Refinement of Medicare's Home Health Prospective Payment System: Final Report

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Empirical Analysis of a New Payment System

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Executive Summary

The Balanced Budget Act of 1997 and subsequent legislation mandated that the Center for Medicaid & Medicare Services (CMS) develop a prospective payment system (PPS) for the reimbursement of home health services. Medicare home health prospective payments are case-mix adjusted by a model developed by Abt Associates for CMS. The original model was based on patient-level data collected from a sample of 88 home health agencies between October 1997 and mid-1999.

Under the prospective payment system, home health agencies are reimbursed for care provided to home health patients for each 60-day period (episode). In accordance with the original model developed by Abt Associates, for each episode, patients are categorized into one of 80 home health resource groups (HHRGs). Each of the HHRGs combines a clinical, functional, and service severity level, where severity levels are determined on a point system based on the following factors:

- Clinical – whether the patient has one or more clinical conditions such as urinary incontinence; pain; problems with vision; intravenous/infusion (IV), enteral, or parenteral therapies; the presence of wounds or pressure ulcers, etc.

- Functional – whether the patient has problems with activities of daily living such as dressing, bathing, transferring, walking (locomotion), and toileting.

- Service use – whether the patient had 10 or more therapy visits during the episode and whether the patient had a recent hospital and/or rehabilitation stay.

Around the time the original HH PPS went into effect, it was generally recognized that ongoing research might lead to improvements in the system and that it would be necessary to update model estimates after home health agencies adapted to the new system. The main areas identified for study were:

- Monitoring changes in patient characteristics and case-mix distribution over time.
- Reduced reliance on the therapy threshold.
- The resource needs of long-term patients.
- Refinements to the then-current case-mix model.
- Changes to the current methodology of paying for non-routine supplies.

The purpose of this report is to describe the results of several analyses that Abt Associates conducted to address these areas. Areas that we address in detail in this report include the development of the four-equation model eventually adopted by CMS in its 2007 case-mix refinement proposals in the Notice of Proposed Rulemaking (NPRM) (CMS-1451-P, Federal Register, May 4, 2007). We also cover in detail subsequent validation analyses that supported the case-mix classification system presented in the Final Payment Rule (CMS-1451-FC, Federal Register, August 29, 2007). This report additionally includes an analysis of the sources of the changes in home health case-mix that have occurred since implementation of PPS and the analyses that led to the proposals for nonroutine supplies payment as presented in the NPRM and the Final Payment Rule.

Exploratory Analyses

We began analyses to describe utilization patterns under the PPS and to identify potential refinements as soon as data on home health service use under the system became available[1]. The materials used for these analyses included home health claims accumulated in the National Claims History, which were cleaned, edited, summarized, and linked with OASIS assessments. The resulting file was called the Home Health Datalink File; the file construction was contracted to Fu Associates, Arlington, VA, so that the file is sometimes referred as the "Fu file." Documentation of the exploratory analyses sometimes refers to the analysis datasets as "waves"; in each case, this represents a file covering a successive time period, and the period covered by the data will be identified. For many of the exploratory analyses, only initial episodes in a series of a person's related episodes were used.

Recalibrating the Original Model

Before exploring ways to refine the original model, we recalibrated (estimated new coefficients for) the model using the second wave of PPS data (July 2002 to March 2003), and compared the fit of the original model to the recalibrated version. The best option for the recalibrated model had a marginally lower adjusted R-squared than the model already used for payment (.3019 as opposed to .3075). This suggests that the home health case-mix model did not need to be recalibrated unless new variables were to be added.

Pattern Analysis

The objective of this task was to describe changes over time in the prevalence of the clinical, functional, and service use variables included in the case-mix "clinical on top" (COT) model (and used to define the 80 HHRG groups), using data from October 1997 through March 2003. This covered periods before and after the implementation of PPS.

- Mean resource use increased by 6%, from $420 to $444, between the first wave of PPS data (six months ending June 2001) and the second wave of PPS data (July 2002 to March 2003).

- The prevalence of most clinical and functional measures decreased, reversing an earlier broadly-based increase that occurred between the time of the original case mix study sample (October 1997 to mid-1999) and the first wave of PPS data. However, most service use variables continued to increase.

- When examining the distribution of therapy visits in the PPS data, we found a pronounced spike at 10 visits and a large increase in the percentage of cases having between 11 and 13 visits.

[1] Memoranda and working papers documenting some of the earlier analyses alluded to in this chapter can be found in a separate project document, *Refinement of Medicare's Home Health Prospective Payment System: Compendium of Research Documents,* Abt Associates Inc.: April 2008, available upon email request to: <HHCompendium@cms.hhs.gov>.

- We found that visit lengths did not change. Minutes per visit was basically constant across the number of therapy visits and were similar in both the interim payment system (IPS) and PPS periods.

- There were only small differences in the marginal impacts of individual variables between the first and second waves of the PPS data.

- Mean resource use also increased as episode sequence numbers increased. Mean resource use was 16% higher for the seventh or higher episodes relative to the initial episode. Prevalence of variables related to chronic conditions also tended to increase as episode numbers increased.

- Marginal impacts did not consistently increase or decrease as episode group numbers increased.

Agency and Local Practice Patterns

These analyses assessed effects of ownership type, the patient's state of residence, and the agency's size (as measured by the number of first episodes) on the fit of the COT model. The data used for this analysis were from the Home Health Datalink File, using a 20% sample of episodes that started between January 1, 2001 and September 30, 2003. This file included a total of 1,656,551 episodes, excluding outliers.

- State and agency indicators improved the models' fit, as measured by the adjusted R-square statistic.

- State and ownership coefficients were all statistically significant.

- Interacting state and agency size with other variables in the COT model improved model fit. Particularly evident were state and agency differences in resources for patients with diabetes and high therapy needs.

Therapy Analyses: Two-Part Model

The objective of this task was to test the explanatory power of a two-stage model that first predicted the probability of therapy use and then predicted how much therapy would be needed, conditional on using therapy. The purpose of this analysis was to test whether this type of nonlinear model would eliminate the need for the so-called "therapy bonus" (the marginal payment made under the case-mix systems for episodes with 10 or more therapy visits). These analyses were conducted separately on an IPS period national sample (n=450,000) and on a 20% sample from the wave 1 PPS sample (December 2000-June 2001, n=198,044).

- The statistical performance of the first-stage model was adequate, accounting for about 30% of the variation in whether an individual uses therapy. Significant predictor variables included functional variables, prior inpatient stay, orthopedic and neurological diagnoses, and a recent deterioration in condition as measured by a negative value for the difference between prior and current status for the ADL and IADL measures.

- The second stage, predicting resources used by therapy users, did not adequately predict resources (R-square=.12).

- We considered the predictive power of the two-part model insufficient for further development.

Therapy Analyses: Reducing the Magnitude of the "Therapy Bonus"

The objectives of this task were to understand more about "high-therapy" patients and to identify potential variables to add to the COT model that would reduce the magnitude of the "therapy bonus." This analysis was performed using the Second Wave PPS file (July 2002-March 2003, n=296,429).

- About one-third of all episodes had no therapy visits, while only 6.5% had 20 or more visits.

- Ten conditions, primarily neurological and orthopedic, were key predictors of therapy use in a multivariate model. Of these, stroke also proved to be a key predictor of very high therapy use. Adding stroke to the COT model reduced the therapy bonus from its baseline value of 306 to 298 standardized resource units.

- The statistical performance of models that did not include measures based on the number of therapy visits was poor, indicating a need to include measures for the need for therapy, based on therapy visits (e.g., therapy thresholds).

Potential Refinements to the Original COT Model

The purpose of these analyses was to examine a more extensive set of variables measured for first episodes to supplement earlier analysis of potential refinements.

- Most of the new conditions identified for testing appeared to be under-reimbursed under the current model.

- Adding conditions to the COT model did not significantly improve the model fit. The R-square statistics for the 16 models with additional conditions but retaining the service variables were all between 0.315 and 0.320.

Several promising additions/modifications to the COT were identified:

- Additions to current diagnosis groups (DGs): 1) myopathy and late effect of CVA to the Neuro DG, 2) non-ulcer, non-trauma wounds to the Burn/trauma DG, 3) non-pressure/non-stasis ulcer to Burn/trauma DG.

- Two new conditions: affective psychosis and depression identified by primary diagnoses.

- Six co-morbidities: neurological conditions; orthopedic conditions; diabetes mellitus; burn/trauma; CHF; and a selected set of mental disorders (denoted as "restricted mental disorders"), including affective psychosis and depression.

- New OASIS items: dependence on the management of injectable medications; dependence on the management of oral medications.

Long-Stay Patients/Non-Initial Episodes

The long-stay analyses assessed whether and how COT models could be modified to explain more resource variation for long-stay patients (patients with length of stay greater than a single 60-day home health episode). We evaluated the statistical performance of the COT model on different episode groups (e.g., 1st, 2nd, 3rd, 4th, 5th, 6th, or 7th+ episodes) and also compared the performance of the COT model estimated only on initial episodes and the model estimated on all episodes. We also estimated an interactive version of the COT model that interacted the episode group with all of the COT independent variables.

- The fit of the COT model was generally higher for first than for later episodes.

- The COT model estimated on first episodes only slightly under-predicted overall resource use for all episodes.

- The interactive COT model had better statistical performance than the COT model without the interaction terms estimated on all episodes.

- The effects of some of the individual clinical, functional, and service use variables varied across episode group. This was especially true for the diabetes and therapy visit threshold variables.

Non-Linear and Multi-Part Models

We tested whether the use of non-linear and multi-part models, rather than the then-current linear versions of the COT model, would improve the models' ability to account for variation in total resource use.

- Non-linear models generally did not perform better than the current linear model.

- A four-equation model – with equations for early (first and second) and later (third and higher) episodes, interacted with whether or not the therapy threshold was exceeded – fit the data for all episodes more closely than the linear COT model.

Unified Models

In the last phase of the COT model analysis, we brought together the most promising ideas described above into a consistent set of "unified models" tested in single-equation form (both on first episodes only and on all episodes) and in several versions of a four-equation model.

- The unified model on the first episodes had better statistical performance than the model on all episodes.

- The best performing of the final four-equation models achieved a closer fit on all episodes than the single-equation model.

Statistical Analysis of Non-Routine Supplies

These analyses assessed the association of standard COT model and other OASIS variables with non-routine supply (NRS) costs. Costs were estimated from merged files of cost report and claims data. We developed several models for predicting NRS costs. The clinical items in these models were identified based on an analysis of the characteristics of home health patients that are associated with NRS use and costs.

- The distribution of NRS costs was highly skewed. More than half the episodes had no NRS cost, while 20% had an NRS cost greater than $50, and 5% had NRS costs of $300 or higher.

- Of all clinical conditions, skin conditions were most closely associated with NRS use and costs. There was a relationship between NRS costs and the number of pressure ulcers, surgical wounds, and stasis ulcers. None of the models tested achieved what might be considered good fit. Most explained between 10% and 20% of NRS cost variation. The identified clinical conditions explained more of the NRS cost variation for later episodes than for earlier ones. As a result, the statistical performance of the models was better when all episodes were used vs. initial episodes only.

Conclusions from Exploratory Analyses

- Adding variables to the original COT model addressed some underpayment issues but does not greatly improve fit.

- A marked shift in the distribution of therapy visits among therapy users was associated with the 10-visit therapy threshold. The most common treatment plan for therapy users included 10 to 13 therapy visits.

- Further work on the problem of predicting therapy should focus on refining the approach to therapy thresholds in order to dampen incentives associated with a single therapy threshold.

- Early and later episodes were different in, for example, the prevalence of conditions, fit of the COT model, lengths of stay, and mean resource use. These results suggested that our modeling efforts should focus on capturing these differences to improve payment accuracy.

- While it represents an improvement in modeling home health resource use, the four-equation model is more complex and difficult to interpret.

- We found that a group of clinical conditions, mostly reflecting skin conditions and problems, were associated with above-average NRS costs, but that the overall statistical performance of NRS models based on clinical items was low.

