Modeling Medicare Costs of PACE Populations

James Robinson, Ph.D., F.S.A., and Sarita L. Karon, Ph.D.

Historically, Medicare has paid PACE providers a monthly capitated rate equal to 95 percent of the site's county AAPCC multiplied by a PACE-specific frailty adjuster of 2.39. The Balanced Budget Act of 1997 makes PACE a permanent provider category and mandates that future Medicare payments be based upon the rate structure of the Medicare+Choice payment system, adjusted for the comparative frailty of PACE enrollees and other factors deemed to be appropriate by the Secretary of Health and Human Services. This study revisits the calculation of the PACE frailty adjuster and explores the effect of risk adjustment on that frailty adjuster.

INTRODUCTION

Concerns about high health care expenditure rates have given rise to a variety of public and private initiatives to better manage both the use and costs of health care services. Several programs have been developed that use managed care strategies to better control costs and utilization. One of the few such programs to address the needs of elders with complex and chronic care needs is the Program of All-Inclusive Care for the Elderly (PACE), a voluntary program that coordinates all acute and long-term care services and multiple sources of funding (typically, Medicare and Medicaid) for elders who are deemed to be "nursing home certifiable" (NHC) under the laws of their State. In the past, Medicare has paid PACE providers a monthly capitated rate equal to 95 percent of the site's county average adjusted per capita cost (AAPCC), multiplied by a frailty adjuster of 2.39. The Balanced Budget Act of 1997 (BBA) makes PACE a permanent provider category and mandates that future Medicare payments be based upon the rate structure of the new Medicare+Choice (M+C) program. This study presents a model that can be used to calculate a frailty adjuster that is appropriate for a variety of populations, such as may be present in the different PACE sites.

The original development and subsequent analyses of the frailty adjuster by Gruenberg (Gruenberg, Tompkins, and Porell, 1990; Gruenberg, Silva, and Leutz, 1993; Gruenberg and Kaganova, 1997) used data from the Social Health Maintenance Organization (SHMO) demonstration program to develop models that predicted the likelihood that an individual would meet NHC criteria. These predictive models were applied to nationally representative data bases (the 1982 National Long-Term Care Survey [NLTCS], 1984 NLTCS, 1989 NLTCS, and the Medicare Current Beneficiary Survey [MCBS], depending on the particular study) to obtain NHC weights (predicted likelihoods) that were used in the regression of individual Medicare cost ratios against respondent characteristics, such as age, sex, and functional status. The fitted regression functions were then applied to the observed distribution of characteristics

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for existing PACE sites to estimate the aggregate ratio of PACE Medicare costs to national Medicare costs. The SHMO data were ideal for this purpose, as they provided a clinical assessment of NHC status, as well as self-reported data on health and functional status that closely approximated those available from the other surveys.

The use of data from the SHMO also imposes some important limitations in applying this experience to PACE. First, the data reflect the NHC definitions of only four States and do not reflect the experience of all States that are home to one or more PACE programs. Analyses by Gruenberg, Tompkins, and Porell (1990) found differences even among these four States in the definition of NHC. Although these differences appeared to have little impact on the average Medicare cost ratio, they did have a significant impact on the proportion of individuals predicted to be NHC. This has important implications for the costs that one might expect, as the PACE demonstration moves to a permanent provider status and is expanded to new sites.

Second, data are limited to those who are members of a SHMO program. Because the SHMO is a voluntary demonstration program, it is likely that there is some bias associated with the choice to enroll. It is difficult to assume that the SHMO population is representative of the general Medicare population or even of the NHC population. The use of a screening and queuing mechanism has been used to ensure that the SHMO population is, within broad categories, comparable to the average Medicare population in terms of impairment level (Leutz et al., 1988). However, this is a rather crude adjuster. Further, the SHMO population is overwhelmingly white, and few enrollees in the original four sites were eligible for Medicaid (Harrington, Newcomer, and Preston, 1993). These two factors alone distinguish the SHMO from the PACE program, which serves primarily low-income and substantially other-than-white populations. Both of these factors (income and race) are known to be associated with health care costs. Each of these reasons suggested that it would be useful to explore alternative methods of modeling NHC status.

Finally, an evaluation of this relationship in 1997 by Gruenberg et al. suggested that the PACE frailty adjuster was not excessive and might indeed be inadequate to capture the costs of the PACE membership. However, that study estimated Medicare costs based upon the characteristics of individuals currently enrolled in existing PACE sites. The expected expansion of PACE sites and likely increased variation among them raises concerns that such a method might not yield the best predictor of future costs. The study reported here was intended to address some of these challenges and to provide an assessment of the appropriateness of the frailty adjuster that is independent of the original developers of that rate.

METHODS

Overall Approach

The principal objective of the study was to construct a mechanism for determining the Medicare fee-for-service (FFS) costs for PACE populations and to assess the appropriateness of the current 2.39 PACE adjuster. More specifically, the question was hypothetical: "What would Medicare have spent on PACE enrollees in an FFS environment had they not been the subject of a special payment program?" Because the appropriateness of the frailty adjuster will depend on the needs of the enrollee population, and the characteristics of that

population vary by site, we focused on the development of a model that could be used to set site-specific rates, rather than on the determination of a single best national average adjuster. Given the potential variability of PACE enrollee characteristices, we focused our analysis on PACE-eligible individuals (i.e., those who met NHC and age eligibility criteria), rather than on enrollees in PACE programs. The model we developed can be used to develop a single frailty adjuster for each population or to develop a set of frailty adjusters that are risk-adjusted for the case-mix characteristics of the population.

The current PACE frailty adjuster is constant across sites and over time. In reality, however, each PACE site uses the definition of NHC that is current in the State where it is located. The definition of NHC status drives the calculation of the appropriate frailty adjuster. Thus, understanding the variations in the State definitions is key to understanding the appropriateness of any frailty adjuster. Consequently, we began by identifying the variation in NHC definitions and their similarities to develop a set of NHC definitions to be used throughout the remainder of the analyses.

The remaining steps were devoted to the problem of estimating Medicare FFS costs of a target NHC population, which may be defined by NHC status at admission alone (i.e., current PACE policy) or by ongoing NHC qualification (i.e., future PACE policy). There were three key components in the analysis: a population model, a cost model, and a capitation model. The population model defined cost-level groups (CLGs), i.e., groups of individuals with similar expected costs, and summarized the rates of transition between groups. The cost model provided estimates of expected Medicare FFS costs for each CLG, by age, sex, and service type. Finally, the capitation model applied the population and cost models to specific target NHC populations to derive appropriate capitation rates and/or frailty adjusters. Together, these three model components identified population characteristics that had a significant impact on expected Medicare FFS costs, allowing us to assess the stability (or lack thereof) of program costs across subpopulations for new entrants versus tenured participants and for early versus later program years. The models further allowed us to evaluate the stability over time of Medicare FFS costs for NHC populations, evaluate the variation in these costs within NHC populations, and compare these costs for NHC populations with costs for the entire Medicare FFS population.

Data Sources

We employed two primary data sources in this modeling effort, the MCBS and the NLTCS. We briefly describe each of these in this section. Additional discussion of the similarities, differences, and the challenging aspects presented by each of these two data sources can be found in Robinson and Karon (1998).

NLTCS Data Considerations

Survey responses and linked Medicare claim records for the 3 calendar months prior to the interview in the 1994 round of the NLTCS were used to classify individuals with respect to demographic characteristics and health status. Linked claim records for the 4-month period starting with the calendar month of the interview were used to derive the relationship between these characteristics and expected Medicare FFS monthly claim payments.

