This suggests that functional impairment may be associated with health care expenses that are not reflected in diagnostic profiles. Diagnosed-based risk adjusters have also been found to overpredict Medicare expenses for persons institutionalized in long-term care (LTC) settings (Pope et al., 1998, 1999; Gruenberg et al., 1999; McCall and Korb, 1998).

The purpose of this study was to extend previous research that examined the ability of selected diagnosis-based risk adjusters to predict Medicare costs of frail and functionally impaired populations. This study addressed the following questions:
- How are Medicare expenses distributed across types of service, for different functional categories?
- Why do diagnosis-based risk adjusters predict expenses poorly for groups of people defined by functional status?
- Do diagnosis-based risk adjusters predict certain types of expenses better than others?

- Do diagnosis-based adjusters underpredict expenses for most functionally impaired persons, or for only a few who have high expenses?

DATA AND METHODS

Data

The data source for the study was the Medicare Current Beneficiary Survey (MCBS), a longitudinal, multipurpose survey of a nationally representative sample of the Medicare population (Adler, 1994). Both institutionalized persons and those residing in the community are included. Respondents are asked about health service utilization and costs, health status, and functional status. Survey responses are routinely linked to Medicare administrative records.

This study was conducted using a special file created by Health Economics Research for their development and validation of the PIPDCG model (Pope et al., 1999). The file contains MCBS data for 1991-1994. Persons with end stage renal disease or who were not entitled to Medicare Part A and Part B, or who were working aged, or who lived outside the United States were excluded. Each observation on the file contains PIPDCG and hierarchical coexisting condition (HCC) risk scores based on claims data in a base year (1991-1993), and actual expenses (excluding hospice expenses) incurred in the corresponding prediction year (1992-1994). Hospice expenses were excluded because they are not covered under Medicare capitation payments. Time in hospice and costs of non-hospice services incurred while enrolled in hospice were included in the study. If the sample person was in a health maintenance organization for part of either the base or prediction

year, or if the person was not alive at the start of the prediction year, then that observation was deleted from the file. Individuals could contribute more than one observation to the file if they were in the survey for more than 2 years.

Methods

Prediction year costs were annualized for persons who died during the year and their MCBS sample weight was multiplied by the fraction of the year that they were alive (Ellis and Ash, 1995). Costs for each prediction year were adjusted so that their weighted means were equal to the mean 1996 costs for the national 5 percent sample of Medicare data on which the PIPDCG was developed ($5,186).

The study file denoted the fraction of the prediction year that an individual resided in an institution, and the type of institution(s). Because the study file did not identify which months the respondent spent in an institution, it was not known which individuals were institutionalized at baseline (i.e., the beginning of the prediction year). Individuals were therefore defined as institutionalized if they resided in a nursing home or other LTC institution for the entire prediction year (or for that part of the year they were alive). By definition, these individuals were institutionalized at the beginning of the prediction year. All others were defined as community dwelling individuals, including those who spent part of the year in an institution. Analysis of MCBS data showed that most persons spending part of the year in an institution began the year in the community and entered an institution during the year (data not available). Persons entering an institution tend to have high costs in the year they enter, in part because of services used prior to institutionalization, and also because of heavy service use shortly after entering the institution (Gruenberg et al., 1999).

Each observation in the community dwelling population was categorized according to the number of ADLs that the person reported difficulty performing in the base year. Difficulty performing ADLs is a broad measure of functional limitation. Alternative measures that identify smaller numbers of individuals with greater impairment levels, are the need for supervision in performing ADLs, and the need for mechanical or human assistance in performing ADLs (Wiener et al., 1990). An additional functional impairment category was defined to include persons who reported needing human assistance in performing three or more ADLs. This category is meant to approximate many States' definitions of NHC status, which is the criterion for triggering higher AAPCC payments under S/HMO, PACE, and MSHO (Gruenberg et al., 1999). The group needing help with three or more ADLs overlapped significantly with the group reporting difficulty with five to six ADLs; also the findings for the group needing help with three or more ADLs were almost identical to the findings for the group reporting difficulty with five to six ADLs. Therefore, findings are not reported separately for persons needing help with three or more ADLs.