- As an alternative to the nonroutine supplies amount bundled into the episode rate, CMS asked us to develop a multi-tiered payment model based on grouped scores that reflected the marginal effects of identified clinical conditions on NRS costs.

Refining the Four-Equation Model

We continued to use the four-equation model to test potential independent variables, with the goal of identifying a parsimonious set of variables. In a regression context, the model coefficients could be used to derive "scores" for measuring the clinical, functional, and service-use severity of each episode in the study sample. As with the original method of case-mix group development, score intervals could be used to define the payment groups along each of the three dimensions. At the same time, we studied alternative sets of therapy visit thresholds. In addition to consultations with CMS clinical experts, we convened several meetings of a Technical Expert Panel between December 2005 and May 2006. Major results of these activities were:

- We tested numerous variables created from diagnosis codes to isolate clinical conditions hypothesized to be associated with increased resource use. In some cases, it appeared that either miscoding or imprecise coding of home health episodes hampered efforts to create useful diagnostic groups.

- Based on suggestions from the TEP, we tested a number of variables representing interactions among clinical conditions. A few interactions between functional status and certain clinical conditions were statistically significant.

- We tested therapy thresholds below and above the original 10-visit therapy threshold. A threshold at 6 visits would eliminate the potential for underpayment of episodes with 6 to 9 therapy visits. Patterns in the data did not identify break points for additional therapy thresholds that should be given clear preference.

- Discussion of alternative therapy thresholds with the TEP led to a final decision from CMS to set thresholds at 6, 14, and 20 therapy visits.

- At CMS's request, we devised a method to reduce the "jumps" in payment produced by therapy thresholds and to model a decelerating cost trend with each added therapy visit between thresholds. These methods were implemented as part of the regression procedures.

- We sought to further simplify the model by testing equivalence of scores across the four equations, and imposing score equivalence when statistical tests did not support maintaining separate scores. A scoring table based on a 20% sample of claims data from Federal Fiscal Year 2003 was proposed in the May 4, 2007, NPRM.

Refining an Alternative NRS Payment Model

Based on statistical analyses of NRS costs, as an alternative to the current bundled payment for supplies, we proposed two versions of a payment system that would redistribute NRS payments to more equitably compensate agencies for episodes with high NRS costs. One version treated early and later episodes separately, while the other pooled early and late episodes.

- Payment levels were set for five episode categories, grouped by scores representing the contributions of clinical conditions to NRS costs.

- Both alternative models provide more-accurate NRS payments, particularly for episodes with clinical conditions that often involve high NRS costs.

- In the May 4, 2007, NPRM, CMS proposed a system of five categories based on the pooled model.

Model Validation

After publication of the NPRM, a dataset that included calendar 2005 utilization data became available. We used these data to validate the results that led to the NPRM proposals. The objective was to ensure that the essential relationships of the four-equation case-mix model and the NRS model developed to date continued to hold in the more recent data. This phase of the analysis also incorporated testing of several ideas suggested by the public in the comment period that followed the publication of the NPRM. Some of the changes resulting from these analyses include:

- A number of changes in the formulation of variables related to neurological conditions.

- Dropping of the incontinence variable from the case-mix model because its cost-increasing effect was no longer statistically significant.

- Addition of V-codes for care of selected ostomies to the four-equation model.

- Addition of the V-codes for selected ostomy care as well as several other variables (including diabetic ulcer) to the NRS model.

- Splitting the highest of the five severity levels in the NPRM NRS model to form a sixth severity level for the highest cost cases**.**

Changes in the data and certain model details between the NPRM proposals and the Final Rule produced changes in the overall R-squared for the case-mix system from .4393 to .4634. Similarly, the R-squared for the NRS model changed from .137 to .166.

Development of Payment Groups, Weights, Rates, and Impact Analysis

In addition to the research activities described above, we also supported CMS in the conversion of the predictive models into a payment system. This included a number of activities documented in detail in this report, including:

- Using the models to develop discrete patient categories or groups that could be used for payment. These allow CMS to establish a rate schedule with a defined number of payment groups. A system of 153 groups was developed for the NPRM, and adjusted slightly for the Final Payment Rule.

- Calculating the payment weight for each group. Given the small sample size of some groups, this was not a matter of calculating simple averages. Rather, regression analysis was used to estimate a consistent set of weights (once for the NPRM, again for the Final Payment Rule).

Also included in the calculations were factors to account for budget neutrality and adjustments for data missing from some OASIS assessments on use of injectable medications.

- Calculating the forthcoming year's payment rates, taking into account CMS policy and budget parameters, inflation projections, and outlier parameters.

- Predicting the impact of the system on patients and agencies of different types, based on alternative policy assumptions.

Analysis of Nominal Case-Mix Change over Time

Since the inception of PPS, there has been an upward trend in the overall average case-mix weight of Medicare home health patients. Between 2000 and 2005, the national average case-mix weight of Medicare home health episodes increased by 12.8%. CMS was interested in knowing how much of this increase was due to changes in patient characteristics and care needs, and how much might be due to changes in coding practices or other factors unrelated to actual patient care needs. We analyzed claims and assessment data from the IPS period (1999-2000) and from 2005, and we also augmented the home health data with APR-DRG classifications of patient condition during hospitalizations preceding home care. We found that most of the case-mix change could not be attributed to changes in patient care needs.

1. Introduction and Overview

1.1. Background

The Balanced Budget Act of 1997 and subsequent legislation mandated that CMS develop a prospective payment system (PPS) for the reimbursement of home health services. Under the home health PPS, which was implemented on October 1, 2000, Medicare pays home health agencies (HHAs) a fixed base payment for each 60-day episode of care. The base payment is then adjusted by the geographic wage index value associated with the location of service (to account for geographic differences in HHA's labor costs) and also by the beneficiary's health status/health care needs (to reflect variations in the costs home health agencies incur caring for different types of patients). Such adjustments help ensure that all beneficiaries have equal access to home health services.

The current health status/health care needs adjuster (case-mix) is based on a model Abt Associates Inc. developed under contract to the then-Health Care Financing Administration (now CMS). Around the time the new payment system went into effect, it was generally recognized that improvements might continue to come from further study of home health case-mix and that it would be desirable to update the original model estimates after home health agencies adapted to the prospective payment system. The main areas identified for study were:

- Monitoring changes over time in the distribution of patient characteristics related to case-mix classification and related changes in payment, service use, and payment accuracy.

- Reducing reliance on the therapy threshold. Since payments for patients who received 10 or more therapy visits (i.e., patients who exceed the therapy threshold) were much higher under the original model, this created an incentive to provide additional therapy visits.

- Careful modeling of the resource needs of long-term patients – in particular, should payments for patients after the first 60-day episode be paid differently, in response to care needs that are different from first episodes?

- Refinements to the model that might improve fit and recognize patient conditions and needs that contribute to variation in resource use.

- Changes to the current methodology of paying for non-routine supplies (NRS), to recognize the differences in the variation of NRS resource use across patients that the original model does not capture.

Work toward these goals began almost before the full implementation of the new system, with successive waves of analyses and validation of earlier findings conducted each year as more-recent data became available. Addressing substantive questions and proposals submitted in the public comments on the original NPRM in 1999 was part of the research agenda. Also, some research questions were addressed that required larger sample sizes than were available from the original primary data collection. This report

presents the analyses that led most directly to the payment system refinements implemented on January 1, 2008[2].

Most of the analyses that led to the payment refinements that were included in the Notice of Proposed Rulemaking (NPRM) (CMS-1451-P, Federal Register, May 4, 2007) were performed using a data set that included Medicare home health episodes starting from 2001 through September 2003. After the publication of the NPRM, data on utilization during calendar 2005 (CY05) became available and were used for further refinement and validation analyses, conducted over the summer of 2007. In addition, we completed an analysis that examined case-mix change over time, comparing data on home health patients during a pre-PPS period (October 1999 through September 2000) with similar data for CY05. This was an effort to distinguish actual patient-based change in case-mix (changes in patient characteristics) from nominal change due to other factors, such as assessment and coding practices.

These recent analyses produced the final case-mix classification model and payment rates published in the Final Payment Rule (CMS-1451-FC, Federal Register, August 29, 2007; correction notice published November 30, 2007). In order to provide the reader with an understanding of both the NPRM and the Final Payment Rule, both the original and CY05 validation analyses are presented in this report.

1.2. Report Overview

The body of this report is organized as follows. Chapter 2 presents our further work with the original case-mix variables, including an examination of changes in its performance over time, and investigatory analyses using different variables and specifications. These suggested that patterns of resource use and patient characteristics differed across episodes that occurred earlier or later in a spell of home health care, and that the factors that explained total resource use differed for episodes with higher or lower levels of rehabilitation therapy visits. These differences were used to achieve higher levels of explanatory power in the "four-equation" model discussed in Chapter 3. Chapter 4 presents our analyses of patterns of therapy use and evaluation of alternative therapy visit thresholds (for incorporation into the four-equation model). Chapter 5 presents the CY05 analyses of the four-equation model, which led to selected refinements published in the Final Rule.

Chapters 6 and 7 document the calculations that were performed to take the research results from Chapters 2 through 5 and convert them into a functioning payment system. The initial modeling work produced "index models" that produce an individual estimate for each case, based on its specific values on all of the explanatory variables included in the model. If used directly in a payment system, the index model would produce thousands of individualized payment rates. This would not be practical for the home health PPS, so the model must be used to create a more limited number of payment groups. If each group has members with approximately the same resource needs, a single payment rate for all members of the group will represent an acceptably accurate payment. In Chapter 6, we present the development of the 153 payment groups in the refined PPS from the four-equation model, as well as the calculation of each group's weight, and the setting of actual payment amounts. Section 6.1 describes the initial round of this process, which produced the figures in the NPRM, while Section 6.2 documents the corresponding

[2] Memoranda and working papers documenting some of the earlier analyses alluded to in this document can be found in a separate project document, *Refinement of Medicare's Home Health Prospective Payment System: Compendium Of Research Documents,* Abt Associates Inc.: April 2008, available upon email request to: <HHCompendium@cms.hhs.gov>.

process using the CY2005 data and published in the Final Payment Rule. In Chapter 7, we present analyses of the projected impacts of the implementation of the refined payment system on home health agencies of different types, under alternative sets of program parameters. As in the previous chapter, Section 7.1 describes the initial round of this process that produced the figures in the NPRM, while Section 7.2 documents the corresponding process using the CY2005 data and published in the Final Payment Rule.

Chapter 8 presents our analysis of case-mix change over time, as described above, and finally, Chapter 9 presents our analysis of the use of nonroutine medical supplies (NRS) by Medicare home health patients, and the development of the separate model of NRS resource use and the separate classification system that is part of the refined home health PPS. As with the analyses described above, there were also two separate rounds of NRS analysis that fed, respectively, into the NPRM and the Final Payment Rule. However, since the NRS analysis used data from Medicare cost reports as well as claims, the periods covered were different. Sections 9.1 through 9.8 describe development of the NRS model using data for 2001-2002, as presented in the NPRM; Section 9.9 presents the validation and refinements developed using data for 2004-2005, and published in the Final Payment Rule.

Some of the most detailed (and voluminous) tables have been placed in an Appendix for convenience.

2. COT Index Model Refinements

2.1. Overview

The home health prospective payment system (HH PPS) reimburses home health agencies for care provided to home health patients for each 60-day period (episode). If that individual continues to receive home health services, a second 60-day episode then commences, and subsequent episodes (i.e., third, fourth, fifth, etc.) commence after each additional 60-day period.

Under the original case-mix system that went into effect on Oct. 1, 2000, for each episode, home health patients are categorized into one of 80 home health resource groups (HHRGs). Each of the 80 HHRGs combines a clinical, functional, and service severity level, where severity levels are determined on a point system based on the following factors:

- Clinical – whether the patient has one or more clinical conditions such as urinary incontinence; pain; problems with vision; IV, enteral, or parenteral therapies; the presence of wounds or pressure ulcers, etc.