Linked claim records included charges and payments by type of service for 1994 and 1995 along with the service period associated with each record. The payment

amount for each claim record (or line item within a record) was prorated across the indicated service period to obtain payment amounts by calendar month of service. Average monthly claim amounts for the 3-month period prior to the interview month and the 4-month period starting with the interview month were summarized for each individual. The presurvey claim activity was used as explanatory variables in the construction of the cost model. The post-survey claim activity served as the dependent variable in the cost-model regression analyses. The 4-month maximum was felt to be short enough to ensure that the individual's characteristics would not have drifted very far from those measured on the interview date and was long enough to provide a reasonably credible estimate of the individual's Medicare claim rate.

Because the NLTCS is not a random sample of Medicare enrollees, individual-specific weights provided with the public use files were used in the statistical analysis of the survey data. Some individuals represented a few hundred individuals in the general population, and others represented several thousand. Individuals with claim records indicating end stage renal disease were removed from the analysis, because the Medicare costs of such individuals are not covered under the capitation structure.

Two limitations of the NLTCS presented problems in the analysis. First, the NLTCS did not include Medicare enrollees under the age of 65, i.e., the adult disabled population. We relied instead on the MCBS data to provide information on this group.

The second issue concerns the identification of individuals enrolled in managed care programs such as Medicare HMOs. Because the objective of the analysis was to estimate NHC expected FFS expenditures, we needed to remove the managed care population from the survey data. The linked Medicare claim records only related to FFS claims, so no adjustments were needed to remove managed care expenditures from that data. The survey records, however, included a complete cross-section of elderly Medicare enrollees, some of whom were enrolled in managed care. Unfortunately, there was no explicit identifier in the survey for managed care enrollees. To overcome this shortcoming in the data, we used the MCBS data files (where managed care status was available for all records) to examine the relationship between linked FFS claim record activity and managed care enrollment. We developed a simple predictive model of managed care status as a function of the presence or absence of FFS claim records and attained age. This predictor was applied to each individual in the NLTCS sample by multiplying the individual's sample weight by the estimated probability that the individual was not enrolled in managed care. The re-weighted NLTCS sample was representative of the Medicare elderly FFS population in 1994.

MCBS Data Considerations

The second principal data source employed in the study was the 1994, 1995, and 1996 Access to Care rounds from the MCBS, along with the linked Medicare FFS claim records for each year. As with the linked NLTCS claim records, we grouped claim amounts by service month relative to the interview month. Unlike the NLTCS, however, the linked claim records were subject to discontinuities at the end of each calendar year.

The Access to Care public use files are structured on an always-enrolled basis within each survey year. That is, individuals must be enrolled in Medicare continuously from the start of the year through the Access to Care interview date in that year

to be included in the file. Only the claim records associated with these individuals are included in the linked claim file for that year. For example, if an individual included in the 1994 survey died in 1995 before the 1995 interview, no information about the death would be available in the 1995 survey, and no 1995 FFS claim records would be available in the 1995 linked claim file. Consequently, we can only follow the postinterview FFS claim experience through the end of the interview year.

For each individual, we computed the average monthly Medicare FFS claim amount for a relatively short period of time during and following the interview month. For each individual, the observation period was defined to start at the beginning of the interview month and extend through the earliest of (1) the end of the month of death, (2) the end of the interview year, or (3) the end of the third calendar month following the interview month. The 4-month maximum was chosen for the same reasons as described for the NLTCS data. We limited the observation period to the end of the calendar year because matching claim records for the following year were only available for those who persisted to the next Access to Care interview date. (Including these claims would have biased the calculations by giving disproportionately greater weight to survivors versus those who died or were otherwise excluded from the next round of interviews.)

Therefore, the sampled monthly claim rates included the predeath claim experience of individuals who died during the observation period. Using this approach, rather than dividing the individual's claims for the full year by 12, yields two significant advantages. First, the effects of status drift are minimized. Second, end-of-life claim costs are appropriately represented.

Unlike the NLTCS data, end stage renal disease and managed care enrollment status were both explicitly available in the MCBS data, enabling us to easily remove these groups from the analysis.

Modeling NHC Status

As indicated, NHC definitions are set by each State. Practical limitations made it impossible to assess each State's approach to NHC. Instead, we chose a sample of States, which we used to evaluate the variation among definitions. A review of States' NHC criteria conducted for the American Association for Retired Persons (Snow, 1995) suggested that State NHC definitions could be classified as falling into one of three types, based on the types of concerns addressed. These types were medical-necessity only, medical and functional concerns, and comprehensive, which included consideration of social supports, physical environment, and other issues as well as medical and functional concerns.

We used this typology, in addition to geography, to stratify the 50 States for purposes of selecting a sample of 9 States. A request was made to each State selected for a copy of all NHC-related documentation. Proxy definitions were developed that applied data available from each of the study data sources (MCBS, NLTCS) to determine whether each of the individual sample members would meet specific State NHC criteria. Details of these States' NHC definitions and the proxy definitions used in this study can be found in Robinson and Karon (1998). All individuals who were receiving care in nursing homes at the time of data collection were assumed to meet NHC criteria in all States. Because of the limited nature of the MCBS data,

extensive use was made of the linked claims data to identify NHC status. We recognize that this is not an optimal approach, as claims data capture only an expressed need that is satisfied by purchased services paid for by Medicare. It does not identify individuals who are at a point where they have a need for service that has not yet been met, nor does it identify individuals whose needs are currently being met by family caregivers or other sources not paid for by Medicare. However, without using the claims data, it was not possible to define NHC status from the MCBS data. We therefore used information from the home health, durable medical equipment, and Part B claims data for claims occurring within 1 month before or after the interview date.

A string variable was created to indicate NHC status with respect to each State. This variable was analyzed to identify similarities among States and reduce the number of NHC definitions to a representative set for use in cost analyses. Categorical data analyses were conducted to determine the most efficient groupings of NHC definitions, such that the nine definitions could be reduced to a concise and meaningful set of representative definitions for use in the cost analyses.

Modeling Costs

CLG Definitions

The initial step in modeling costs was to develop the CLGs, used in the population, cost, and capitation components, that identify groups of individuals with relatively homogeneous Medicare cost profiles. This approach recognized the heterogeneity of any NHC population. Differences in age, sex, functional, cognitive, and medical status can be significant within any NHC population. As a result, expected monthly FFS expenditures can vary dramatically from one NHC individual to another.

We used data from both the MCBS and NLTCS to develop CLG definitions. CLGs were developed from each data base separately, and results were compared to identify a single CLG structure that captured significant amounts of the cost variance in each data base. Initially, the CLG structure included age group, sex, Medicaid status, institutional status, functional impairment (activities of daily living [ADLs] and instrumental activities of daily living [IADLs]), cognitive status, and other factors represented by the level of recent FFS claim activity. The analysis of postinterview FFS claim data produced model R^2 values (coefficient of determination) of 12 percent and 11 percent, respectively, for the 1994 NLTCS and 1994-1996 MCBS data. Given the other explanatory factors, Medicaid status was found to be statistically insignificant, accounting for only 0.1 percent of the variation explained by the full NLTCS model and 0.003 percent in the MCBS model. We further found that age could be ignored beyond the distinction between the disabled adult (ages 55-64) and the elderly (65 and over) Medicare populations. With these variables removed, the CLGs were formed by the intersection of the following defining dimensions: sex, disabled adult versus elderly, functional/cognitive status, and recent Medicare FFS activity.