Predicted costs derived from the PIPDCG and HCC models were calibrated to the study sample by regressing actual prediction year costs for the full sample on PIPDCG and HCC scores separately. Because the study file had HCC scores derived from an early version of the HCC model that did not include Medicaid or formerly disabled status, two binary variables for these characteristics were included as additional independent variables in the HCC regression. The Medicaid variable identified persons who were "buyins" at any time in the base year, i.e., persons for whom the State paid the Part B Medicare premium. Buy-ins

Table 1

Sample Size and Distribution, by Institutional and Functional Status: Pooled Data, 1991-1994

Institutional and Functional Status	Medicare	Dually Eligible
N (Unweighted)	32,228	5,471
	Weighted Percent	
Total	100.0	100.0
Institutionalized	4.1	18.1
Non-Institutionalized	95.9	81.9
Non-Institutionalized	100.0	100.0
0 Activity of Daily Living	65.9	47.2
1-2 Activities of Daily Living	22.1	28.9
3-4 Activities of Daily Living	7.6	13.4
5-6 Activities of Daily Living	4.3	10.6

NOTES: Activity of Daily Living status was measured in the base years. Institutionalized persons are those residing in a long-term care facility for the entire prediction year.

SOURCE: Medicare Current Beneficiary Survey, 1991-1994.

include Medicaid eligibles, qualified Medicare beneficiaries and specified low-income Medicare beneficiaries, and exclude medically needy persons for whom certain States do not buy in. Medicare expenses were also regressed on demographic characteristics (age, sex, Medicaid, and institutional status, with interactions) for purposes of producing an AAPCC-type model that could be compared with PIPDCG and HCC.

Predicted costs for each observation were computed from each set of regression results. The primary focus of the analysis was on the computation of predictive ratios, i.e., the ratio of average predicted to average actual costs, for subgroups of the population defined by institutional and functional status. Predictive ratios close to 1.0 signify accurate prediction. All analyses incorporated MCBS weights, with adjustments as previously described for decedents.

RESULTS

Sample Description

The full sample comprised 32,228 observations, of whom 4.1 percent were continuously institutionalized in the prediction year (Table 1). Among persons living in the community at least part of the prediction year, approximately one-third reported one or more ADL difficulties in the base year. Almost 12 percent reported difficulty performing three or more ADLs (out of a maximum of six), with 4.3 percent reporting difficulty with five or more.

Dually-eligible persons showed a much greater level of impairment than the general Medicare population. Out of 5,471 observations, 18.1 percent represented persons who were institutionalized. Among those in the community, 24 percent reported difficulty performing three or more ADLs; 10.6 percent reported difficulty performing five or more ADLs. The high average level of impairment for dually eligible persons does not pose a problem for risk adjustment per se because PIPDCGs and HCCs incorporate a separate adjustment for Medicaid eligibility.

Among persons in the community, average Medicare expenses in the prediction year increased rapidly with the number of ADL difficulties reported in the base year (Table 2). Persons reporting no difficulty incurred $3,604 on average, compared with $13,557 for persons reporting difficulty with five or six ADLs. Institutionalized persons averaged $5,960, only 16 percent higher than persons living in the community.

Table 2

Distribution of Average Medicare Expenses[1], by Type of Service: Pooled Data, 1991-1994

| Type of Service | Total | Non-Institutionalized | | | | | Institutionalized |
		All	0 ADL	1-2 ADLs	3-4 ADLs	5-6 ADLs	
Medicare							
N (Unweighted)	32,228	30,269	18,507	7,278	2,734	1,750	1,959
Average Medicare Expenses	$5,186	$5,153	$3,604	$6,763	$9,131	$13,557	$5,960
				Percent			
Inpatient Hospital	54.1	54.4	54.8	56.4	54.0	48.3	47.4
Physician	27.3	27.1	31.2	25.8	22.3	19.5	31.5
Outpatient Hospital	7.5	7.2	8.7	6.4	6.1	4.4	12.8
Home Health	7.7	8.1	3.2	7.6	14.0	22.5	0.0
Skilled Nursing Facility	3.4	3.1	2.0	3.8	3.6	5.4	8.3
Cost Factor	1.0	1.0	0.7	1.3	1.8	2.6	1.1
Dually Eligible							
N (Unweighted)	5,471	4,383	2,048	1,236	586	513	1,088
Average Medicare Expenses	$7,152	$7,408	$4,756	$7,253	$10,178	$16,139	$5,987
				Percent			
Inpatient Hospital	50.4	51.0	53.5	53.1	50.0	45.8	47.1
Physician	25.6	24.6	29.0	25.1	22.3	20.3	31.0
Outpatient Hospital	8.5	7.5	9.4	7.2	8.0	5.0	13.7
Home Health	11.2	13.1	5.6	11.3	15.9	23.1	0.0
Skilled Nursing Facility	4.4	3.8	2.5	3.4	3.8	5.7	8.1
Cost Factor	1.4	1.4	0.9	1.4	2.0	3.1	1.2