- Functional – whether the patient has problems with dressing, bathing, transferring, walking (locomotion), and toileting.

- Service use – whether the patient had a recent hospital and/or rehabilitation stay, and most importantly, has the patient used 10 or more therapy (occupational, physical, or speech) visits during a 60-day home health episode (therapy visit threshold).

Each HHRG is then assigned a relative payment weight, and home health agency payments are based on these relative payment weights.[3]

Underlying the original set of HHRGs was a series of regression analyses, from which we derived the scores that determine the severity levels for the clinical and functional dimensions of the case-mix classification.

For our work to refine the HH case-mix groups, we again used regression models, known as COT ("clinical on top") index models. COT index models consisted of the following basic specification:

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[3] The current system adjusts payments to reflect differences in local area wages, includes outlier payments for high-cost patients, and also categorizes episodes into three special payment categories:

- Significant Change in Condition (SCIC) – patients whose clinical, functional, and/or therapy use levels change during the episode are classified as SCIC episodes, and payment is per-diem pro-rated, in accordance with the number of days an HHRG is in effect.

- Partial Episode Payment (PEP) – episodes that end prematurely due to certain intervening events are paid on a per-diem pro-rated basis, but note that if during one of these short "PEP" episodes the patient experiences a significant change in condition (SCIC), the episode can be both PEP and SCIC.

- Low Utilization Payment Adjustment (LUPA) – 60-day episodes with four or fewer home health visits are paid on a per-visit basis, depending on the number and type of visits provided during the episode.

$$\text{Total Resource Use Units} = \alpha + \beta * \text{Clinical Variables} + \gamma * \text{Functional Variables} + \theta * \text{Service Use Variables} + \varepsilon$$

Total resource use units are the total number of weighted minutes of care provided during a 60-day episode's home health visits. The weights are based on estimates of the national hourly wage (including benefits) for each home health discipline (i.e., home health aides, medical social services, occupational therapists, physical therapists, skilled nursing, and speech therapists), where hourly wage data were extracted from the Bureau of Labor Statistics Occupational Employment Survey. The model's independent variables include a constant term and the clinical, functional, and service use variables used to define HHRG clinical, functional, and service severities.

The main reasons for the use of COT index models are ease and efficiency. By estimating a COT index model, one can determine if a patient characteristic (e.g., clinical, functional, service use, and, as will be seen later, diagnostic) is consistently and statistically significantly associated with variations in the cost of caring for the patient, as proxied by total resource use. Using a COT modeling approach, one can first determine what variables are important, and then go on to develop payment groups, and finally, to test how well such payment groups account for variation in patient resource use. One can also test whether different model structures better account for variations in patient resource use. With those variables in place, the results of the COT index model can be used to create various clinical, functional, and service use levels, thus defining alternative home health resource groups. Ultimately, relative payment weights for each new set of HHRGs can then be calculated, allowing evaluation of potential revisions to the home health prospective payment system.

There were three primary limitations of the original COT model, and thus in turn with the original HH PPS, that are the focus of our model refinements.

- First, due to data limitations, the COT index models underlying the original HH PPS were estimated using "first episodes."[4] That is, the only episodes used to estimate these COT models were for home health patients in their first 60-day episode of care. If the resource utilization patterns for later episodes (second episodes and beyond) differ systematically from those in the first episodes, the original HH PPS based on this COT model may not accurately account for systematic differences in patient resource use and cost between first and later episodes. The second limitation was the use of the 10-therapy visit threshold. A very strong and significant statistical relationship existed between the therapy visit threshold and total resource use units in the COT model. This result was expected, because patients with 10 or more therapy visits have more total visits and thus more total units of care. The concern is that the therapy threshold visit "effect" was quite high, which in turn led to much higher relative payment weights for HHRGs whose service use level was above the threshold, which ultimately translated into higher payment amounts. It is possible that these higher payments for reaching the 10-therapy visit threshold could encourage agencies to provide more therapy

[4] For the purposes of our analysis, each beneficiary's home health 60-day payment episodes were considered as a "continuous series of adjacent payment episodes" if the time between the end of one episode and the start of the next was less than 60 days. (This was regardless of whether the same home health agency was delivering the services.) If there was a gap of 60 days or more, the next episode was considered the initial episode in a new sequence of payment episodes.

visits, at least to some of their patients. Moreover, if the added episodes at or above the therapy threshold do not present the same frequencies of total therapy visits as the analogous episodes from the original system's development sample – for example, if the episodes cluster at or around 10 therapy visits – the relative payment weights developed on the earlier data will not accurately account for the resources being used.

- The third limitation was that the original COT model tended to overpay or underpay home health agencies for distinct groups of home health patients. In particular, the original case-mix model did not well represent patients with certain diseases or conditions, such as intensive wound care patients or certain psychiatric patients, or patients dependent on daily insulin injections.

Efforts to improve the original case-mix model (and thus current HH PPS) proceeded in two major stages. In the first stage, differences between first and later episodes were identified. Then, COT index models estimated using first episodes only were compared to those estimated using all episodes. In addition, the dependent variable (total resource use units) was transformed in several different ways, to assess whether such a transformation would enhance model performance. Two basic conclusions were reached:

- There are noticeable differences between first and later episodes, and models estimated using all episodes better account for differences in resource utilization than models estimated using only first episodes.

- Transforming the dependent variable does not improve COT index model performance.

After concluding this first stage, we worked to further improve the COT index model. Thus, the second stage explored other changes to the COT index model, including:

- Estimating separate and distinct relationships between COT index independent variables and resource use for different sets of episodes defined by episode number (e.g., first, second, third, etc.) and therapy visit use (i.e., being above or below a therapy visit threshold).

- Varying the number of therapy visit thresholds included within a model, as well as the therapy visit threshold "breaks" (i.e., the number of therapy visits needed to reach each threshold).

- Including diagnostic variables within the model. These diagnostic variables helped improve model performance for patient groups that had been consistently overpaid or underpaid.

This second stage of model development led to what we will refer to as "four-equation" models. The first stage of model development is described later in this section, while the second stage (four-equation models) is presented in Chapter 3.

2.2. COT Index Model Specification

Except where noted, the COT index models presented in this section included the following independent variables:

- Intravenous (IV) or parenteral therapy
- Enteral therapy
- The presence of pain
- Problems with vision
- Urinary incontinence
- Bowel incontinence
- Ostomy
- Pressure ulcers – both stages 1 to 2 and stages 3 to 4
- Stasis ulcers – with healing status "early/partial granulation" or "not healing"
- Surgical wounds – with healing status "early/partial granulation" or "not healing"
- Dyspnea
- Problems with dressing
- Problems with bathing
- Problems toileting
- Problems with transferring – both level 1 and level 2 or more
- Problems with locomotion – both levels 1 or 2 and level 3 or more
- 14 or more therapy visit threshold variable

All of these variables were included in the original home health PPS model implemented in 2000. Except where otherwise noted, the models discussed in this chapter do not include the additional diagnosis variables (orthopedic, neurological, burns/trauma, diabetes) and service use variables (whether the patient had a hospital visit and/or an inpatient rehabilitation or skilled nursing visit in the past 14 days) that were included in the original home health PPS model.

2.3. Measures of Model Performance and Methods

Choosing the "best" model is not a simple matter. This decision combines a variety of statistical tests along with qualitative and/or clinical judgments. Generally, four different statistical tests were used to evaluate model performance. The first two tests, adjusted R-squared and pseudo adjusted R-squared, are closely related. One way of evaluating a regression model is to decompose the amount of variation in the dependent variable (here, total resource use units) into the variation accounted for by the independent variables in the model ("explained by the model") and the remaining amount of variation ("unexplained"). An adjusted R-squared statistic essentially is the ratio of variation explained by the model divided by total variation (explained and unexplained). Strictly speaking, this ratio actually is the R-squared statistic. One limitation of the R-squared statistic, however, is that it continues to increase as more and more independent variables are added to the model, until it eventually reaches 100%, regardless

of whether these additional independent variables are statistically significant. The adjusted R-squared statistic adjusts for the effect of adding more independent variables to a model.[5]

The pseudo adjusted R-squared statistic is the adjusted R-squared statistic from the following type of regression model:

Total Resource Use Units = A + B*Predicted Value + e

In addition to the constant/intercept, the only independent variable in the previous model is the predicted value for total resource use units from another regression model – for example, from a COT index model. In effect, the pseudo adjusted R-squared statistic measures how much variation is explained by the predicted values of another regression model.

There are two reasons for using pseudo adjusted R-squared statistics. First, sometimes the results of a regression model are used to predict the total resource use units for another set of episodes. For example, the results from a COT index model estimated using only first episodes might be used to predict the resource use of all (first and later) episodes. A pseudo adjusted R-squared statistic can then be calculated for all episodes, to determine how much variation in total resource use units can be accounted for by a first-episode-only model.

The second and less common reason to use pseudo adjusted R-squared statistics is when the dependent variable has been transformed. For example, instead of entering total resource use units in levels (i.e., actual units), a transformed dependent variable might be used, such as the natural log of resource units or the square root of resource use units.[6] The results from models where the dependent variable has been transformed can be converted back into levels and then be used to calculate a pseudo adjusted R-squared statistic. This can allow one to determine if models that transform the dependent variable do a better job of explaining variation in resource use than do models where the dependent variable has not been transformed.

Adjusted R-squared and pseudo adjusted R-squared statistics, however, account only for how well different models perform at accounting for variation at an individual episode level. As a practical matter, the differences among adjusted or pseudo adjusted R-squared statistics for different models often are quite modest. Another way of evaluating model performance is at the group level. That is, how well do various models account for differences in actual resource use for groups of episodes defined by geography, the size of the home health agency providing care, the type of facility and ownership for agencies, and other characteristics?

Predictive ratios are used to measure model performance at the group level. A predictive ratio is equal to the sum of the predicted resource use divided by the sum of actual resource use for a group of episodes. For example, if a regression model predicts that resource use for agencies of a particular size was

[5] Adjusted R-squared increases when a variable is added to a model only if that variable has a t statistic greater than or equal to 1.00 in absolute value.

[6] Two common reasons for transforming a dependent variable are either to reduce the effects of outliers and/or because the untransformed dependent variable is not normally distributed, while a transformed dependent variable's distribution is more "normal."

1,000,000 units, and actual resource use was 1,250,000 units, the predictive ratio for this group of agencies = 1,000,000/1,250,000 = 0.8000.

Predictive ratios have several key properties.

- First, predictive ratios of less than 1.000 indicate under-prediction – that is, actual resource use exceeds predicted resource use for a group of episodes. Conversely, predictive ratios greater than 1.000 indicate over-prediction (predicted resource use > actual resource use), while predictive ratios that equal 1.0000 indicate exact prediction (predicted resource use = actual resource use). Thus, predictive ratios measure how well various reimbursement systems work for subgroups within the population, rather than at the individual level.

- Second, predictive ratios always equal 1.000 if they are calculated for all episodes used to estimate a regression model. This is another way of saying that the sum of predicted values always equals the sum of actual values for regression models. It is worth noting, however, that if a regression model is estimated using a subset of episodes (e.g., only first episodes), the predictive ratio for that model for all (first and later) episodes does not have to equal 1.000.

- Third, if a model includes a binary independent variable – such as whether the patient for a particular episode has trouble dressing – the predictive ratio for the subgroup "all episodes where patients have trouble dressing" (or the subgroup "all episodes where patients do not have trouble dressing") will always be equal to 1.000. Predictive ratios are often used to "diagnose" model performance, to identify groups of episodes where models do a poor job of predicting resource use. Adding a variable to represent such groups always causes predictive ratios for that group to equal 1.000. In models with sizeable numbers of independent, explanatory variables, adding such indicator variables, especially those defining small subgroups, often has little impact on adjusted R- squared for the model overall. (In fact, it will actually reduce the adjusted R-squared if the indicator variable added has a t- statistic with an absolute value of less than one.) Because predictive ratios are an alternative indicator of model performance, they can be used to identify new variables to consider as candidates for inclusion in the model.