Functional/cognitive status was defined as a six-level scale shown in Table 1. The five ADLs considered were eating, dressing, transferring, bathing, and toileting. A person was considered to be impaired in a given ADL if the survey indicated that the respondent did not perform the activity at all, required help (direct or standby), or relied upon special equipment to perform

Table 1

Functional/Cognitive Scale

Status	Description
0	Well, i.e., no functional/cognitive impairments
1	One or more of 6 IADLs impaired, or cognitive impairment
2	One of 5 ADLs impaired
3	Two or 3 of 5 ADLs impaired
4	Four or 5 of 5 ADLs impaired
5	Institutionalized

NOTES: IADL is instrumental activity of daily living. ADL is activity of daily living.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

the activity. The six IADLs included telephone use, heavy housework, light housework, meal preparation, shopping, and paying bills. A person was considered impaired in a specific IADL if the survey indicated that the respondent was not capable of performing the activity due to health or disability. These standards for ADL and IADL impairment were selected in order to allow consistent scoring from the information available from both the NLTCS and the MCBS while yielding a reasonable number of survey respondents in each CLG.

Cognitive impairment on the MCBS was based upon an explicit indication of mental retardation or Alzheimer's on the survey or an indication that the interview was completed by proxy because of mental inability of the individual. Cognitive impairment on the NLTCS was based upon two or more incorrect responses to the Short Portable Mental Status Questionnaire (SPMSQ) included in the survey or an explicit indication of mental retardation, senility, or Alzheimer's, or an indication that the interview was completed by proxy due to a mental/physical impairment of the individual.

Recent Medicare FFS activity was used to help explain the variation in expected monthly FFS expenditures that remained after accounting for the effects of age, sex, and functional/cognitive status. There are a multitude of individual characteristics that contribute to this remaining variation, not all of which are available from the survey questionnaires. Rather than attempting to itemize these lurking variables, we employed recent claim history as an aggregate proxy for these factors. Knowledge of an individual's claim activity prior to the interview proved to be a significant factor in predicting postinterview claim activity. We classified individuals based upon the average monthly FFS claims incurred in the 3 calendar months prior to the interview month according to the following, using a four-tier classification: no Medicare claims; average monthly claims of $1-99; average monthly claims of $100-999; and average monthly claims of $1,000 or more. Although the boundaries between these groups are somewhat arbitrary, they yield reasonable numbers of survey respondents at each level and explain a large portion of the variation in Medicare claims from respondent to respondent.

The reader is cautioned that scoring functional or cognitive status using other standards for impairment, such as requiring hands-on assistance each time the activity is performed, can result in a very different status distribution than that produced by the standard employed in this analysis. Therefore, many of the CLG-specific results of this analysis would not be applicable to groups defined under alternative standards without adjustment. On the other hand, we believe that the use of reasonable alternative standards for establishing health status, consistently applied in a parallel analysis, would produce similar aggregate results. Similarly, alternate approaches to reflecting recent levels of respondent claim activity are likely to impact the CLG-specific results more significantly than aggregate results.

Cost-Model Structure

To complete the cost model, we next considered the marginal impact of NHC status, conditional upon the information contained in the CLG structure. With the additional NHC dimension, data sparseness required that we employ regression methods to estimate NHC effects within CLGs, rather than computing sample averages for every combination of CLG and NHC status. Weighted least-squares regression was applied to estimate cost-model parameters.

Regression models were fit separately to the 1994 NLTCS and the combined 1994-1996 MCBS data without NHC status as an explanatory variable to provide baseline costs by CLG. These models included distinct parameters for each combination of health status, claim-history level, and disabled/aged classification. Additional adjustment terms for the enrollee's gender varied by claim-history level. The resulting model R^2 values were 11 percent for both data sources.

With baseline cost estimates in hand, additional, simpler models were fit to the NLTCS data to estimate the impact of NHC status on expected monthly costs. Identical model forms were fit using the three NHC working definitions. These models included terms for each combination of health status, recent claim activity level, and aged/disabled classification, plus additive NHC adjustment terms, one for health status, one for claim-history level, and one for aged/disabled classification. Estimated NHC costs from these models were compared with those from a simple model that excluded the NHC adjustment terms. These differences by CLG were used to adjust the baseline NLTCS cost estimates to obtain expected NHC monthly costs. The resulting fitted NLTCS cost function is of the form:

$$\text{Cost}(\text{sex}, \text{CLG}, \text{NHC}) = \mu_{\text{sex,CLG}} + \beta_{\text{CLG, NHC,}}$$

where Cost(sex, CLG, NHC) is the average cost per month as a function of the sex, CLG, and NHC status of the individual, $\mu_{\text{sex,CLG}}$ is a tabulated value varying by sex and CLG, and $\beta_{\text{CLG, NHC}}$ is a tabulated adjustment factor varying by cost level group and NHC status.

Population-Model Structure

To follow the progress of a population of interest after NHC certification, it is necessary to know the rate of change in those factors that affect expected FFS costs, i.e., the CLG transition rates. Using the 1994-1996 MCBS data, individuals can be classified by CLG in successive annual interviews, and the annual transition rates between CLGs can be directly observed. Unfortunately, the MCBS Access to Care files only include individuals continuously enrolled since the beginning of the interview year. Consequently, individuals who die before the interview date cannot be distinguished from those who leave the survey for other reasons (e.g., terminating panels). Thus, the observed transition rates are conditional upon survival from year to year. These conditional transition rates can be used, but only in conjunction with estimates of annual survival rates.

Because we can observe the MCBS from the interview date through the end of the year, unbiased estimates of annual mortality rates, by CLG, were obtained by dividing the number of deaths prior to the end of the year by the person-years of exposure from the interview dates to the earlier of the date of death or the end of the year. Conditional transition probabilities, given survival, were derived by sorting the 1994 survey individuals by health status, recent claim activity level, sex, and age group. For each such grouping, individuals surviving to the 1995 interview were

classified by new health-status and claim-history level. Individuals not persisting to the 1995 survey interview were removed. Therefore, for each sex and age group, a 24-by-24 observed conditional transition matrix was available, with each row corresponding to a starting health status and recent claim-history level and each column corresponding to a destination combination. The numbers in each row were expressed as percentages of the starting population to obtain transition rates from status to status. An identical analysis was applied to the 1995-1996 transition period.

The transition rates exhibited broad general trends by age and sex. Precise estimates of the rate of change with age was difficult to ascertain from the available data, however. Age/sex-specific CLG transition rates were obtained as a weighted average of the observed age/sex-specific rates and the average transition rates obtained by combining all ages and sexes. The weight given the observed age/sex-specific values was positively related to the number of observations in the starting population for the group. This approach gave greater credibility to observed trends by age/sex exhibited by groups with more observations.

Using these estimates of mortality rates and conditional transition rates, the population model was developed to describe the distribution of Medicare enrollees by CLG cell and NHC status as well as the rates of transition among the cells and statuses. The population model was used to track the CLG migration of a population of interest, i.e., a cohort of Medicare enrolless recently determined to be NHC, month by month through time. Because the BBA requires annual recertification of NHC status, we were interested in following the progress of the group for at least 1 year. The cost model provided FFS expenditure estimates for only a short period following NHC certification. The population model was applied to estimate the month-by-month change in the CLG distribution so that the cost model could be applied appropriately to the changing status distribution of the population several months after NHC certification. The blending of the population and cost models in this manner was the function of the capitation model.

Capitation-Model Structure

The capitation model combines the fitted cost and population models to predict FFS costs over a specified rating period. In addition, the capitation basis (e.g., total person-months) for the period was summarized so that appropriate capitation rates for the group could be computed. For this study, the capitation model took the form of an Excel spreadsheet that was easily modified to the user's specifications.