[1] Expenses are expressed in 1996 dollars and exclude hospice services.

NOTES: ADL is activity of daily living. ADL status was measured in the base years. Cost factor is average Medicare expenses for a specific group divided by the mean Medicare expenses for all persons in the study sample ($5,186).

SOURCE: Medicare Current Beneficiary Survey, 1991-1994.

Average costs for institutionalized persons are relatively low because the institutionalized population was defined to include only those persons who resided in LTC settings for the entire prediction year. Their Medicare expenses tend to be much lower than those of persons who are new entrants to institutions (Gruenberg et al., 1999).

The types of expenses incurred by non-institutionalized persons with functional impairments differed from those incurred by the unimpaired. Among persons reporting no ADL difficulty, slightly more than 5 percent of expenses went toward home health or skilled nursing facility (SNF) care. By contrast, nearly 28 percent of expenses incurred by persons reporting difficulty with five or six ADLs went toward home health and SNF care, with most of it going to home health. Non-institutionalized dually eligible persons incurred higher average expenses than the overall Medicare population, but the pattern of expenditures was similar within functional categories, with slightly greater use of home health and SNF services among dually eligible persons at each functional level. Because the non-institutionalized dually eligible population has more people in high-ADL categories, the use of home health and SNF services was considerably higher overall (16.9 percent of expenses, compared with 11.2 percent for all non-institutionalized Medicare enrollees).

Predictive Ratios

The PIPDCG and HCC models both outperformed the demographic model in terms of predicting Medicare costs for non-institutionalized beneficiaries with ADL impairments (Table 3). For example, among persons reporting difficulty with five or six ADLs, the predictive ratios for

Table 3

Predictive Ratios, by Institutional and Functional Status: Pooled Data, 1991-1994

| Model | Total | Non-Institutionalized | | | | | Institutionalized |
		All	0 ADL	1-2 ADLs	3-4 ADLs	5-6 ADLs	
Medicare							
Demographic	1.00	1.00	1.36	0.81	0.63	0.46	1.00
PIPDCG	1.00	0.98	1.27	0.83	0.69	0.55	1.35
HCC	1.00	0.97	1.18	0.87	0.76	0.64	1.57
Dually Eligible							
Demographic	1.00	1.00	1.47	1.04	0.77	0.51	1.00
PIPDCG	1.02	0.95	1.32	1.01	0.75	0.56	1.44
HCC	1.00	0.90	1.15	0.95	0.76	0.61	1.59

NOTES: ADL is activity of daily living. ADL status was measured in the base years. A predictive ratio is the ratio of predicted to actual average Medicare expenses, excluding hospice expenses. The predictive ratio for total dually eligible beneficiaries is not always 1.0 because the models were calibrated on the full study sample, not the subset of dually eligible persons. Analysis is based on 32,228 Medicare cases and 5,471 dually eligible cases (unweighted). PIPDCG is principal inpatient diagnostic cost group. HCC is hierarchial coexisting condition.

SOURCE: Medicare Current Beneficiary Survey, 1991-1994.