It is common to calculate predictive ratios for sets of subgroups. For instance, one might calculate predictive ratios for episodes for home health agencies of different types (e.g., free-standing, facility-based, or other). If one is comparing the predictive ratios for two or more models across all these agency types, the "best" performing model is the one with predictive ratios closest to 1.000 (in absolute value) for all agency types. Commonly, however, a different model might perform best (i.e., have the predictive ratio closest to 1.000) for different types of agencies. One way to summarize model performance across a set of groups is to calculate the sum of squared prediction errors, or:

$$\sum_i \quad (\text{Actual}_i - \text{Predicted}_i)^2$$

where actual_i is the actual resource use of group i and predicted_i is the predicted resource use for this group. Smaller sum of squared prediction errors indicates better model performance across a set of groups, and this measure also gives greater weight to larger groups.

In addition to determining how well different models perform at an individual level (adjusted R-squared or pseudo adjusted R-squared) or group level (predictive ratios or sum of squared prediction errors), there are other considerations for choosing a "better" or "best" model. One such criterion is which independent variables to include in the model. Here, there are both quantitative and qualitative reasons for including or excluding a variable or set of variables. On the quantitative side, the following rules were used to include each independent variable:

- The estimated coefficient must be greater than or equal to five (5) units.
- The coefficient must be statistically significant at the 10% level (i.e., the t-statistic must be greater than or equal to 1.645)**.**

There were two reasons for requiring coefficients to be greater than or equal to five units. First, a goal was to identify clinical, functional, service use, or diagnostic variables that increased predicted total resource use – i.e., coefficients should be positive and additive. Second, coefficients were later translated into "points" when determining clinical, functional, or service use levels (to define new HHRGs), and each point equals the coefficient divided by 10 and rounded to the nearest whole number – coefficients had to be five or greater to achieve a minimum one-point score.

Allowing variables to be included in the model if they were significant at the 10% level was chosen so that the model could include relatively rare clinical or diagnostic conditions. The relatively low (10%) level of significance tended to retain these rarer conditions that also had large estimated coefficients.

In addition to statistical considerations, as much or more care was paid to qualitative concerns. As will be explained in more detail later, a large set of clinical and diagnostic variables that were thought to be associated with resource use during home health episodes were tested. These variables were designed by clinicians and were included only if their statistical performance was adequate (based on the rules described above) and if they were clinically meaningful.

In addition to clinical considerations, another goal was simplicity. For example, closely-related clinical variables were often combined if their statistical effects were similar and the variables were closely related clinically. In addition, variables that were extremely rare (i.e., that occurred in less than 30 episodes in our very large analytic file) but had large and significant coefficients were closely inspected. These variables were typically either excluded or combined into larger clinical groups.

2.4. Data

The main data used for the analysis was drawn from the Home Health Datalink File, a data file that includes records for all Medicare home health episodes from the start of the PPS, linked with a variety of other types of data, including:

- All information included on the episode claim (dates, types of visits, length of each visit, charges, payments, etc.).
- The patient's OASIS assessment, providing clinical and functional status information as of the start of the episode.

- Data on patient characteristics and group health plan enrollment (from the Medicare Enrollment Data Base [EDB] and Medicare Beneficiary Database [MBD]).

- Data on provider characteristics (agency auspice, etc.) from the Online Survey and Certification Reporting System (OSCAR) database.

- Data on the beneficiary's Medicare inpatient utilization (hospital, skilled nursing, inpatient rehabilitation facility) before and after the home health episode.

- Area level (county) data on health resources and utilization from the Area Resource File (ARF).

The file was constructed using the CMS Standard Analytic Files (SAF), which include final action claims. These files are constructed for each calendar year (based on date of service) and are "frozen" as of June 30 of the following year. Therefore, they do not reflect the relatively small number of claims or adjustments processed after that point.

For the analyses described below, 10% or 20% samples from the file were used. These samples were selected based on specific digits of the beneficiary Health Insurance Claim (HIC) number.

The actual course of model development proceeded over several years. Comparing results from different points in time is problematic. In many cases, the data sets used to estimate different models were not the same. As more-recent data became available, these more-recent data were used to estimate models. In addition, the definition of variables, particularly diagnostic variables, continued to evolve and change. One issue that repeatedly emerged was that diagnostic variables were not mutually exclusive but instead overlapped. For example, suppose a variable that encompasses a broad set of cancer diagnoses was found to be significant and have a large, positive coefficient. A clinician reviewing this result might be interested to determine if the effect for brain cancer was even larger. To test this, a new brain cancer diagnosis variable could be added to the model, and if that variable also was found to have a positive and significant coefficient, the hypothesis that brain cancer was associated with significantly higher resource use than other cancers would be confirmed.

Over time, as more and more diagnostic variables were considered, such overlaps (e.g., brain cancer diagnoses are included in both broader cancer variables as well as the brain cancer variable) became more and more common. Towards the end of model development, clinicians again reviewed all the diagnostic and clinical variable definitions, to refine them and to eliminate any such overlaps. Such changes in variable definition could also make it difficult to compare models estimated at different points in time, even for models estimated using the same data (but with different variable definitions).

For that reason, to the fullest extent possible, the key models that eventually were used to develop what became the four-equation model were re-estimated using a consistent set of variable definitions as well as the same data set. These data were a two-decile file of episodes with start dates from January 1, 2001 to September 30, 2003. This file had a total of 1,656,551 episodes, excluding PPS outliers.

In addition to models estimated using this "consistent" data set, results for several key models estimated using alternative data sets will also be reported. These additional models often shaped the course of the work – particularly the decisions to estimate models using all episodes as opposed to only first episodes,

to pursue "four-equation" models, and how to group episodes when developing the four-equation models. The specifications and data sets used to estimate these alternative models will be noted.

In all cases, the episodes used to estimate the various models were non-truncated, non-Low Utilization Payment Adjustment (LUPA) episodes only. That is, truncated episodes, including those with significant change in condition (SCIC) and partial episode payment (PEP) adjustments, were excluded before models were estimated. Episodes with outlier payments were also excluded.

There were several reasons why "truncated" episodes – i.e., SCIC, PEP – were not included when estimating the various models. For SCIC episodes, it is not clear what clinical, diagnostic, and functional data should be used, as these data elements could have changed during an episode. For all truncated episodes, there is also the issue of weighting – i.e., how should a shorter, truncated episode be counted in a model? Should truncated episodes count the same (have the same weight) as non-truncated (normal and outlier episodes)? If not, what adjustments should be used? Finally, for shorter PEP episodes, it is unclear if there has been enough time for some information to be recorded – for example, some PEP episodes that might be higher therapy episodes if they were longer might be recorded as having fewer than 10 (or 6 or 14) therapy visits. Using complete, non-truncated episodes avoids these issues. This decision does not compromise the applicability of the results to Medicare's home health payment system, because the vast majority of non-LUPA episodes are not truncated.

2.5. Documenting Differences Across Episodes

Exhibit 2.1 presents the mean of total resource use units and the COT index model independent variables for first vs. later (second and above) episodes. Mean resource use is higher for later episodes (461 units) than for earlier episodes (444 units); the relative frequency for most (17 vs. 6) of the COT index model independent variables was higher in later episodes (true) than first episodes (false). This simple cross-tabulation strongly suggests that first and later episodes systematically differ from each other with respect to the incidence of the items used in the COT model.

Another way to divide episodes is based on whether an episode is below or above the 10-therapy visit threshold (Exhibit 2.2). The most dramatic difference is the enormous (713 vs. 354) difference in mean total resource units for the two groups. This is not surprising, because increases in therapy visits directly translate into additional total resource units. There was no strong, consistent pattern in the relative frequency of the COT index model variables: relative frequencies were higher for 13 of the 23 variables below the 14-therapy visit threshold and higher for the other 10 above the 14-visit therapy threshold.

Exhibit 2.1

Relative Frequencies of COT Index Model Variables: First vs. Later Episodes

		1st Episodes		Later Episodes		
Variable	**Variable Description**	**N**	**Mean**	**N**	**Mean**	**Later > 1st**
RES_TOT_UPDT	Total Resource Use Units	296,429	444	187,813	471	TRUE
Ther_IP	IV or Parenteral Therapy	296,429	2.0%	187,813	2.5%	TRUE
Ther_e	Enteral Therapy	296,429	1.5%	187,813	4.0%	TRUE
Pain23	Pain	296,429	52.3%	187,813	50.4%	FALSE
vis_ge1	Vision	296,429	27.3%	187,813	44.7%	TRUE
Ucontnew	Urinary Incontinence	296,429	22.2%	187,813	34.0%	TRUE
bcont2_5	Bowel Incontinence	296,429	8.5%	187,813	20.7%	TRUE
ostomy12	Ostomy	296,429	1.8%	187,813	2.6%	TRUE
Multpulc	Multiple Pressure Ulcers	296,429	0.4%	187,813	1.8%	TRUE
Press12	Pressure Ulcer stage = 1 and/or 2	296,429	4.8%	187,813	8.0%	TRUE
Press34	Pressure Ulcer stage = 3 and/or 4	296,429	1.3%	187,813	5.6%	TRUE
stasis2	Stasis Ulcer healing status = 2	296,429	1.1%	187,813	2.8%	TRUE
stasis3	Stasis Ulcer healing status = 3	296,429	1.0%	187,813	1.7%	TRUE
Surg2	Surgical Wound healing status = 2	296,429	18.2%	187,813	5.9%	FALSE
Surg3	Surgical Wound healing status = 3	296,429	2.0%	187,813	1.8%	FALSE
Dysp234	Dyspnea 2 to 4	296,429	38.6%	187,813	54.3%	TRUE
Dress13	Dressing 1 to 3	296,429	68.5%	187,813	74.3%	TRUE
Bth_ge2	Bathing >= 2	296,429	77.4%	187,813	82.8%	TRUE
Toi_ge2	Toileting >= 2	296,429	13.0%	187,813	27.1%	TRUE
tfr_ge1	Transferring = 1	296,429	58.6%	187,813	54.4%	FALSE
tfr_ge2	Transferring >= 2	296,429	11.9%	187,813	24.3%	TRUE
Loco_ge1	Locomotion = 1 or 2	296,429	78.0%	187,813	68.8%	FALSE
Loco_ge3	Locomotion >= 3	296,429	9.1%	187,813	23.8%	TRUE
th_10vis	10 or More Therapy Visits	296,429	34.4%	187,813	17.8%	FALSE

Data set included episodes from July 2002 to March 2003 (484,242 episodes).