The capitation model starts with a user-specified breakdown by age, sex, and CLG of individuals immediately following NHC certification. This starting population might be based upon an existing PACE site or upon the possible profile of a new PACE site. For this analysis, we used the 1994 NLTCS profile of non-institutional Medicare enrollees meeting the conditions of the comprehensive NHC definition. With PACE being expanded, we felt it was appropriate to consider the Medicare costs of new sites formed from a random sample of NHC-eligible individuals. The capitation model next applies the mortality and status transition rates from the population model to project the month-by-month migration among the CLGs. The cost-model formula for monthly FFS Medicare expenditures is applied to the evolving population CLGs and the results are summed over the analysis period. Because PACE regulations under BBA were expected to require annual recertification, we projected results

Table 2

Proportions of Weighted Sample That Are NHC Under Varying State Criteria

State	1994 NLTCS	1996 MCBS
Alabama	11.5	11.6
Arkansas	8.5	10.5
Florida	12.6	16.1
Kansas	12.8	11.6
Louisiana	17.1	13.9
Maryland	20.7	13.9
Massachusetts	8.4	9.9
Minnesota	11.4	11.1
Montana	8.7	13.5

NOTES: NHC is nursing home certifiable. NLTCS is National Long-Term Care Survey. MCBS is Medicare Current Beneficiary Survey. HMO is health maintenance organization. Data exclude individuals with end stage renal disease. Data in the MCBS exclude individuals enrolled in an HMO. Weights in the NLTCS have been adjusted to reflect the probability of being enrolled in an HMO. A fixed portion of each sample (5.5 percent NLTCS; 6.1 percent MCBS) meet NHC criteria because of institutional residence.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

for 1 year following NHC certification in this analysis. The aggregate projected expenditures are also subtotaled by age, sex, and CLG and are expressed as per member per month values by dividing by the corresponding number of person-months observed in each grouping. For comparison purposes, the capitation model also generates results for a starting population of individuals drawn at random from all Medicare enrollees.

FINDINGS

Table 2 shows the proportion of weighted sample members who met each State's NHC definition for each of the two data bases. For the NLTCS data, the portion ranged from 8.4 percent to 20.7 percent; for the MCBS data, it ranged from 9.9 percent to 16.1 percent. In several States, the proportions identified as NHC-eligible were similar in each of the two data bases. However, in other States (e.g., Maryland and Montana) there were large differences in the proportions classified as NHC-eligible. These differences stem from the limitations of each data base, relative to the State-specific NHC definitions. In Maryland, much of the NHC definition addressed the need for skilled nursing care; there was more such information in the NLTCS than MCBS. By contrast, the MCBS and linked Medicare claims data, but not the NLTCS, allowed identification of people receiving ostomy care, a key component of the Montana NHC definition.

A key step in the analysis was the identification of a reduced set of NHC definitions. Given the nine State definitions available, there were 512 (29) possible combinations of NHC definitions. In both data bases, far fewer combinations were found to actually exist, supporting the idea of a reduced set. Of the 512 possible combinations, only 102 were found in the NLTCS, and 23 of those described 97.2 percent of all individuals, including the 76.0 percent who were not NHC under any State's criteria. Using data from the MCBS, only 70 combinations were found, with 18 describing 98.9 percent of all weighted individuals. Overall, 76.9 percent of weighted individuals did not meet any State's NHC definition. These proportions are similar to those found in the NLTCS data base. The high degree of overlap among State definitions may result, in part, from our inability to model the full complexity of the NHC definitions because of data limitations. However, a conceptual review of the State NHC definitions also indicates a high degree of similarity among them.

After testing a number of models, we developed a hierarchical approach to summarizing NHC status. People who were NHC by virtue of residing in an institution were placed in the first level of the hierarchy. Conceptually, the subsequent levels captured community-resident individuals who met medical-necessity criteria; community residents who met medical/functional criteria; and community residents who met comprehensive NHC criteria,

respectively. These levels were applied hierarchically, so that a person who met the medical-necessity criteria was removed from the sample to which the medical/functional criteria were applied. In order to develop a reduced form archetype of each of these levels, we defined each level by two States only. Medical necessity was typified by Maryland and Alabama, so that a person who met the NHC criteria in either of those two States was classified as meeting a generic medical-necessity criterion. The medical/functional NHC status was typified by Louisiana and Kansas, and the comprehensive NHC status was typified by Florida and Montana. This scheme categorized all individuals in both data bases, with the exception of a single observation in the 1996 MCBS.

Table 3 shows the distribution under this scheme for each of the data bases. Clearly, medical necessity captures the majority of individuals who are NHC, regardless of the type of definition applied. For example, using the NLTCS data and looking at the community-resident people only, anywhere from 75.8 percent to 100 percent of NHC-eligible people can be identified through the medical-necessity definition. In Montana, a State that uses a comprehensive definition, 97.8 percent of the people who met Montana's comprehensive NHC definition would also be considered NHC using only a medical-necessity criterion. Most of the people who did not meet the medical-necessity definition would have been identified as NHC-eligible using a medical/functional definition. Only 0.3 percent of the people who are NHC under Montana's comprehensive definition would not be eligible under one of the more restrictive definitions (i.e., medical necessity or medical/function). Similar but less extreme patterns are observed in the MCBS data. This reflects the more limited data on skilled nursing that is available in the MCBS.

Table 4 shows the population estimates, broken down by CLGs, for the 1994 NLTCS and 1996 MCBS. Note that the NLTCS values (29.7 million in total) are restricted to ages 65 and over. The displayed MCBS values (28.7 million in total) are for ages 55 (the minimum age for PACE eligibility) and over but exclude individuals not enrolled in Medicare continuously from the start of the year through the interview date. Consequently, the MCBS values for the disabled adults and for new elderly enrollees (age 65) are understated. Aside from these differences, the results in total and by CLG from the two data sources are reasonably consistent. This provides some assurance that the CLG definitions tailored to the very different information available from each survey result in similar extrapolations to the general population.

Table 5 shows the percent of individuals classified as NHC, using the three working definitions of NHC, broken down by health status and recent claim history for the 1994 NLTCS. For example, 85 percent of individuals with one ADL impairment and between $100 and $999 of recent Medicare claims per month are estimated to be NHC-eligible under the comprehensive NHC definition. As expected, the NHC percentage generally increases with increasing impairment and recent claim activity. Individuals living in institutions are, by definition, 100 percent NHC under the working definitions. Similar results were obtained for the 1996 MCBS data, with a stronger reliance on recent claim activity. (Data available from the authors.) This was most likely attributable to the differences in the types of information available in the two surveys rather than to any significant differences in the sampled populations.