Table 4

Predictive Ratios Based on Risk-Adjustment Models Incorporating Institutional Status: Pooled Data, 1991-1994

| Model | Total | Non-Institutionalized | | | | | Institutionalized |
		All	0 ADL	1-2 ADLs	3-4 ADLs	5-6 ADLs	
Medicare							
PIPDCG	1.00	1.00	1.29	0.85	0.71	0.57	1.00
HCC	1.00	1.00	1.20	0.90	0.80	0.68	1.00
Dually Eligible							
PIPDCG	0.99	0.99	1.36	1.04	0.78	0.59	1.03
HCC	1.00	1.00	1.29	1.06	0.84	0.67	1.00

NOTES: ADL is activity of daily living. ADL status was measured in the base years. A predictive ratio is the ratio of predicted to actual average Medicare expenses, excluding hospice expenses. The predictive ratio for total dually eligible beneficiaries is not always 1.0 because the models were calibrated on the full study sample, not the subset of dually eligible persons. Analysis is based on 32,228 Medicare cases and 5,471 dually eligible cases (unweighted). PIPDCG is principal inpatient diagnostic cost group. HCC is hierarchial coexisting condition.

SOURCE: Medicare Current Beneficiary Survey, 1991-1994.

the demographic, PIPDCG, and HCC models were 0.46, 0.55, and 0.64, respectively. All three models overpredicted average expenses for unimpaired persons and underpredicted average expenses for persons with functional impairments, with the degree of underprediction increasing with number of ADL impairments. The PIPDCG and HCC models overpredicted expenses for the continuously institutionalized population, but the demographic model did not because it includes a specific adjustment for institutional status. The institutional adjustment in the demographic model is positive, meaning that predicted costs are increased for the institutionalized; if the PIPDCG and HCC models contained an institutional adjustment, it would be negative. The HCC model outperformed the PIPDCG model in predicting expenses within ADL category, but overpredicted expenses to a greater degree for the institutionalized population. Patterns of over- and underprediction for dually eligible beneficiaries were similar to those for all Medicare beneficiaries. These findings are similar to those reported previously from MCBS data (Pope et al., 1998, 1999; Gruenberg et al., 1999).

The overprediction of expenses for the continuously institutionalized population suggests that the PIPDCG and HCC models might benefit from inclusion of a separate adjuster for baseline institutional status. Table 4 shows predictive ratios based on

Table 5

Mortality in the Prediction Year, by Institutional and Functional Status Pooled Data: 1991-1994

Institutional and Functional Status	Medicare	Dually Eligible
	Percent	
Total	5.2	8.3
Non-Institutionalized	4.5	6.0
0 Activity of Daily Living	2.5	3.1
1-2 Activities of Daily Living	5.9	5.0
3-4 Activities of Daily Living	8.7	7.4
5-6 Activities of Daily Living	18.7	19.0
Institutionalized	20.1	17.8

NOTES: ADL is activity of daily living. ADL status was measured in the base years. Analysis is based on 32,228 Medicare cases and 5,471 Medicare and Medicaid cases (unweighted). Percents reflect sample weights.

SOURCE: Medicare Current Beneficiary Survey, 1991-1994.

PIPDCG and HCC models plus an additional adjustment for institutional status (defined as those institutionalized the entire prediction year). This adjustment decreased predicted costs for the institutionalized population and increased them for the community population. The predictive ratios for both the institutionalized and community populations became 1.00, eliminating overprediction for the institutionalized, on average. Within the community population, predictive ratios for groups of functionally impaired persons improved slightly. For example, the predictive ratio for persons reporting difficulty with five or six ADLs increased from 0.55 to 0.57 and 0.64 to 0.68 under the PIPDCG and HCC models, respectively. Predictive ratios for unimpaired persons became slightly less accurate, however, increasing from 1.27 to 1.29 under PIPDCG, and 1.18 to 1.20 under HCC. Similar patterns are evident among dually eligible persons; the effect of incorporating an institutional adjuster was greater under the HCC model than under PIPDCG.