Exhibit 2.2

Relative Frequencies of COT Index Model Variables: Below and Above the 10-Therapy Visit Threshold

Variable	Variable Description	Below 10-Therapy Visit Threshold		Above 10-Therapy Visit Threshold		Above > Below
		N	Mean	N	Mean	
RES_TOT_UPDT	Total Resource Use Units	349,015	354	135,227	713	TRUE
Ther_IP	IV or Parenteral Therapy	349,015	2.7%	135,227	0.8%	FALSE
Ther_e	Enteral Therapy	349,015	2.8%	135,227	1.6%	FALSE
Pain23	Pain	349,015	49.3%	135,227	57.3%	TRUE
vis_ge1	Vision	349,015	35.0%	135,227	31.6%	FALSE
Ucontnew	Urinary Incontinence	349,015	26.4%	135,227	28.0%	TRUE
bcont2_5	Bowel Incontinence	349,015	14.2%	135,227	10.7%	FALSE
ostomy12	Ostomy	349,015	2.4%	135,227	1.3%	FALSE
Multpulc	Multiple Pressure Ulcers	349,015	1.1%	135,227	0.4%	FALSE
Press12	Pressure Ulcer stage = 1 and/or 2	349,015	6.3%	135,227	5.3%	FALSE
Press34	Pressure Ulcer stage = 3 and/or 4	349,015	3.6%	135,227	1.4%	FALSE
stasis2	Stasis Ulcer healing status = 2	349,015	2.1%	135,227	0.7%	FALSE
stasis3	Stasis Ulcer healing status = 3	349,015	1.6%	135,227	0.5%	FALSE
Surg2	Surgical Wound healing status = 2	349,015	13.5%	135,227	13.3%	FALSE
Surg3	Surgical Wound healing status = 3	349,015	2.3%	135,227	1.0%	FALSE
Dysp234	Dyspnea 2 to 4	349,015	46.6%	135,227	39.9%	FALSE
Dress13	Dressing 1 to 3	349,015	66.7%	135,227	81.1%	TRUE
Bth_ge2	Bathing >= 2	349,015	76.1%	135,227	88.2%	TRUE
Toi_ge2	Toileting >= 2	349,015	18.1%	135,227	19.3%	TRUE
tfr_ge1	Transferring = 1	349,015	53.0%	135,227	67.3%	TRUE
tfr_ge2	Transferring >= 2	349,015	16.1%	135,227	18.3%	TRUE
Loco_ge1	Locomotion = 1 or 2	349,015	70.5%	135,227	84.4%	TRUE
Loco_ge3	Locomotion >= 3	349,015	15.6%	135,227	12.8%	FALSE
th_10vis	10 or More Therapy Visits	349,015	0.0%	135,227	100.0%	TRUE

Note: Data set included episodes from July 2002 to March 2003 (484,242 episodes)

2.6. COT Index Models

Model development began by estimating the COT model for first episodes only and for all episodes, using a data set with episodes from July 2002 to March 2003. Instead of a 14-therapy visit threshold, this model used a 10-therapy visit threshold, and included the following additional variables:

- Orthopedic diagnosis.
- Diabetes diagnosis.
- Neurological diagnosis.
- Burn/trauma diagnosis.
- Behavioral problem indicator.
- Hospital visit in the previous 14 days.
- Inpatient rehabilitation or skilled nursing facility (SNF) stay in previous 14 days.
- Interaction between hospital stay in previous 14 days and inpatient rehabilitation/SNF stay in previous 14 days.

In the initial model, all of these variables were included regardless of coefficient or significance level. This model estimated using only first episodes had a much higher adjusted R-squared statistic (0.3153) than the model estimated using all episodes (0.2287). Next, we excluded independent variables with coefficients less than five and/or variables that are not significant at the 10% level. The adjusted R-squared statistic for these two models decreased to 0.3017 (first episodes only) and 0.1925 (all episodes), while the pseudo adjusted R-squared statistic of the model estimated using only first episodes applied to all episodes was 0.1909, indicating that a model estimated using only first episodes was not particularly successful at accounting for resource use variation across all episodes.

Exhibit 2.3 presents the estimates for this model. Column entries include:

- The coefficients, standard errors, t statistics, and significance levels for the two models.

- A comparison of the coefficients – if the (absolute) difference between the two coefficients for an independent variable divided by the greater of the two standard errors exceeds 1.96 (5% significance level, two-tailed test), an entry of "True" results in the last column of the table (the column labeled "Sig. Difference"). If the independent variable was not included in one or both models (because its coefficient was less than five or it was not significant at the 10% level), the entry is noted as "NA" (not applicable), while if the coefficient difference is not significant at the 5% level, the entry is "False."

Exhibit 2.3

COT Index Models First Episodes Only vs. All Episodes

Variable	Variable Description	1st Episodes Only				All Episodes				Sig. Difference
		Coefficient	Std. Error	T-Stat	Sig. Level	Coefficient	Std. Error	T-Stat	Sig. Level	
Intercept	Constant	236	1.75	134.74	<.0001	219	1.68	130.52	<.0001	TRUE
ther_IP	IV or Parenteral Therapy	98	3.58	27.36	<.0001	118	3.85	30.72	<.0001	TRUE
ther_e	Enteral Therapy	8	3.50	2.30	0.02	67	4.57	14.76	<.0001	TRUE
pain23	Pain									NA
vis_ge1	Vision	40	1.15	34.31	<.0001	18	1.26	14.04	<.0001	TRUE
ucontnew	Urinary Incontinence					6	1.38	4.39	<.0001	TRUE
bcont2_5	Bowel Incontinence									NA
ostomy12	Ostomy	43	3.64	11.78	<.0001	63	4.03	15.69	<.0001	TRUE
multpulc	Multiple Pressure Ulcers	62	6.40	9.65	<.0001	48	10.04	4.83	<.0001	FALSE
press12	Pressure Ulcer stage = 1 and/or 2	49	2.27	21.53	<.0001	65	2.61	24.70	<.0001	TRUE
press34	Pressure Ulcer stage = 3 and/or 4	153	3.68	41.73	<.0001	188	5.42	34.74	<.0001	TRUE
stasis2	Stasis Ulcer healing status = 2	119	4.01	29.65	<.0001	131	5.24	25.02	<.0001	TRUE
stasis3	Stasis Ulcer healing status = 3	148	4.65	31.89	<.0001	169	5.48	30.85	<.0001	TRUE
surg2	Surgical Wound healing status = 2									NA
surg3	Surgical Wound healing status = 3	120	3.79	31.71	<.0001	125	3.85	32.46	<.0001	FALSE
dysp234	Dyspnea 2 to 4	12	1.08	11.30	<.0001	19	1.14	16.32	<.0001	TRUE
dress13	Dressing 1 to 3	40	1.44	27.89	<.0001	27	1.44	18.55	<.0001	TRUE
bth_ge2	Bathing >= 2	25	1.57	16.07	<.0001	27	1.55	17.61	<.0001	FALSE
toi_ge2	Toileting >= 2	18	2.01	9.11	<.0001	23	2.22	10.20	<.0001	FALSE
tfr_ge1	Transferring = 1	7	1.50	4.75	<.0001	8	1.50	5.14	<.0001	FALSE
tfr_ge2	Transferring >= 2	22	2.28	9.78	<.0001	37	2.49	15.03	<.0001	TRUE
loco_ge1	Locomotion = 1 or 2	16	2.02	8.10	<.0001	14	1.95	7.00	<.0001	FALSE

Note: Data set included episodes from July 2002 to March 2003 (484,242 episodes)

The estimated coefficients for 15 of the 21 independent variables included in the COT models were significantly different from each other. A number of the significant differences between pairs of coefficients were small, because coefficients in each model tended to be tightly estimated (i.e., have small standard errors). There were, however, two variables with coefficient differences of 30 or more points, including enteral therapy (67 for all episodes vs. 8 for first episodes only) and pressure ulcers, stage three or four (188 for all episodes vs. 153 for first episodes only). Of the 21 variables included in either or both models, the coefficients for 15 variables were higher for the all-episode model than for the model estimated using only first episodes.

COT index models were also estimated using data from January 2001 - September 2003. This was a larger data set (1,656,551 episodes) that excluded outlier episodes. The adjusted R-squared statistic for the model estimated using only first episodes (0.3525) was higher than that for the model estimated using all episodes (0.3129). Note that this difference was smaller than the difference between the models estimated using the July 2002 to March 2003 data. The pseudo adjusted R-squared statistic for the model estimated using first episodes applied to all episodes was 0.3104.

Exhibit 2.4 provides predictive ratios and sum of squared prediction errors for the two models estimated using the January 2001 to September 2003 data set. Overall, the COT index model estimated using only first episodes had a predictive ratio across all episodes of 1.0222, indicating that it over-predicted resource use by about 2%. In particular, the first-episode-only model over-predicted resource use for all later episodes. In most cases, the COT index model estimated using all episodes performed better (indicated by a "True" in the last column) than the COT index model estimated using only first episodes at the group level. In most cases, the sum of squared prediction errors was lower for the COT index model estimated using all episodes, for all sets of groups, although the magnitude of the differences was small. Exceptions to this pattern were smaller agencies (agencies with less than 20 initial episodes), free-standing proprietary facilities, "other" types of facility (other than free-standing or facility-based), and other voluntary/non-profit facilities.

2.7. Alternative Specifications: Non-Linear and Two-Part Models

Another issue considered during the first phase of model development was whether changing the specification of the dependent variable would improve performance. It is possible that if the distribution of total resource use units across episodes was not normally distributed and/or there were a significant number of episodes with very high total resource use (i.e., outlier episodes), an alternative specification could fit better.

Three different specifications were considered, including:

- Using the square root of total resource use units (square root model).
- Using the natural log of total resource use units (log model).
- A two-part model that first estimated the probability that an episode had more (high use) or less (low use) than the median number of total resource use units, and then conditional on being a high or low use episode, the number of total resource use units that were used.

The square root, log, and two-part models did not include the orthopedic diagnosis, neurological diagnosis, diabetes diagnosis, or burn/trauma indicator variables included in the original FY2001 case-mix model.

None of these specifications performed consistently better than a COT index model estimated on untransformed resource units. For example, estimating models across all episodes using the data set including episodes from January 2001 to September 2003, the adjusted R-squared of the COT index model estimated on untransformed resource units (0.3129) was almost the same as the pseudo adjusted R-squared of the square root (0.3138) or log (0.3120) models, and was much higher than the pseudo adjusted R-squared of the two-part model (0.2597). There was also no evidence that any of these models performed better at a group level using either predictive ratios or sum of squared prediction errors, and the two-part model again tended to perform more poorly than the other three models. Finally, a series of specification tests comparing the COT index model estimated on untransformed resource units, the square root model, and the log model did not find a clear "winner." Thus, there was no reason to choose a specification other than estimating total resource use units as originally scaled.

Exhibit 2.4

Predictive Ratios and Sum of Squared Prediction Errors for COT Index Models Estimated Using All (First and Later) Episodes vs. First Episodes Only

Group	N	Actual Resource Use	Predicted Resource Use: Estimated Using All Episodes	Predicted Resource Use: Estimated Using 1st Episodes Only	All Episode Predictive Ratio	1st Episode Predictive Ratio Only	All Episode Better Than 1st Episode Only
Episode Number							
1st Episodes	1,020,700	444,199,364	438,209,848	444,199,375	0.9865	1.0000	FALSE
2nd Episodes	238,469	99,373,078	101,628,892	104,265,011	1.0227	1.0492	TRUE
3rd Episodes	115,417	47,142,804	48,366,321	50,095,486	1.0260	1.0626	TRUE
4th Episodes	68,020	27,218,745	28,110,464	29,258,765	1.0328	1.0749	TRUE
5th Episodes	45,353	18,018,172	18,592,706	19,408,367	1.0319	1.0772	TRUE
6th Episodes	33,249	13,135,269	13,565,675	14,180,724	1.0328	1.0796	TRUE
7th+ Episodes	135,343	54,286,925	54,900,445	57,546,702	1.0113	1.0600	TRUE
Total	1,656,551	703,374,357	703,374,351	718,954,429	1.0000	1.0222	TRUE
Sum of Squared Prediction Errors			44,146,903,570,254	50,462,788,157,528			TRUE
Facility Size (Number of 1st Episodes)							
Unknown	62	45,717	24,946	26,142	0.5457	0.5718	FALSE
1 to 5	3,370	1,527,496	1,358,566	1,405,649	0.8894	0.9202	FALSE
6 to 9	5,110	2,274,244	2,093,397	2,164,947	0.9205	0.9519	FALSE
10 to 14	7,569	3,571,660	3,140,966	3,246,432	0.8794	0.9089	FALSE
15 to 19	10,773	4,538,960	4,375,263	4,534,946	0.9639	0.9991	FALSE
20 to 29	27,760	11,377,676	11,168,952	11,590,802	0.9817	1.0187	TRUE
30 to 49	60,141	24,634,211	24,446,913	25,312,697	0.9924	1.0275	TRUE
50 to 99	168,532	69,613,535	70,840,618	72,942,344	1.0176	1.0478	TRUE
100 to 199	299,571	128,829,599	128,242,351	131,598,506	0.9954	1.0215	TRUE
200 or More	1,073,663	456,961,259	457,682,378	466,131,963	1.0016	1.0201	TRUE
Total	1,656,551	703,374,356	703,374,350	718,954,429	1.0000	1.0222	TRUE
Sum of Squared Prediction Errors			2,723,217,733,169	103,488,356,501,151			TRUE
Facility Type							
Unknown	397	209,072	170,611	174,915	0.8160	0.8366	FALSE
Free-Standing	384,048	161,002,090	162,213,400	165,104,927	1.0075	1.0255	TRUE
Facility-Based	490,834	199,080,293	204,703,614	208,075,848	1.0282	1.0452	TRUE
Other	781,272	343,082,901	336,286,725	345,598,738	0.9802	1.0073	FALSE
Total	1,656,551	703,374,356	703,374,350	718,954,428	1.0000	1.0222	TRUE
Sum of Squared Prediction Errors			79,278,498,478,946	104,083,883,700,050			TRUE