Table 3

Distribution of NHC-Eligible Persons Across Summary Levels

Data Source and State	NHC Total	NHC Type	Total NHC by Hierarchical Level				Community-Based NHC by Level		
			Institution	Medical Necessity	Medical/ Functional	Compre-hensive	Medical Necessity	Medical/ Functional	Compre-hensive
1994 NLTCS			Percent						
Alabama	3,413,971	Med Nec	47.8	52.2	—	—	100.0	—	—
Maryland	6,149,939	Med Nec	26.5	73.5	—	—	100.0	0.0	—
Arkansas	2,531,668	Med Nec	64.5	34.0	1.5	—	95.9	4.1	—
Kansas	3,813,623	Med/Fxn	42.8	46.5	10.7	—	81.3	18.7	—
Louisiana	5,076,849	Med/Fxn	32.2	51.4	16.4	—	75.8	24.2	—
Massachusetts	2,492,534	Med/Fxn	65.5	33.8	0.7	—	98.0	2.0	—
Florida	3,741,365	Comp	43.6	46.1	9.2	1.1	81.9	16.3	1.9
Minnesota	3,376,204	Comp	48.4	39.7	12.0	—	76.8	23.2	—
Montana	2,590,112	Comp	63.0	36.1	0.7	0.1	97.8	1.9	0.3
1996 MCBS									
Alabama	3,588,171	Med Nec	52.7	47.3	—	—	100.0	—	—
Maryland	4,295,268	Med Nec	44.0	56.0	—	—	100.0	—	—
Arkansas	3,250,532	Med Nec	58.2	41.8	—	—	100.0	—	—
Kansas	3,600,237	Med/Fxn	52.5	17.2	30.3	—	36.2	63.8	—
Louisiana	4,304,467	Med/Fxn	43.9	56.1	—	—	100.0	—	—
Massachusetts	3,077,671	Med/Fxn	61.5	38.5	—	—	100.0	—	—
Florida	4,978,102	Comp	38.0	20.7	21.2	20.1	33.4	34.2	32.4
Minnesota	3,434,326	Comp	55.1	34.9	9.5	0.5	77.7	21.0	1.2
Montana	4,170,006	Comp	45.4	33.3	6.6	14.8	60.9	12.1	27.0

NOTES: NHC is nursing home certifiable. NLTCS is National Long-Term Care Survey. MCBS is Medicare Current Beneficiary Survey. Med Nec is medical necessity. Med/Fxn is medical/ functional. Comp is comprehensive.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

Table 4

Medicare Enrollment, by Cost-Level Group

Functional/Cognitive Status and Recent Claims Amounts	Enrollees inThousands		Percent of Total	
	1994 NLTCS	1996 MCBS	1994 NLTCS	1996 MCBS
Total	29,698	28,653	100.0	100.0
Well				
All Amounts	22,683	20,856	76.4	72.8
$0	9,295	6,658	31.3	23.2
$1-99	9,153	9,483	30.8	33.1
$100-999	3,362	3,838	11.3	13.4
$1,000 or More	873	878	2.9	3.1
IADL/CI				
All Amounts	2,068	2,377	7.0	8.3
$0	650	548	2.2	1.9
$1-99	897	991	3.0	3.5
$100-999	374	589	1.3	2.1
$1,000 or More	148	250	0.5	0.9
1 ADL				
All Amounts	1,250	1,643	4.2	5.7
$0	274	317	0.9	1.1
$1-99	510	596	1.7	2.1
$100-999	321	500	1.1	1.7
$1,000 or More	145	230	0.5	0.8
2-3 ADLs				
All Amounts	1,171	1,358	3.9	4.7
$0	240	196	0.8	0.7
$1-99	403	481	1.4	1.7
$100-999	299	346	1.0	1.2
$1,000 or More	229	335	0.8	1.2
4-5 ADLs				
All Amounts	892	741	3.0	2.6
$0	156	100	0.5	0.4
$1-99	197	160	0.7	0.6
$100-999	222	199	0.7	0.7
$1,000 or More	317	282	1.1	1.0
Institutional				
All Amounts	1,633	1,677	5.5	5.9
$0	179	57	0.6	0.2
$1-99	746	806	2.5	2.8
$100-999	433	510	1.5	1.8
$1,000 or More	275	304	0.9	1.1

NOTES: NLTCS is National Long-Term Care Survey. MCBS is Medicare Current Beneficiary Survey. IADL/CI is instrumental activity of daily living/cognitive impairment. ADL is activity of daily living.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

Medicare FFS Monthly Costs by CLG

The CLGs were defined to break down the NHC working definitions into subgroups that help to explain the variation in Medicare FFS claim activity within and between NHC classifications. Table 6 shows the average monthly FFS expenditures by major CLG grouping arising from the 1994 NLTCS and from the combination of the 1994, 1995, and 1996 MCBS Access to Care files.

The overall average values are consistent with published national Medicare monthly expenditures. The 1994 NLTCS average value of $348 per month is very close to the $343 per month average reported for aged Medicare enrollees without end stage renal

Table 5

NHC Classification, by Cost-Level Groups for 1994 NLTCS Data

Health Status and Recent Claims Amounts	Total Enrollees	NHC Count in Thousands			Percent NHC		
		Medical Necessity	Medical/ Functional	Compre-hensive	Medical Necessity	Medical/ Functional	Compre-hensive
Total	29,698	6,163	7,090	7,130	21	24	24
Well							
All Amounts	22,683	1,109	1,248	1,249	5	6	6
$0	9,295	248	311	311	3	3	3
$1-99	9,153	508	566	566	6	6	6
$100-999	3,362	280	296	296	8	9	9
$1,000 or More	873	73	76	76	8	9	9
IADL/CI							
All Amounts	2,068	1,003	1,263	1,288	49	61	62
$0	650	202	303	315	31	47	48
$1-99	897	459	567	577	51	63	64
$100-999	374	232	279	282	62	75	75
$1,000 or More	148	110	114	115	74	77	78
1 ADL							
All Amounts	1,250	782	1,004	1,013	63	80	81
$0	274	127	216	216	46	79	79
$1-99	510	304	384	388	60	75	76
$100-999	321	237	269	272	74	84	85
$1,000 or More	145	114	135	137	78	93	94
2-3 ADLs							
All Amounts	1,171	819	1,057	1,059	70	90	90
$0	240	94	192	192	39	80	80
$1-99	403	276	357	359	68	88	89
$100-999	299	246	281	281	82	94	94
$1,000 or More	229	203	227	227	89	99	99
4-5 ADLs							
All Amounts	892	817	885	888	92	99	99
$0	156	123	151	154	78	97	98
$1-99	197	178	197	197	91	100	100
$100-999	222	210	222	222	95	100	100
$1,000 or More	317	306	316	316	97	99	99
Institutional							
All Amounts	1,633	1,633	1,633	1,633	100	100	100
$0	179	179	179	179	100	100	100
$1-99	746	746	746	746	100	100	100
$100-999	433	433	433	433	100	100	100
$1,000 or More	275	275	275	275	100	100	100

NOTES: NHC is nursing home certifiable. NLTCS is National Long-Term Care Survey. IADL/CI is instrumental activity of daily living/cognitive impairment. ADL is activity of daily living.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

disease in calendar year 1994 (Health Care Financing Administration, 1996). Similarly, the 1994-1996 MCBS average value of $365 per month is very close to the average of $369 reported for Medicare enrollees without end stage renal disease in 1995 (Health Care Financing Administration, 1996). Please note that the $369 average is a weighted average of the aged and disabled (both without end stage renal disease) adult values at the end of the table.

Within these global averages, both data sources exhibit average FFS expenditures ranging from as little as $100 per month to more than $3,000 per month. It is also

Table 6

Average Monthly Medicare Fee-for-Service Costs, by Cost-Level Group

Health Status and Recent Claims Amounts	1994 NLTCS	1994-1996 MCBS
Total	$348	$365
Well		
All Amounts	238	221
$0	98	93
$1-99	205	178
$100-999	434	362
$1,000 or More	1,308	1,052
IADL/CI		
All Amounts	371	469
$0	135	87
$1-99	325	311
$100-999	655	611
$1,000 or More	969	1,598
1 ADL		
All Amounts	528	593
$0	186	160
$1-99	298	281
$100-999	622	800
$1,000 or More	1,768	1,547
2-3 ADLs		
All Amounts	819	815
$0	445	305
$1-99	397	300
$100-999	855	602
$1,000 or More	1,911	2,075
4-5 ADLs		
All Amounts	1,548	1,875
$0	620	361
$1-99	520	714
$100-999	976	1,014
$1,000 or More	3,041	3,681
Institutional		
All Amounts	721	748
$0	281	204
$1-99	388	306
$100-999	752	588
$1,000 or More	1,863	2,288

NOTES: NLTCS is National Long-Term Care Survey. MCBS is Medicare Current Beneficiary Survey. IADL/CI is instrumental activity of daily living/cognitive impairment. ADL is activity of daily living.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

interesting to note that the most expensive cells are not associated with individuals residing in institutions but with heavily impaired community residents.