The findings in Table 3 demonstrate that functional impairment has an association with Medicare costs that is not reflected in individual demographic and diagnostic profiles. This suggests that functional status may be a proxy for disease severity, given that the PIPDCG and HCC models only capture severity with the limited data available in the diagnostic codes. Table 5 illustrates this point with mortality rates in the prediction year (a measure of illness severity), by institutional and impairment category. Among all Medicare beneficiaries, the mortality rate was 5.2 percent, varying from 2.5 percent for persons in the community with no impairments to 18.7 percent for persons in the community reporting difficulty with five or six ADLs. A similar pattern was observed among dually eligible persons. Functional status was significantly associated with probability of dying after controlling for demographics and PIPDCG score or HCC score through logistic regression models (results not shown).[1]

Another possible explanation for the patterns of under- and overprediction observed in Table 3 is that certain types of expenses associated with impairment category may not be well predicted by diagnosis-based models. Table 6 shows predictive ratios for specific types of expenses, based on the HCC adjusters. Predicted expenses were obtained from models that regressed a specific type of expense (physician expenses, for example), on HCC score, Medicaid status, and former disability status. Predictive ratios for outpatient and physician services were not far from one, even for categories of high

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[1] Data available from the author upon request.

Table 6

Average Medicare Expenses and Predictive Ratios, by Institutional and Functional Status and Type of Service: Pooled Data, 1991-1994

Institutional and Functional Status	Total Expenses		Inpatient Hospital		Outpatient Hospital		Physician		Skilled Nursing Facility		Home Health	
	Actual	Predictive Ratio	Actual	Predictive Ratio	Actual	Predictive Ratio	Actual	Predictive Ratio	Actual	Predictive Ratio	Actual	Predictive Ratio
Total	$5,186	1.00	$2,805	1.00	$388	1.00	$1,417	1.00	$175	1.00	$401	1.00
Non-Institutionalized	5,153	0.97	2,805	0.97	372	1.01	1,397	0.99	162	1.03	418	0.90
0 ADL	3,604	1.18	1,976	1.16	314	1.05	1,125	1.08	72	1.89	116	2.45
1-2 ADLs	6,763	0.87	3,815	0.84	435	0.98	1,743	0.90	258	0.78	511	0.95
3-4 ADLs	9,131	0.76	4,928	0.77	557	0.88	2,038	0.88	332	0.74	1,276	0.48
5-6 ADLs	13,557	0.64	6,543	0.73	592	1.00	2,643	0.82	731	0.44	3,047	0.27
Institutionalized	5,960	1.57	2,827	1.79	760	0.88	1,877	1.24	494	0.75	2	482.00
R-square		0.07		0.04		0.04		0.11		0.01		0.04

NOTES: ADL is activity of daily living. ADL status was measured in the base years. A predictive ratio is the ratio of predicted to actual average Medicare expenses, excluding hospice expenses. Predicted values are based on hierarchial coexisting conditions. Analysis is based on 32,228 Medicare cases (unweighted).

SOURCE: Medicare Current Beneficiary Survey, 1991-1994.

Table 7

Predictive Ratios Excluding Home Health and Skilled Nursing Facility Expenses:
Pooled Data, 1991-1994

| Model | Total | Non-Institutionalized | | | | | Institutionalized |
		All	0 ADL	1-2 ADLs	3-4 ADLs	5-6 ADLs	
Medicare							
Demographic	1.00	1.00	1.29	0.80	0.66	0.53	1.00
PIPDCG	1.00	0.99	1.21	0.82	0.73	0.66	1.27
HCC	1.00	0.98	1.12	0.87	0.81	0.77	1.47
Dually Eligible							
Demographic	1.00	1.00	1.36	1.01	0.78	0.58	1.00
PIPDCG	1.05	1.00	1.26	1.02	0.81	0.68	1.35
HCC	1.00	0.91	1.05	0.94	0.80	0.72	1.46

NOTES: ADL is activity of daily living. ADL status was measured in the base years. A predictive ratio is the ratio of predicted to actual average Medicare expenses, excluding home health, skilled nursing facility, and hospice expenses. The predictive ratio for total dually eligible beneficiaries is not always 1.0 because the models were calibrated on the full study sample, not the subset of dually eligible persons. Analysis is based on 32,228 Medicare cases and 5,471 dually eligible cases (unweighted). PIPDCG is principal inpatient diagnostic cost group. HCC is hierarchial coexisting condition.