Exhibit 2.4

Predictive Ratios and Sum of Squared Prediction Errors for COT Index Models Estimated Using All (First and Later) Episodes vs. First Episodes Only

Group	N	Actual Resource Use	Predicted Resource Use: Estimated Using All Episodes	Predicted Resource Use: Estimated Using 1st Episodes Only	All Episode Predictive Ratio	1st Episode Predictive Ratio Only	All Episode Better Than 1st Episode Only
Facility Ownership							
Unknown	397	209,072	170,611	174,915	0.8160	0.8366	FALSE
Voluntary Non-Profit (VOL/P)	839,515	350,632,983	351,797,128	357,271,468	1.0033	1.0189	TRUE
Proprietary	699,104	305,813,327	302,096,431	311,166,817	0.9878	1.0175	TRUE
Government	117,535	46,718,974	49,310,180	50,341,228	1.0555	1.0775	TRUE
Total	1,656,551	703,374,356	703,374,349	718,954,429	1.0000	1.0222	TRUE
Sum of Squared Prediction Errors			21,886,374,307,131	85,851,229,433,399			TRUE
Facility Type and Ownership							
Unknown	397	209,072	170,611	174,915	0.8160	0.8366	FALSE
Free-Standing VOL/NP	257,316	105,149,062	106,777,966	108,418,131	1.0155	1.0311	TRUE
Free-Standing Proprietary	73,408	34,087,588	32,767,484	33,561,279	0.9613	0.9846	FALSE
Free-Standing Government	53,324	21,765,440	22,667,950	23,125,518	1.0415	1.0625	TRUE
Facility-Based VOL/NP	398,625	163,216,370	166,160,344	168,738,513	1.0180	1.0338	TRUE
Facility-Based Proprietary	37,013	14,624,300	15,797,205	16,105,257	1.0802	1.1013	TRUE
Facility-Based Government	55,196	21,239,623	22,746,066	23,232,078	1.0709	1.0938	TRUE
Other VOL/NP	183,574	82,267,551	78,858,818	80,114,823	0.9586	0.9738	FALSE
Other Proprietary	588,683	257,101,439	253,531,743	261,500,281	0.9861	1.0171	TRUE
Other Government	9,015	3,713,911	3,896,164	3,983,633	1.0491	1.0726	TRUE
Total	1,656,551	703,374,356	703,374,350	718,954,428	1.0000	1.0222	TRUE
Sum of Squared Prediction Errors			41,919,471,362,372	73,528,763,043,445			TRUE

Notes: Facility type is based on the Online Survey and Certification System (OSCAR); the "other" category is a self-reported facility type but assumed to be freestanding.
Data set included episodes from January 2001 to September 2003 (1,656,551 episodes)

3. Four-Equation Model – Initial Development for the NPRM

In the previous section, predictive ratio results for a large (1,656,551 episode) data set with episodes from January 2001 to September 2003 indicated that a case-mix model should recognize differences in resource use between early and later episodes. After determining that the COT index model should be estimated using all episodes, the second stage of model development considered various options for further improving the model. These options can be grouped into the following three broad categories:

- Grouping episodes – Should the model consider differences between groups of episodes defined by episode number (first, second, third, etc.) and/or by being above or below a 14-therapy visit threshold?

- Using multiple therapy thresholds – Instead of using a single 14- therapy visit threshold, what happens to model performance if multiple therapy thresholds are included in the model? (See Chapter 4 for a discussion of this issue.)

- Additional diagnostic variables: Would the inclusion of additional diagnostic variables improve the statistical performance of the COT model?

This work yielded a model that defined the payment groups published in the Notice of Proposed Rulemaking (NPRM).

3.1. Grouping Episodes

The first issue we addressed was the extent to which treating episodes defined by episode number could improve model performance. To some degree, this is a clinical question, given that patients in later episodes differ systematically from patients in earlier episodes. For example, patients who need only one or two 60-day episodes of home health care may be recovering from an acute health care crisis or condition. Once their health improves, they may no longer require home health assistance. In contrast, patients with longer home health care needs may be suffering from health care conditions that are unlikely to improve. Recognizing such underlying clinical differences formally in the model could improve the model's ability to account for variations in resource use across early- and later-stay patients.

Episode number can be incorporated into a model in a number of different ways. First, indicator variables indicating the episode number could be added to the model. Such an approach would allow predicted resource use to differ by a varying amount (of total resource units), depending on the episode group, but the added units due to each of the other clinical, functional, and service use variables would be the same across all episode groups.

A second approach would interact the episode indicator variables with some of the other clinical, functional, and/or service use variables in the model. For example, difficulties with dressing could be interacted with the episode number indicator variables. The interactions between the episode number indicator variables and another variable in the model allow the impact of these other variables to vary across episode number groups. For example, by interacting difficulties with dressing with the episode number indicator variables, the impact of dressing on resource use could be greater in earlier episodes

than in later episodes. A model that interacts a set of indicator variables (here, the episode number indicator variables) with all other variables in the model (here, each clinical, functional, and service use variable) is known as a Chow model.

Exhibit 3.1 presents the results of estimating a COT index model where the coefficients for each variable were allowed to vary for each episode number group. This model begins by including a series of episode group number indicator variables for the 2nd, 3rd, 4th, 5th, 6th, and 7th+ episodes, and then interacting these episode group number indicator variables with all other variables in the model. Next, variables with coefficients that were less than five or were not significant at the 10% level were then eliminated. Interestingly, this process eliminated all the episode group number indicator variables. The resulting adjusted R-squared statistic of this model (0.3160) was only slightly higher than the all-episode COT index model presented in the previous section (0.3129).

Some clear similarities emerged in the coefficients across the various episode groups. The coefficients for episodes 3-7 tended to be similar. The results for the second episode were sometimes similar to those for first episodes and sometimes were more like those for third episodes and above. Based on these findings, we tested two alternative specifications: one where first and second episodes and then third through seventh+ episodes were grouped together, and a second where first episodes were grouped separately from second through seventh+ episodes. In both alternatives, the effects for each COT index variable in each group (first alternative first and second vs. third+, and in the second alternative first and second+) were allowed to differ from each other.

Exhibit 3.1

COT Index Model Estimated Across All Episodes Where Coefficients for Each Variable Are Allowed to Vary by Episode Group Number

Variable	Variable Description	1st Episodes		2nd Episodes		3rd Episodes		4th Episodes		5th Episodes		6th Episodes		7th+ Episodes	
		Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Intercept	Constant	217	0.72												
Ep2	2nd Episodes														
Ep3	3rd Episodes														
Ep4	4th Episodes														
Ep5	5th Episodes														
Ep6	6th Episodes														
Ep7+	7^{th}+ Episodes														
ther_IP	IV or Parenteral Therapy	83	1.91	78	3.66	65	5.10	67	6.56	68	7.88	74	9.47	51	4.52
ther_e	Enteral Therapy	54	2.22	17	3.54										
pain23	Pain	9	0.54	13	1.11	15	1.59	11	2.08	10	2.56	7	3.00		
vis_ge1	Vision	10	0.62												
Ucontnew	Urinary Incontinence	13	0.68												
bcont2_5	Bowel Incontinence														
ostomy12	Ostomy	38	1.98	17	3.73	25	5.12	20	6.53	18	7.79	21	9.02		
Multpulc	Multiple Pressure Ulcers	28	4.87	33	5.90	55	6.84	45	8.32	53	10.02	47	11.69	45	5.81
press12	Pressure Ulcer stage = 1 and/or 2	51	1.29	39	2.20	38	2.95	41	3.84	45	4.71	50	5.51	54	2.68
press34	Pressure Ulcer stage = 3 and/or 4	143	2.63	106	3.33	100	3.98	87	4.96	97	6.06	105	7.14	124	3.61
stasis2	Stasis Ulcer healing status = 2	74	2.57	53	3.58	66	4.58	83	5.72	75	7.24	75	8.73	82	4.88
stasis3	Stasis Ulcer healing status = 3	97	2.70	95	4.54	104	5.89	113	7.33	106	9.02	121	10.57	114	5.70
surg2	Surgical Wound healing status = 2			40	2.00	52	3.39	70	4.93	72	6.71	83	8.27	73	5.11
surg3	Surgical Wound healing status = 3	74	1.95	90	3.98	90	5.95	91	8.13	98	10.24	95	12.28	71	7.01
dysp234	Dyspnea 2 to 4	17	0.56												
dress13	Dressing 1 to 3	31	0.71	36	1.54	42	2.34	39	3.04	38	3.80	45	4.54	47	2.36
bth_ge2	Bathing >= 2	35	0.77	47	1.63	51	2.50	59	3.36	60	4.25	57	5.12	62	2.83
toi_ge2	Toileting >= 2	21	1.08	15	2.04	14	2.81	11	3.61	10	4.42	14	5.17	19	2.56
tfr_ge1	Transferring = 1	26	0.74	17	1.57	9	2.38								
tfr_ge2	Transferring >= 2	59	1.38	51	2.72	37	3.85	30	4.14	30	5.08	20	5.92	30	2.91
loco_ge1	Locomotion = 1 or 2	40	0.92	25	1.76	21	2.63	21	3.08	24	3.89	20	4.68	22	2.56
loco_ge3	Locomotion >= 3	41	1.53	26	2.78	29	3.83	36	4.70	37	5.78	40	6.81	41	3.53
ther_ge14	14 or More Therapy Visits	461	0.72	483	1.61	503	2.65	516	3.90	517	5.23	534	6.55	564	3.95

Data set included episodes from January 2001 to September,2003 (1,656,551 Episodes). Note that variables that had coefficients less than five or that were not significant at the 10% level were dropped.

Exhibit 3.2 presents the results for combining episodes into these two sets of larger groups. The results for the two models, comparing coefficients for first and second episodes (the first model) vs. third+ episodes (the second model), or first episodes (the first model) vs. second+ episodes (the second model), were quite similar. One notable difference was the coefficient for the 14 or more therapy visit variable, which was higher for third+ episodes (first model, 519 units) vs. second+ episodes (the second model, 498 units). Adding second episodes tended to reduce the therapy visit threshold variable effect for later episodes. The adjusted R-squared statistics for the two models (0.3147 and 0.3155) were quite similar and only slightly less than the adjusted R-squared statistic from the model where COT index coefficients were allowed to vary for all episode number groups (0.3160).