Although there are some cell-by-cell differences between the NLTCS and MCBS values, the overall monthly average cost patterns by health status and level of recent claim activity are quite similar.

The impact of NHC status on monthly Medicare FFS costs is most easily seen in the output from the capitation model. Table 7 shows average monthly FFS costs generated by the capitation model using the NLTCS cost model previously described. The ratios of the NHC costs to the base costs indicate that the percentage loading for NHC decreases to nearly zero as we move to more heavily impaired health statuses. When both CLG dimensions, health status and recent claim activity, are considered together, the statistical significance of NHC status is greatly diminished. That is, the CLG structure "explains away" a substantial portion of the higher-than-average costs observed for NHC individuals. This effect is more pronounced for the medical/functional and comprehensive working definitions of NHC than for the medical-necessity definition. Although the medical-necessity NHC effect contributes an additional 0.2 percent to the model's 11.7 percent R^2 value, the two broader definitions produce increments of only 0.05 percent.

Mortality Rates by CLG, Sex, and Age

Table 8 shows the estimated annual probability of death by CLG and age group derived from the observed postsurvey deaths in each of the 3 MCBS years. The annual mortality rates range from as low as 0.5 percent for young, unimpaired females to as high as 75 percent for severely impaired elderly males. These values have been smoothed subject to the constraint that the rates not decrease by age or with increasing impairment. The high mortality exhibited by those in more heavily impaired CLGs contributes to a gradual reduction in the average impairment (and cost) levels of those that survive.

Table 7

1994 NLTCS Average Monthly Medicare FFS Costs, by Cost-Level Group and NHC Status

Health Status and Recent Claims Amounts	Expected FFS Cost per Month				As a Percent of Base		
	Base	Medical Necessity	Medical/ Functional	Compre-hensive	Medical Necessity	Medical/ Functional	Compre-hensive
Well							
All Amounts	$238	$286	$282	$282	120	119	119
$0	98	61	103	95	62	104	96
$1-99	205	221	202	212	108	99	104
$100-999	434	449	450	443	103	104	102
$1,000 or More	1,308	884	955	938	68	73	72
IADL/CI							
All Amounts	371	450	397	402	121	107	108
$0	135	144	124	129	107	91	95
$1-99	325	360	316	327	111	97	100
$100-999	655	686	656	660	105	100	101
$1,000 or More	969	887	892	892	91	92	92
1 ADL							
All Amounts	528	598	553	552	113	105	105
$0	186	198	185	180	106	99	97
$1-99	298	330	295	294	111	99	99
$100-999	622	640	621	617	103	100	99
$1,000 or More	1,768	1,671	1,735	1,736	94	98	98
2-3 ADLs							
All Amounts	819	927	887	885	113	108	108
$0	445	477	520	518	107	117	116
$1-99	397	433	440	439	109	111	111
$100-999	855	874	879	878	102	103	103
$1,000 or More	1,911	1,868	1,911	1,911	98	100	100
4-5 ADLs							
All Amounts	1,548	1,627	1,548	1,544	105	100	100
$0	620	705	612	608	114	99	98
$1-99	520	564	520	520	109	100	100
$100-999	976	999	976	976	102	100	100
$1,000 or More	3,041	3,043	3,038	3,035		100	100
100							

NOTES: NLTCS is National Long-Term Care Survey. FFS is fee for service. NHC is nursing home certifiable. IADL/CI is instrumental activity of daily living/cognitive impairment. ADL is activity of daily living.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

CLG Transition Rates

CLG transition rates are best summarized by the results generated by the capitation model. Table 9 shows sample CLG distributions at the beginning and end of a 12-month period. The "All" columns correspond to the CLG distribution exhibited by all individuals in the 1994 NLTCS. The "medical necessity" columns correspond to a starting CLG distribution taken from community-based 1994 NLTCS NHC individuals using the medical-necessity working definition.

Note that the "All" population ages as expected. That is, after a year, there is a general shift in the surviving population to more impaired CLG cells. The surviving NHC population, on the other hand, becomes less impaired. Those in very impaired statuses at the start of the year are subject to higher mortality, resulting in a "survival of the fittest" effect that produces a regression toward a more typical health-status distribution.

We see that it is inappropriate to use the population breakdown by CLG immediately following NHC certification to represent

Table 8

1994-1996 MCBS Mortality Rates, by Cost-Level Group, Sex, and Age Group

Health Status and Recent Claims Amounts	Male Age Groups				Female Age Groups			
	45-64	65-74	75-84	85 and Over	45-64	65-74	75-84	85 and Over
	Percent							
Well								
$0	0.7	1.2	1.9	7.2	0.5	0.6	1.2	4.7
$1-99	0.8	1.3	2.1	7.7	0.5	0.7	1.2	5.0
$100-999	0.8	1.4	2.2	8.0	0.6	0.7	1.3	5.2
$1,000 or More	2.4	4.1	6.2	22.0	1.6	2.1	3.8	14.7
IADL/CI								
$0	0.7	1.2	1.9	7.2	0.5	0.6	1.2	4.7
$1-99	0.8	1.3	2.1	7.7	0.5	0.7	1.2	5.0
$100-999	0.8	1.4	2.2	8.0	0.6	0.7	1.3	5.2
$1,000 or More	2.5	4.1	6.3	22.0	1.6	2.1	3.8	14.7
1 ADL								
$0	0.7	1.2	1.9	7.2	0.5	0.6	1.2	4.7
$1-99	0.8	1.3	2.1	7.7	0.5	0.7	1.2	5.0
$100-999	0.8	1.4	2.2	8.0	0.6	0.7	1.3	5.2
$1,000 or More	2.5	4.1	6.3	22.0	1.6	2.1	3.8	14.7
2-3 ADLs								
$0	1.0	1.7	2.6	9.7	0.7	0.9	1.6	6.3
$1-99	1.1	1.8	2.8	10.4	0.7	0.9	1.7	6.7
$100-999	1.1	1.9	2.9	10.8	0.8	1.0	11.8	7.0
$1,000 or More	3.3	5.5	8.4	28.7	2.2	2.8	5.1	19.4
4-5 ADLs								
$0	3.0	4.9	7.5	26.0	2.0	2.5	4.6	17.5
$1-99	3.2	5.2	8.0	27.6	2.1	2.7	4.9	18.6
$100-999	3.3	5.5	8.4	28.5	2.2	2.8	5.1	19.3
$1,000 or More	9.5	15.3	22.8	63.1	6.4	8.1	14.4	47.2
Institutional								
$0	4.1	6.8	10.3	34.3	2.8	3.5	6.4	23.6
$1-99	4.4	7.2	11.0	36.3	3.0	3.7	6.8	25.0
$100-999	4.6	7.5	11.5	37.5	3.1	3.9	7.1	26.0
$1,000 or More	13.0	20.8	30.4	75.2	8.9	11.1	19.6	59.0

NOTES: MCBS is Medicare Current Beneficiary Survey. IADL/CI is instrumental activity of daily living/cognitive impairment. ADL is activity of daily living.
SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

the average breakdown over the entire period until the next certification. Over the course of 1 year, the percent of the population exhibiting no functional or cognitive impairment increases from 24.5 percent to 40.5 percent.