SOURCE: Medicare Current Beneficiary Survey, 1991-1994.

impairment. Predictive ratios for inpatient hospital services resembled those for total Medicare expenses, presumably because inpatient hospital care is the largest component of Medicare costs. Predictive ratios were the farthest from 1.0 for home health and SNF expenses, particularly home health. For unimpaired persons the predictive ratio for home health expenses was 2.45, indicating severe overprediction. For persons reporting difficulty with five or six ADLs, the predictive ratio for home health was only 0.27, indicating severe underprediction. The inability of HCC to accurately predict home health care and SNF expenses, and the heavy use of these services by the severely impaired, partially explains the significant underprediction of total Medicare expenses for persons with five to six ADLs under the HCC model. It should be noted, however, that HCC categories were created on the basis of their relationship to total Medicare costs, and that diagnostic data might better predict home health and SNF expenses if diagnostic categories were created on the basis of their ability to predict these types of expenses.

The role of home health and SNF expenses in producing patterns of under- and overprediction is summarized in Table 7.

The table shows predictive ratios for Medicare expenses excluding home health and SNF care. A comparison with Table 3 reveals that the predictive ratios for highly impaired individuals are somewhat closer to 1.00 once home health and SNF expenses are removed from Medicare costs. For example, under the HCC model, the predictive ratio for non-home health and SNF expenses is 0.77 for persons reporting difficulty with five or more ADLs, compared with 0.64 for all Medicare expenses. Predictive ratios for persons with few or no functional impairments improved to a lesser degree after removing home health and SNF expenses, consistent with the smaller role of home health and SNF care in the service mix of these individuals.

Prediction at the Individual Level

Actual and predicted values under the HCC model were compared at the individual level to determine the consistency of under- and overprediction within specific ADL groups (Table 8). Despite the fact there was substantial underprediction on average for functionally impaired persons in the community, the HCC model over-predicted Medicare expenses for most

Table 8

Percent Distribution of Differences Between Actual and Predicted Costs: Pooled Data, 1991-1994

| Actual Minus Predicted Costs | Total | Non-Institutionalized | | | | | Institutionalized |
		All	0 ADL	1-2 ADLs	3-4 ADLs	5-6 ADLs	
Medicare							
				Percent			
Less than -$20,000	0.3	0.3	0.1	0.4	0.9	1.0	1.5
-$20,000 to -$10,001	3.8	3.3	2.4	4.5	5.7	7.1	16
-$1 to -$10,000	75.2	75.7	80.6	69.8	62.9	53.7	63.8
$0 to $9,999	12.1	12.1	11.0	13.2	16.3	16.8	10.8
$10,000 to $19,999	3.9	3.9	2.8	5.7	5.9	8.1	4.4
$20,000 or More	4.6	4.7	3.1	6.4	8.4	13.3	3.6
Dually Eligible							
				Percent			
Less than -$20,000	0.6	0.4	0.2	0.7	0.3	0.2	1.7
-$20,000 to -$10,001	6.9	4.9	3.1	5.9	6.7	7.9	16.3
-$1 to -$10,000	67.8	68.7	76.6	68.2	59.3	46.8	64.1
$0 to $9,999	12.8	13.6	11.5	13.4	17.1	18.9	9.4
$10,000 to $19,999	5.6	5.8	4.9	5.0	8.2	9.2	4.8
$20,000 or More	6.2	6.7	3.8	6.9	8.4	17.0	3.8

NOTES: ADL is activity of daily living. ADL status was measured in the base years. Predicted values are based on hierarchial coexisting conditions. Analysis is based on 32,228 Medicare cases and 5,471 cases (unweighted).

SOURCE: Medicare Current Beneficiary Survey, 1991-1994.

individuals within this group. For example, among persons reporting difficulty with five or six ADLs, predicted expenses under the HCC model exceeded actual expenses for 61.8 percent of the observations. Most overpredictions were not of high magnitude because more than 95 percent of the HCC-predicted expenses were under $15,000, and the lower limit on actual expenses is $0. On the other hand, some underpredictions fell short by large dollar amounts because actual expenses were highly skewed to the right, with 5 percent of the observations exceeding $32,000. Among persons in the community reporting difficulty with five or six ADLs, 13.3 percent had actual expenses that were higher than predicted by $20,000 or more. This minority of observations with large underpredictions produced an average predictive ratio of less than 1.0 for the group of persons reporting difficulty with five or six ADLs. Among persons with no ADL impairments, the HCC model overpredicted costs for 83 percent, with a smaller percent of significant underpredictions (3.1 percent had actual expenses $20,000 or

more above predicted). Among individual dually eligible persons, there was a similar pattern of under- and overprediction.