Exhibit 3.2

COT Index Models Combining Episode Number Groups: First and Second Episodes vs. Third+ Episodes and First Episodes vs. Second+ Episodes

Variable	Variable Description	1st and 2nd vs. 3rd+				1st vs. 2nd+			
		1st and 2nd		3rd+		1st		2nd+	
		Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Adjusted R Square Statistic					0.3147				0.315
Intercept	Constant	218	0.72			217	0.72		
Ep3+	third+ Episodes								
Ep2+	2nd+ Episodes								
ther_IP	IV or Parenteral Therapy	83	1.69	61	2.70	83	1.91	68	2.17
ther_e	Enteral Therapy	42	1.88			54	2.22		
pain23	Pain	10	0.49	9	0.87	9	0.54	11	0.68
vis_ge1	Vision	5	0.55			10	0.62		
ucontnew	Urinary Incontinence	9	0.60			13	0.68		
bcont2_5	Bowel Incontinence								
ostomy12	Ostomy	34	1.75	20	2.62	38	1.98	19	2.14
Multpulc	Multiple Pressure Ulcers	28	3.76	49	3.48	28	4.87	45	2.99
press12	Pressure Ulcer stage = 1 and/or 2	47	1.11	45	1.58	51	1.29	43	1.28
press34	Pressure Ulcer stage = 3 and/or 4	125	2.06	104	2.10	143	2.63	105	1.78
stasis2	Stasis Ulcer healing status = 2	64	2.09	76	2.56	74	2.57	68	2.08
stasis3	Stasis Ulcer healing status = 3	96	2.32	111	3.17	97	2.70	106	2.60
surg2	Surgical Wound healing status = 2			62	2.21			50	1.48
surg3	Surgical Wound healing status = 3	76	1.75	86	3.54	74	1.95	88	2.64
dysp234	Dyspnea 2 to 4	13	0.50			17	0.56		
dress13	Dressing 1 to 3	32	0.65	43	1.29	31	0.71	40	1.00
bth_ge2	Bathing >= 2	37	0.70	57	1.47	35	0.77	52	1.10
toi_ge2	Toileting >= 2	20	0.96	15	1.50	21	1.08	16	1.21
tfr_ge1	Transferring = 1	24	0.67			26	0.74	9	1.03
tfr_ge2	Transferring >= 2	58	1.23	29	1.71	59	1.38	40	1.67
loco_ge1	Locomotion = 1 or 2	38	0.86	22	1.43	40	0.92	23	1.26
loco_ge3	Locomotion >= 3	37	1.37	39	2.03	41	1.53	35	1.73
ther_ge14	14 or More Therapy Visits	466	0.66	519	1.72	461	0.72	498	1.16

Data set included episodes from January 2001 to September,2003 (1,656,551 episodes).
Note that variables that had coefficients less than five or that were not significant at the 10% level were dropped.

Exhibit 3.3 provides the predicted ratios and sum of squared prediction errors for the three models presented in Exhibits 3.1 and 3.2. The performance of the three models was quite similar:

- Episode number groups – as one would expect, the All Seven model performed the best, but the performance of the 1 vs. 2 to 7+ model was nearly as good. The predictive ratio in the All Seven model was 1.00 for first episodes and ranged from 0.9997 to 1.009 for other episodes. By comparison, the predictive ratios for the 1 and 2 vs. 3 to 7+ model was 0.9919 for first episodes and ranged from 0.9822 to 1.0354 for later episodes.

- Facility size – all three models performed comparably well, but the 1 and 2 vs. 3 to 7+ model performed better than the All Seven model, with predictive ratios that were closer to 1 for all of the facility size categories.

- Facility type – The performance of the three models was quite similar, although the predictive ratios for the 1 and 2 vs. 3 to 7+ models tended to be slightly closer to 1 than the predictive ratios for the All Seven model.

- Facility ownership – As with our other analyses of model performance by facility characteristics, the performance of all the models was very similar for facilities of different ownership types.

The small differences in statistical performance that we observed across the three models give us reason to favor models that combine episode groups together. These models have far fewer variables and thus are much simpler in structure than the All Seven model. The question then becomes, which is better: combining first and second episodes into one category and third+ episodes in another, or dividing episodes into first and all later episodes. The results reported in Exhibit 3.3 suggest that this decision is not likely to make a great difference. Therefore, relatively early in the model development process, the decision was made to group first and second episodes together and then to group third+ episodes in a second category. One factor pointing towards this choice was that grouping first episodes separately from all later episodes could influence agency discharge decisions. This could occur if resource cost estimates for later episodes led to higher payment rates for later episodes, providing an incentive for delaying patient discharges.

Subsequently, a considerable amount of resources and modeling effort was devoted to considering models of this type – i.e., models that grouped first and second episodes together in one group ("early episodes") and third+ episodes together in a second group ("later episodes.") The remainder of this chapter considers models of this type.

Exhibit 3.3

Predictive Ratios and Sum of Squared Prediction Errors for Models Combining Different Episode Number Groups Together

Group	N	Actual Resource Use	Predicted Resource Use: Coefficients Vary Across All Episode Number Groups (All Seven)	Predicted Resource Use: 1st and 2nd Episodes vs. 3rd+ Episodes (1 and 2 vs. 3 to 7+)	Predicted Resource Use: 1st Episodes vs. 2nd+ Episodes (1 vs. 2 to 7+)	All Seven Predictive Ratio	1 and 2 vs. 3 to 7+ Predictive Ratio	1 vs. 2 to 7+ Predictive Ratio
Episode Number								
1st Episodes	1,020,700	444,199,364	444,199,212	440,622,564	444,188,348	1.0000	0.9919	1.0000
2nd Episodes	238,469	99,373,078	99,343,725	102,891,857	100,082,587	0.9997	1.0354	1.0071
3rd Episodes	115,417	47,142,804	47,139,875	47,618,091	47,300,913	0.9999	1.0101	1.0034
4th Episodes	68,020	27,218,745	27,214,920	27,539,047	27,390,567	0.9999	1.0118	1.0063
5th Episodes	45,353	18,018,172	18,024,866	18,153,114	18,072,363	1.0004	1.0075	1.0030
6th Episodes	33,249	13,135,269	13,147,470	13,227,103	13,173,293	1.0009	1.0070	1.0029
7th+ Episodes	135,343	54,286,925	54,304,294	53,322,590	53,166,282	1.0003	0.9822	0.9794
Total	1,656,551	703,374,357	703,374,363	703,374,367	703,374,353	1.0000	1.0000	1.0000
Sum of Squared Prediction Errors			1,380,113,089	26,460,383,451,526	1,818,269,347,408			
Facility Size (Number of 1st Episodes)								
Unknown	62	45,717	24,288	24,691	24,384	0.5313	0.5401	0.5334
1 to 5	3,370	1,527,496	1,355,666	1,359,334	1,356,468	0.8875	0.8899	0.8880
6 to 9	5,110	2,274,244	2,094,000	2,094,000	2,091,291	0.9207	0.9207	0.9196
10 to 14	7,569	3,571,660	3,136,845	3,139,400	3,136,956	0.8783	0.8790	0.8783
15 to 19	10,773	4,538,960	4,357,359	4,360,867	4,356,351	0.9600	0.9608	0.9598
20 to 29	27,760	11,377,676	11,100,169	11,120,724	11,105,902	0.9756	0.9774	0.9761
30 to 49	60,141	24,634,211	24,343,926	24,376,438	24,347,400	0.9882	0.9895	0.9884
50 to 99	168,532	69,613,535	70,764,933	70,811,079	70,755,135	1.0165	1.0172	1.0164
100 to 199	299,571	128,829,599	128,268,911	128,298,712	128,263,974	0.9956	0.9959	0.9956
200 or More	1,073,663	456,961,259	457,928,264	457,789,123	457,936,492	1.0021	1.0018	1.0021
Total	1,656,551	703,374,356	703,374,362	703,374,367	703,374,353	1.0000	1.0000	1.0000
Sum of Squared Prediction Errors			3,020,976,239,332	2,813,555,886,502	3,015,873,471,397			
Facility Type								
Unknown	397	209,072	172,418	172,096	172,522	0.8247	0.8231	0.8252
Free-Standing	384,048	161,002,090	162,202,785	162,163,011	162,171,986	1.0075	1.0072	1.0073
Facility-Based	490,834	199,080,293	204,935,771	204,781,209	204,979,990	1.0294	1.0286	1.0296
Other	781,272	343,082,901	336,063,389	336,258,051	336,049,854	0.9795	0.9801	0.9795
Total	1,656,551	703,374,356	703,374,363	703,374,367	703,374,352	1.0000	1.0000	1.0000
Sum of Squared Prediction Errors			85,003,183,338,565	80,428,125,542,541	85,640,167,330,328			
Facility Ownership								

Exhibit 3.3

Predictive Ratios and Sum of Squared Prediction Errors for Models Combining Different Episode Number Groups Together

Group	N	Actual Resource Use	Predicted Resource Use: Coefficients Vary Across All Episode Number Groups (All Seven)	Predicted Resource Use: 1st and 2nd Episodes vs. 3rd+ Episodes (1 and 2 vs. 3 to 7+)	Predicted Resource Use: 1st Episodes vs. 2nd+ Episodes (1 vs. 2 to 7+)	All Seven Predictive Ratio	1 and 2 vs. 3 to 7+ Predictive Ratio	1 vs. 2 to 7+ Predictive Ratio
Unknown	397	209,072	172,096	172,522	171,911	0.8231	0.8252	0.8223
Voluntary Non-Profit (VOL/P)	839,515	350,632,983	351,767,687	351,996,766	351,767,376	1.0032	1.0039	1.0032
Proprietary	699,104	305,813,327	302,120,701	301,879,424	302,128,377	0.9879	0.9871	0.9880
Government	117,535	46,718,974	49,313,883	49,325,640	49,306,676	1.0555	1.0558	1.0554
Total	1,656,551	703,374,356	703,374,368	703,374,353	703,374,340	1.0000	1.0000	1.0000
Sum of Squared Prediction Errors			21,657,960,912,480	24,131,540,820,615	21,563,283,810,535			
Facility Type and Ownership								
Unknown	397	209,072	172,096	172,522	171,911	0.8231	0.8252	0.8223
Free-Standing VOL/NP	257,316	105,149,062	106,698,233	106,711,564	106,660,131	1.0147	1.0149	1.0144
Free-Standing Proprietary	73,408	34,087,588	32,823,415	32,822,077	32,812,747	0.9629	0.9629	0.9626
Free-Standing Government	53,324	21,765,440	22,641,363	22,638,345	22,617,726	1.0402	1.0401	1.0392
Facility-Based VOL/NP	398,625	163,216,370	166,203,487	166,373,157	166,242,698	1.0183	1.0193	1.0185
Facility-Based Proprietary	37,013	14,624,300	15,809,162	15,823,641	15,799,189	1.0810	1.0820	1.0803
Facility-Based Government	55,196	21,239,623	22,768,560	22,783,192	22,789,452	1.0720	1.0727	1.0730
Other VOL/NP	183,574	82,267,551	78,865,967	78,912,045	78,864,548	0.9587	0.9592	0.9586
Other Proprietary	588,683	257,101,439	253,488,124	253,233,706	253,516,440	0.9859	0.9850	0.9861
Other Government	9,015	3,713,911	3,903,960	3,904,103	3,899,498	1.0512	1.0512	1.0500
Total	1,656,551	703,374,356	703,374,368	703,374,352	703,374,340	1.0000	1.0000	1.0000
Sum of Squared Prediction Errors			42,094,023,660,908	44,847,513,211,574	42,044,409,365,933			

Data set included episodes from January 2001 to September 2003 (1,656,551 episodes).

Note that facility type is based on the Online Survey and Certification System (OSCAR); the "other" category is a self-reported facility type but assumed to be freestanding.

The next step in model development was to divide episodes by therapy use – i.e., into groups above and below the 14-therapy visit threshold developed based on analysis described in Chapter 4 and consultation with our Technical Expert Panel (TEP). This formed four groups of episodes, or four "legs":

- Leg one – first and second (early) episodes, less than 14 therapy visits.
- Leg two – first and second (early) episodes, 14 or more therapy visits.
- Leg three – third+ (later) episodes, less than 14 therapy visits.
- Leg four – third+ (later) episodes, 14 or more therapy visits.

Exhibit 3.4 provides the relative frequencies of resource use and the independent variables in the COT model across the four legs. Mean resource use was higher for later episodes – among episodes with fewer than 14 therapy visits, mean resource use was 350 for episodes one and two and 367 for episodes three and higher. Mean resource use was also much higher for episodes that had more than 14 therapy visits – for first and second episodes, the average was 350 for episodes with less than 14 therapy visits compared to 836 for episodes with 14 or more therapy visits.