Sample Capitation-Model Results

Table 10 shows summary values from the capitation model applied to the 1994 NLTCS data using the comprehensive NHC working definition. The CLG distribution of all elderly community-based NHC individuals was tracked for 12 months from the NHC determination. Aggregate results for the 12-month period are shown in the upper portion of the table. The bottom portion of the table shows the appropriate frailty adjusters, depending upon the level of risk adjustment incorporated in the base cost estimate to which the frailty adjuster is applied.

Four levels of risk adjustment are presented. The first level assumes no risk adjustment in the base. The resulting frailty adjuster for this random sample of the NHC-eligible persons is 183 percent. This value is the counterpart to the current 239-percent frailty adjuster. Of course, the current adjuster reflects the characteristics

Table 9

Annual Cost-Level Group Distribution Change in Total Medicare Versus Non-Institutional Medical-Necessity NHC

Health Status and Recent Claim Amounts	Starting Distribution				Distribution After 12 Months			
	Count		Percent		Count		Percent	
	All	Medical Necessity	All	Medical Necessity	All	Medical Necessity	All	Medical Necessity
Total	29,698	4,531	100.0	100.0	28,580	4,252	100.0	100.0
Well								
All Amounts	22,683	1,109	76.4	24.5	21,482	1,724	75.2	40.5
$0	9,295	248	31.3	5.5	7,333	378	25.7	8.9
$1-99	9,153	508	30.8	11.2	9,717	839	34.0	19.7
$100-999	3,362	280	11.3	6.2	3,598	397	12.6	9.3
$1,000 or More	873	73	2.9	1.6	835	111	2.9	2.6
IADL/CI								
All Amounts	2,068	1,003	7.0	22.1	2,219	604	7.8	14.2
$0	650	202	2.2	4.5	524	123	1.8	2.9
$1-99	897	459	3.0	10.1	868	241	3.0	5.7
$100-999	374	232	1.3	5.1	607	180	2.1	4.2
$1,000 or More	148	110	0.5	2.4	220	61	0.8	1.4
1 ADL								
All Amounts	1,250	782	4.2	17.3	1,325	510	4.6	12.0
$0	274	127	0.9	2.8	273	77	1.0	1.8
$1-99	510	304	1.7	6.7	506	191	1.8	4.5
$100-999	321	237	1.1	5.2	369	177	1.3	4.2
$1,000 or More	145	114	0.5	2.5	177	64	0.6	1.5
2-3 ADLs								
All Amounts	1,171	819	3.9	18.1	1,216	667	4.3	15.7
$0	240	94	0.8	2.1	176	88	0.6	2.1
$1-99	403	276	1.4	6.1	452	258	1.6	6.1
$100-999	299	246	1.0	5.4	309	171	1.1	4.0
$1,000 or More	229	203	0.8	4.5	279	150	1.0	3.5
4-5 ADLs								
All Amounts	892	817	3.0	18.0	762	552	2.7	13.0
$0	156	123	0.5	2.7	111	64	0.4	1.5
$1-99	197	178	0.7	3.9	141	111	0.5	2.6
$100-999	222	210	0.7	4.6	213	162	0.7	3.8
$1,000 or More	317	306	1.1	6.8	297	215	1.0	5.1
Institutional								
All Amounts	1,633	-	5.5	0.0	1,576	195	5.5	4.6
$0	179	-	0.6	0.0	74	8	0.3	0.2
$1-99	746	-	2.5	0.0	749	55	2.6	1.3
$100-999	433	-	1.5	0.0	466	67	1.6	1.6
$1,000 or More	275	-	0.9	0.0	286	65	1.0	1.5

NOTES: NHC is nursing home certifiable. IADL/CI is instrumental activity of daily living/cognitive impairment. ADL is activity of daily living.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

of actual PACE enrollees, a subset of the random sample considered in this example of the capitation analysis.

The second level of risk adjustment assumes that age/sex-specific rates (not shown) for the "Total" column are applied to the age/sex distribution of the NHC population of interest to obtain age/sex-adjusted base rates for the NHC population. The resulting frailty adjuster falls to 168 percent.

The third level of risk adjustment applies the "Total" population average monthly costs by health status to the health-status distribution of the NHC population. The frailty adjuster applicable to these health-status-adjusted base rates decreases to 104 percent.

Finally, the fourth risk-adjustment level applies "Total" population average monthly costs by health status and recent

Table 10

Sample Capitation Model Output for Non-Institutional NHC Persons for Year Following Certification, Using 1994 NLTCS Data

Health Status and Recent Claims Amounts	Year Following Certification				
	Enrollee Months in Thousands		Cost per Month		
	Total	NHC	Total	NHC	NHC/Total
					Percent
Aggregate	350,226	64,212	$358	$655	183
Well					
All Amounts	265,593	19,444	243	279	115
$0	100,749	4,650	99	95	96
$1-99	112,935	9,117	204	211	103
$100-999	41,642	4,453	434	436	101
$1,000 or More	10,267	1,223	1,304	922	71
IADL/CI					
All Amounts	25,650	12,611	403	410	102
$0	7,108	3,021	135	129	95
$1-99	10,606	5,414	325	326	100
$100-999	5,768	3,030	657	658	100
$1,000 or More	2,169	1,146	987	886	90
1 ADL					
All Amounts	15,416	10,143	543	552	102
$0	3,279	2,018	186	180	97
$1-99	6,100	3,881	299	294	99
$100-999	4,120	2,925	624	619	99
$1,000 or More	1,917	1,319	1,757	1,735	99
2-3 ADLs					
All Amounts	14,299	11,480	845	883	105
$0	2,528	1,936	445	518	116
$1-99	5,106	4,110	397	440	111
$100-999	3,644	2,983	856	879	103
$1,000 or More	3,021	2,451	1,921	1,921	100
4-5 ADLs					
All Amounts	9,989	9,235	1,586	1,563	99
$0	1,624	1,452	620	608	98
$1-99	2,053	1,993	519	519	100
$100-999	2,615	2,445	975	976	100
$1,000 or More	3,698	3,344	3,035	3,030	100
Institutional					
All Amounts	19,279	1,299	737	1,000	136
$0	1,572	57	281	281	100
$1-99	8,965	378	388	392	101
$100-999	5,381	423	751	752	100
$1,000 or More	3,361	442	1,860	1,850	99
Frailty Adjusters					
Unadjusted Base		183			
Age/Sex Adjusted Base		168			
Functional/Cognitive Adjusted Base		104			
Functional/Cognitive/Prior- Claim Adjusted Basis		99			

NOTES: NHC is nursing home certifiable. NLTCS is National Long-Term Care Survey. IADL/CI is instrumental activity of daily living/cognitive impairment. ADL is activity of daily living.

SOURCE: Robinson, J., and Karon, S., Madison, Wisconsin, 1998.

claim-history level to the NHC populations. The resulting frailty adjuster is very near 100 percent.

Effective January 1, 2000, the M+C program adopted health-status risk adjustment in its rate structure, specifically incorporating an individuals's prior-year inpatient claims experience into the rate determination for the next year. The appropriate frailty adjuster to be applied to this new M+C rate requires analysis of the relationship between the M+C risk-adjustment factors and those used in this study. If the M+C risk factors can be determined from the NLTCS or MCBS, the capitation model could compute the new M+C rate for the target population and re-express the capitation rate as a percentage of the M+C rate. If more risk factors are added to the M+C rate calculation in the future, the necessary NHC frailty adjuster would shrink in a manner similar to that exhibited by the progression of risk-adjusted bases already discussed.