DISCUSSION

Home Health and SNF Costs

PIPDCG and HCC models tend to underpredict expenses for functionally impaired persons in the community in part because they do not accurately predict home health care and SNF expenses. Medicare home health and SNF expenses may be more difficult to predict with diagnosis-based adjusters because these services are not typically used to treat diseases in the same way as hospital and physician services. They are designed as post-acute benefits for rehabilitative care and for coping with disabilities associated with chronic diseases. Under the HCC model, home health care expenses may be more difficult to predict than other types of expenses because the version of the HCC model used in this analysis did not incorporate diagnoses recorded on home health claims.[2]

In addition, home health care may be more difficult to predict with models based on national data because of the geographic variation in home health use (Mauser and Miller, 1994). Risk adjustment for Medicare home health and SNF care is particularly problematic for dually eligible persons because of cost shifting and substitution of services that occurs between the Medicare and Medicaid programs (Kenney, Rajan, and Soscia, 1998).

The underprediction of Medicare expenses for functionally impaired individuals may have worsened over time, given the fact that home health and SNF costs under Medicare increased substantially during the 1990s. Home health services have increasingly been used in connection with chronic, rather than acute care; the diagnoses that serve as the basis of the PIPDCG and HCC models were designed around the need to explain acute care costs and may not predict chronic disease costs as well. Gruenberg et al. (1999) have found that PIPDCG and HCC models underpredicted Medicare costs for frail beneficiaries to a greater degree in 1994 than in 1992.

The role of home health care in the underprediction of Medicare expenses may change as a result of the BBA. Until recently, home health care was paid for under Medicare using traditional cost-based reimbursement. The BBA mandated a prospective payment system for home health that may significantly decrease home health expenses, particularly for heavy users of service. Underprediction for frail persons in the community may therefore become less severe under PIPDCG and HCC as time goes on. Preliminary analyses of 1997-1998 MCBS data suggest that home health costs still play a signifi-

cant role in the underprediction of Medicare expenses for functionally impaired individuals.

Individual Level Prediction

Although the PIPDCG and HCC models underpredicted average Medicare costs for frail beneficiaries, they overpredicted expenses for a majority of such individuals, and severely underpredicted expenses for a small minority. This pattern of over- and under prediction is a common feature of risk-adjustment models, and is a function of the highly skewed nature of Medicare expenses. The pattern of over- and under prediction within frailty subgroup is of interest because of the potential for significant selection to occur within frailty subgroups. If specialized plans target frail beneficiaries with extensive chronic care needs through advertising or other means, they may be severely underpaid. On the other hand, it may be possible for plans to discourage a small number of frail individuals with ongoing need for chronic care from enrolling. If so, such plans might be overpaid, even if they enrolled a population with a high level of ADL impairments.

Also of concern is the possibility of selective disenrollment, whereby a plan could attempt to selectively disenroll a small number of frail individuals with chronic care needs. For example, persons in need of substantial amounts of chronic care on an in-home basis may be a source of financial loss to their plans if the capitation rate is not adequately adjusted to reflect their needs. Persons with significant chronic care needs may be more at risk for selective disenrollment than expensive enrollees with high acute care needs, whose high costs may already be incurred by the time they are influenced to disenroll.

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[2] It is uncertain whether future versions of the HCC model will include diagnoses from home health and SNF claims.

The variability of expenditures within functional limitation categories suggests caution in the use of functional limitation to determine payment rates. If significant selection occurs within functional impairment category, then setting rates on the basis of functional status will not result in more appropriate payments, and could exacerbate over- or underpayment problems attributable to selection.