Other approaches to reflecting the health status of the PACE participant in the capitation rate are also possible. For example, the base to which the frailty adjuster is applied might be taken to be the unadjusted average monthly FFS cost, $358 in this example. The frailty adjuster could then be modified to reflect information available about the individual's health. If the health-status information (IADLs/ADLs/cognitive impairment) is available, we could compute adjusters by status by dividing the cost-per-month values in Table 10 by $358. This would yield the following values using the comprehensive NHC definition: Well=78 percent, IADL/cognitive impairment=115 percent, 1 ADL=154 percent, 2-3 ADLs=247 percent, 4-5 ADLs=437 percent, Institutionalized=279 percent.

DISCUSSION

In this article, we present an approach developed to examine the appropriate Medicare frailty adjuster to be applied to an expansion of the PACE program. The current frailty adjuster of 2.39 has been in use since the beginning of the PACE demonstration program. Numerous changes in the policy environment and demographic shifts suggest that this factor should be revisited. The model that we developed enables one to specify any starting population, some key characteristics, and transition probabilities, to determine the appropriate adjuster. We used this model to explore the impact of alternative approaches to risk adjustment on the frailty adjuster.

We began by developing a model of program eligibility, based on NHC status. It appears possible to develop a reduced-form NHC definition that captures most people who would qualify under most States' definitions. This suggests that it might be feasible to develop a single, national eligibility standard. Although this could offer the advantages of greater equity across the Nation and a simpler approach to determining payment adjusters, it is likely to be politically difficult to achieve. It would require States to use a different eligibility rule for PACE than for other State programs, such as Medicaid waivers and nursing home care.

We found that 20-30 percent of individuals starting a year as NHC will not be NHC at the end of the year. The NHC persistence varies by the type of definition employed as well as the ending health status of the individual. Consequently, the expected new requirement for annual recertification of PACE eligibility may

affect a significant percentage of program participants. How such individuals should be treated is a policy matter that, once specified, can be incorporated into the capitation model for analysis.

Any discussion of the results of this study must recognize the limitations of the data sources employed for modeling NHC status. Although both the NLTCS and the MCBS provide a wealth of information about the individuals surveyed, the accurate determination of NHC status using a State's definition usually requires specific items not directly available from the survey files. Approximations and proxies for needed values cloud subsequent analysis. On the other hand, it was also clear that the many differences in State NHC definitions, when applied to the survey populations, did not result in entirely different NHC populations. Correlations in the types of information being used to classify individuals acted to offset the apparent differences in the specific data items used. Therefore, even though the survey data frequently did not directly provide the information called for in a State's NHC definition, the approximations and proxies that were used are probably more reliable when taken together than when considered item by item.

An obvious result of the analysis is the lack of homogeneity of the individuals satisfying any NHC definition. Within the NHC class, expected FFS expenditures ranged from as low as $100 per month to more than $3,000 per month. Therefore, variations in the enrollment process at different PACE sites could result in dramatically different expected cost profiles. Unless the payment system reflects these site-to-site differences in enrollee characteristics, the program may be exposed to a substantial selection risk.

This analysis does not attempt to measure differences in the enrollment process among the existing PACE sites. The sample calculation in the previous section assumed that the enrollment rate was constant across CLGs, producing an unbiased sample of the entire comprehensive NHC-eligible population. It is likely that actual PACE sites differ in their enrollment of the various NHC subgroups, so that the appropriate frailty adjuster would be significantly different from the unbiased average of 183 percent. For example, there is evidence that enrollees of existing PACE sites are more heavily impaired than would be the case for a randomly selected NHC population. DataPACE reports (National PACE Association, 1999) for 1998 indicate that, on the average, the number of ADLs impaired for enrollees of current PACE sites is approximately 3.0, well above the average of about 1.1 ADLs for the random sample of NHC-eligible persons. Therefore, the implied adjuster for the average current PACE population is somewhere between 247 percent and 437 percent. The precise value for a particular PACE site will vary, depending upon the participant characteristics of that site.

On the other hand, with the expansion of PACE, it is prudent to consider the random-sample enrollment scenario, as there is no assurance that future sites will enroll similarly biased subpopulations of NHC-eligible individuals. If future PACE sites exhibit similar enrollment profiles as existing sites, then the average adjuster should be greater than 183 percent. If future sites enroll an unbiased sample of NHC-eligible individuals, then the average adjuster should be 183 percent. If future site enrollment is skewed toward less impaired CLGs within the NHC population, then the average adjuster should be less than 183 percent. It is precisely this uncertainty in the future enrollment process that convinces us that the capitation calculation

should reflect actual risk characteristics of the site, either by adjustment to the M+C rate, by adjustment to the frailty adjuster, or a combination of both approaches.

Another clear result of the analysis is that the PACE frailty adjuster must anticipate the level of risk adjustment in the M+C rate to which it is applied. If the rate is a simple unadjusted average for the entire Medicare population, then the PACE frailty adjuster will be significantly greater than 100 percent and, in theory, should vary from site to site with differences in anticipated enrollment profiles. As more information about the site's enrolled population is incorporated into the M+C rate calculation, the necessary additional NHC rate-loading shrinks and becomes less variable from site to site. In fact, the NLTCS analysis indicates that, if functional/cognitive status and recent service utilization are considered in the base rate, then the frailty adjuster might not be needed at all. As the M+C risk-adjustment structure evolves, the PACE adjuster will need to be modified as well.

REFERENCES

Gruenberg, L., Tompkins, C., and Porell, F.: *Capitation Rates for the Frail Elderly*. Report of the Institute for Health Policy, Heller Graduate School, Brandeis University. Waltham, MA. October 1990.

Gruenberg, L., Silva, A., and Leutz, W.: *An Improved Disability-Based Medicare Payment System for the Social/HMO*. Report to HCFA. The Long-Term Care Data Institute. Cambridge, MA. February 1993.

Gruenberg, L., Kaganova, E.,and Rumshiskaya, A.: *Updating the Social/HMO AAPCC*. Report to the Health Care Financing Administration. DataChron Health Systems, Inc. Cambridge, MA. December 1993.

Gruenberg, L., and Kaganova, J.: *An Examination of the Cost-Effectiveness of PACE in Relation to Medicare*. Report to the Health Care Financing Administration. DataChron Health Systems, Inc. Cambridge, MA. January 1997.

Harrington, C., Newcomer, R.J., and Preston, S.: A Comparison of S/HMO Disenrollees and Continuing Members. *Inquiry* 30(4):429-440, Winter 1993.

Health Care Financing Administration: *Medicare and Medicaid Statistical Supplement*. Baltimore, MD. 1996.

Leutz, W., Abrahams, R., Greenlick, M., et al.: Targeting Expanded Care to the Aged: Early SHMO Experience. *The Gerontologist* 28(1):4-17, 1988.

National PACE Association: Proceedings of the 1999 Spring Policy Symposium. Arlington, VA. 1999.

Robinson, J.M., and Karon, S.L.: *PACE Rate Work*. Report to the Health Care Financing Administration. Research Triangle Institute and the Center for Health Systems Research and Analysis, University of Wisconsin. NTIS Accession No. PB99-137168INZ. Research Triangle, North Carolina. December, 1998.

Snow, K.I.: *How States Determine Nursing Facility Eligibility for the Elderly:* A National Survey. American Association of Retired Persons. Washington, DC. 1995.

Reprint Requests: James Robinson, 610 Walnut Street, 11th floor, Madison, WI 53705. E-mail: Jim@chsra.wisc.edu