Institutional Status

The PIPDCG and HCC models were found to overpredict Medicare expenses for persons continuously institutionalized in LTC settings, most of whom have significant physical and/or cognitive impairments. This finding is attributable in part to the methodological decision to define persons institutionalized for part of the year as community dwellers. This decision was made because institutionalization occurring during the prediction year is a post hoc event, like hospitalization, that shouldn't be adjusted for. Because persons entering an institution during the year tend to be expensive (due in part to their frequent use of Medicare-covered SNF services), the inclusion of this group among the non-institutionalized population resulted in greater underprediction of expenses for frail persons in the community. If the analysis had been restricted to persons who lived in the community for the entire year, the predictions for this group would have been more accurate. Pope et al. (1999) have found that the PIPDCG model pays accurately on average for institutionalized persons, with the model tending to overpay for long-term institutional residents and underpay for short-term ones.

The pattern of underprediction for frail persons in the community potentially penalizes plans that enroll such persons and keep them out of nursing homes. This pattern occurs at least in part because of the interchangeability of Medicare-covered and non-covered services. Frail persons in the community receive many Medicare-covered services, particularly home health. Persons in institutions receive no home health care, and receive fewer Medicare-covered services of other kinds; their institutional expenses are seldom paid by Medicare. Consequently, the Medicare expense profile of frail beneficiaries tends to vary significantly according to whether they are institutionalized or not. This complicates the task of risk adjustment, particularly for plans that enroll a substantial number of frail beneficiaries. The problem is potentially worse for plans that target frail dually eligible persons, given that the dually eligible population has more persons in the community with ADL impairments, and a higher rate of institutionalization.

Using Diagnoses Identified from Claims

The underprediction of expenses for frail persons in the community may be related to the fact that some high-cost diagnoses do not put people in higher payment categories in the PIPDCG and HCC models. These diagnoses are considered vague, discretionary, or gameable, and the expenditures associated with these diagnoses were placed in the base categories of the PIPDCG and HCC models. Some of these diagnoses, such as osteoarthritis, osteoporosis, back pain, joint problems, and symptoms may create or signify disability and therefore appear disproportionately in the frail population. To the extent these diagnoses are associated with added health care costs, their exclusion from the models may produce underprediction for frail individuals. It was beyond the scope of this analysis to examine whether frail

beneficiaries have more of these types of diagnoses and whether their inclusion in the models would improve prediction.

Another possible explanation for under-prediction is that diagnoses may be under-coded for frail beneficiaries. Many frail individuals have multiple chronic diseases that interact to limit their functioning. Only selected diagnoses may be recorded on claims and encounter records, to the exclusion of some comorbidities. Diagnostic coding should become more complete as Medicare continues paying on the basis of diagnostic-based risk adjusters, particularly after models using codes from all sites of service are implemented.

A reason that PIPDCG and HCC models predict poorly for categories of people defined by frailty may be that functional status is a proxy for disease severity. Diagnostic categories in the PIPDCG and HCC models are defined by *International Classification of Disease, 9th Revision, Clinical Modification* codes, which contain limited information on severity. Diagnosis-based risk adjustment might improve significantly for frail populations if measures were developed that distinguish between mild and severe cases within disease categories.

SUMMARY

The findings reported herein illustrate some of the potential problems that may be encountered in setting appropriate payment levels for plans that enroll disproportionate numbers of frail Medicare beneficiaries. The PIPDCG and HCC models, which are based primarily on diagnoses, underpredict average expenses for frail persons living in the community. The findings also suggest caution in the incorporation of functional status measures for risk adjustment because of the cost variability within functional status groups, and the potential for significant selection within these groups.

Part of the problem in establishing appropriate payment levels for functionally impaired persons is their heavy use of home health care and SNF services. Improving the prediction of home health and SNF costs would result in more accurate payment for frail persons. Information on users of home health services, which will soon be available from Outcome and Assessment Information Set data, and on the institutionalized population through the Minimum Data Set, may prove useful for risk adjustment.

Although this study was initiated because of concerns about plans that target frail beneficiaries, the findings have implications for plans that enroll a broader cross-section of the Medicare population. Most plans historically have had financial incentives to avoid enrolling chronically ill persons because the AAPCC did not reflect their higher expected expenses. Diagnosis-based risk adjustment will more accurately reflect expenses of persons within disease categories, but will continue to underpredict average expenses for beneficiaries who are frail and functionally impaired. Under existing forms of diagnosis-based risk adjustment, plans will continue to have financial incentives to avoid beneficiaries for whom the models do not pay accurately, i.e., frail persons in need of significant amounts of chronic care.

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