Among the independent variables in the COT model, the following differences were observed across the four legs:

- Greater relative frequency for later than for earlier episodes:
  - Enteral therapy
  - Vision problems
  - Urinary incontinence
  - Bowel incontinence
  - Pressure ulcers
  - Dyspnea
  - Dressing
  - Bathing
  - Toileting
  - Dependent in transferring (transferring ≥ 2)
- Greater relative frequency above than below the 14-therapy visit threshold:
  - Pain
  - Dressing
  - Bathing
  - Transferring
  - Dependent in locomotion (Requires the use of a device or human supervision to walk but not chairfast or bedfast) (locomotion equal to 1 or 2)

A COT index model was then estimated where the coefficients of each COT index variable were allowed to vary across the four legs (Exhibit 3.4). This model also included a set of indicator variables to distinguish each leg from the others. This type of model is referred to as a "four-equation model" and became the basic structure for future model development. Presentation of four-equation COT index model results begins in the next subsection.

Exhibit 3.4

Relative Frequencies of COT Index Model Variables: Four Legs

Variable	Variable Description	Leg One: 1st and 2nd (early) Episodes, Less Than 14 Therapy Visits	Leg Two: 1st and 2nd (early) Episodes, 14 or More Therapy Visits	Leg Three: 3rd+ (later) Episodes, Less Than 14 Therapy Visits	Leg Four: 3rd+ (later) Episodes, 14 or More Therapy Visits
N	Number of Episodes	1,046,562	212,607	370,715	26,667
RES_TOT_UPDT	Total Resource Use Units	350	836	367	888
ther_IP	IV or Parenteral Therapy	2.4%	0.7%	2.7%	1.7%
ther_e	Enteral Therapy	1.7%	1.9%	5.5%	3.3%
pain23	Pain	51.1%	55.8%	50.9%	57.3%
vis_ge1	Vision	29.9%	31.0%	49.8%	43.0%
Ucontnew	Urinary Incontinence	22.7%	27.5%	35.9%	37.0%
bcont2_5	Bowel Incontinence	9.4%	10.8%	26.4%	19.4%
ostomy12	Ostomy	2.1%	1.2%	2.9%	2.1%
Multpulc	Multiple Pressure Ulcers	0.6%	0.4%	2.3%	1.0%
press12	Pressure Ulcer stage = 1 and/or 2	5.2%	5.6%	8.8%	8.1%
press34	Pressure Ulcer stage = 3 and/or 4	2.0%	1.4%	6.9%	3.5%
stasis2	Stasis Ulcer healing status = 2	1.5%	0.6%	3.0%	1.5%
stasis3	Stasis Ulcer healing status = 3	1.2%	0.4%	1.9%	1.0%
surg2	Surgical Wound healing status = 2	16.6%	11.8%	3.8%	5.5%
surg3	Surgical Wound healing status = 3	2.2%	0.9%	1.5%	1.1%
dysp234	Dyspnea 2 to 4	42.1%	38.1%	59.2%	53.3%
dress13	Dressing 1 to 3	66.1%	83.5%	77.1%	86.2%
bth_ge2	Bathing >= 2	75.7%	90.2%	85.5%	92.4%
toi_ge2	Toileting >= 2	13.4%	21.8%	33.4%	32.5%
tfr_ge1	Transferring = 1	55.9%	65.4%	51.4%	58.7%
tfr_ge2	Transferring >= 2	11.8%	21.4%	29.9%	30.6%
loco_ge1	Locomotion = 1 or 2	76.0%	82.8%	63.4%	73.7%
loco_ge3	Locomotion >= 3	9.7%	14.7%	30.5%	24.8%
ther_ge14	14 or More Therapy Visits	0.0%	100.0%	0.0%	100.0%

Data set included episodes from January 2001 to September 2003 (1,656,551 episodes).

The four-equation COT index model allows the marginal resource cost due to each patient condition to vary by type of episode (i.e., leg one vs. leg two vs. leg three vs. leg four) and also allows for a leg-specific difference in resource cost (through the leg indicator variables) that is unrelated to any particular variable and represents otherwise unmeasured differences across legs. In regression modeling terms, the four-equation COT index model specification makes no assumptions regarding what kind of differences are or are not recognized across legs, because the four-equation COT index model allows all effects to vary by leg.

3.2. Four-Equation Models and Therapy Thresholds

Exhibit 3.5 presents model estimates for two four-equation COT index models. The first is a COT index model where the COT index variable coefficients are allowed to vary across all four legs. Members of a Technical Expert Panel (TEP) convened by CMS to review earlier model estimates suggested including three thresholds, and after considering results from our detailed analysis of therapy visits as described in Chapter 4,

Exhibit 3.5

Four-Equation COT Index Model Estimates: 14-Therapy Visit Threshold vs. 6, 14, and 20 Therapy Visit Thresholds

	Four-Equation COT Index Model: 14-Therapy Visit Thresholds								Four-Equation COT Index Model: 6, 14, and 20+Therapy Visit Thresholds							
	1st Leg		2nd Leg		3rd Leg		4th Leg		1st Leg		2nd Leg		3rd Leg		4th Leg	
Variable Description	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Adjusted R Square								0.3198								0.4068
Constant	219	0.74							201	0.75						
2nd Episodes			448	2.37							376	2.26				
3rd Episodes							459	7.13					12	1.95		
4th Episodes															391	6.73
6 to 13 Therapy Visits									198	0.55			249	1.37		
20 or More Therapy Visits											303	1.13			285	3.22
IV or Parenteral Therapy	76	1.74	184	7.22	56	2.75	170	12.75	113	1.63	191	6.75	64	2.58	160	11.90
Enteral Therapy	12	2.08	186	4.35			85	9.38	30	1.95	145	4.07			61	8.76
Pain	18	0.53			10	0.89			6	0.50						
Vision	6	0.60	6	1.30					18	0.56	6	1.22				
Urinary Incontinence	7	0.67	14	1.42					10	0.65	13	1.33				
Bowel Incontinence			25	2.15			21	4.72	9	1.02	28	2.01	9	1.22	30	4.41
Ostomy	27	1.84	81	5.33	18	2.68	71	11.73	51	1.73	89	4.98	24	2.55	66	10.95
Multiple Pressure Ulcers	33	3.98	47	11.01	49	3.52	93	19.16	35	3.72	53	10.28	51	3.29	85	17.89
Pressure Ulcer stage = 1 and/or 2	36	1.23	109	2.59	41	1.63	102	6.21	54	1.15	106	2.41	43	1.52	101	5.80
Pressure Ulcer stage = 3 and/or 4	115	2.21	238	5.69	102	2.14	186	10.33	152	2.07	239	5.31	109	2.00	184	9.65
Stasis Ulcer healing status = 2	55	2.16	164	7.75	72	2.60	141	13.38	95	2.02	172	7.24	84	2.44	144	12.49
Stasis Ulcer healing status = 3	90	2.39	154	9.27	108	3.22	170	16.68	134	2.23	172	8.65	119	3.01	172	15.58
Surgical Wound healing status = 2					58	2.31	101	7.28			7	1.71	48	2.17	92	6.80
Surgical Wound healing status = 3	70	1.82	110	6.17	83	3.61	116	16.25	100	1.70	137	5.77	86	3.38	124	15.17
Dyspnea 2 to 4	8	0.55	32	1.23	42	1.33	17	3.35	30	0.52	40	1.15			33	3.14
Dressing 1 to 3	30	0.69	49	1.80			58	5.65	21	0.64	35	1.68	34	1.24	51	5.28
Bathing >= 2	36	0.74	54	2.18	57	1.49	78	7.07	22	0.69	44	2.04	53	1.44	65	6.61
Toileting >= 2	13	1.11	39	1.89	15	1.57	27	4.79	12	1.05	31	1.77	14	1.51	23	4.48
Transferring = 1	27	0.71	16	1.85			12	5.83			11	1.72			9	5.45
Transferring >= 2	48	1.41	73	2.66	25	1.81	86	7.24	8	1.19	48	2.48	15	1.71	61	6.77
Locomotion = 1 or 2	41	0.89			24	1.46			7	0.78			12	1.87		
Locomotion >= 3	31	1.52	43	2.15	42	2.10			18	1.39	29	2.01	46	2.35		

Data set included episodes from January 2001 to September 2003 (1,656,551 episodes).

Note that variables that had coefficients less than five or that were not significant at the 10% level were dropped.

it was decided to include a 6- (6 to 13) therapy visit threshold, a 14- (14 to 19) therapy visit threshold), and a 20 or more therapy visit threshold. These are the second set of estimates included in Exhibit 3.5.

The 14-therapy visit threshold effect is reflected in the leg two indicator variable (for first and second episodes) or the leg four indicator variable (for third+ episodes) in both models. In the first model with only the 14-therapy visit threshold, these effects were 448 resource units (leg two) and 459 resource units (leg four). In contrast, the second model splits up this jump into several stages:

- Legs one and two (early episodes) – the 6 to 13 therapy visit threshold effect was 198 units, the 14-therapy visit threshold (representing 14 to 19 visits) was 376 units (this is the coefficient on the leg two indicator variable), and the 20 or more therapy visit threshold was 679 units (the sum of the leg two indicator variables and the coefficient on 20 or more therapy visits).

- Legs three and four (later episodes) – the 6 to13 therapy visit threshold effect was 249 units, the 14-therapy visit threshold was 391 units (this is the coefficient on the leg four indicator variable), and the 20 or more therapy visit threshold was 676 units (the sum of the leg four indicator variable and the coefficient on 20 or more therapy visits).

Adding the two additional therapy thresholds substantially improved the adjusted R-squared of the model – from 0.3198 to 0.4068, an improvement of 27.2%.

In many cases, COT index variable coefficients differed systematically either above or below the 14- therapy visit threshold or between first and second vs. third+ episodes. For example, for the four-equation COT index model with 6, 14, and 20 therapy visit thresholds, some of the largest differences in the coefficients for individual COT index independent variables across the four legs include:

Above vs. below 14-therapy visit threshold:

- IV or parenteral therapy was higher for leg two than for leg one (191 vs. 113) and for leg four than for leg three (160 vs. 64).

- Enteral therapy was higher for leg two than for leg one (145 vs. 30) and for leg four than for leg three (61 vs. excluded from leg three).

- Ostomy was higher for leg two than for leg one (89 vs. 51) and for leg four than for leg three (66 vs. 24).

- Pressure ulcers was higher for leg two than for leg one (106 for pressure ulcer = 1 or 2 and 239 for pressure ulcer = 3 or 4 for leg two, vs. 54 and 152 for leg one, respectively) and for leg four than for leg three (101 for pressure ulcer = 1 or 2 and 184 for pressure ulcer = 3 or 4 for leg two, vs. 43 and 109 for leg three, respectively).

- Transferring (> = 2) was higher for leg two than for leg one (48 vs. 8) and for leg four than for leg three (61 vs. 15).

First and second (early) vs. third+ (later) episodes:

- IV or parenteral therapy was higher for leg one vs. leg three (113 vs. 64) and for leg two vs. leg four (191 vs. 160).

- Enteral therapy was higher for leg one vs. leg three (30 vs. excluded from leg three) and for leg two than for leg four (145 vs. 61).

- Pressure ulcers three or four were higher for leg one vs. leg three (152 vs. 109) and for leg two vs. leg four (239 vs. 184).

There appear to be differences in the relationship between some of the COT index variables and resource use across different legs.

Exhibit 3.6 provides the predictive ratios and sum of squared prediction errors for the four-equation COT index models with either a 14-therapy visit threshold or a 6, 14, and 20 therapy visit threshold. The model with the 3-therapy visit thresholds performed better (as indicated by a "True" in the last column) for groups defined based on the episode number and number of therapy visits. Models with the single therapy visit threshold performed better only when facilities were grouped based on size (measured by the number of initial episodes). One set of predictive ratios included in Exhibit 3.6 is for episode groups defined by the threshold-created intervals of therapy visits (e.g., 6 to 13 therapy visits). The threshold variables in the second model isolate the same intervals of therapy visits, and therefore ensure that predictive ratios for all these groups were exactly 1.000. Models that included only a 14-therapy visit threshold had somewhat poorer performance. This model consistently over-predicted resource use for the 0 to 5 therapy visit and 14 to 19 therapy visit groups (by over 16% in both cases), and under-predicted resource use for the 6 to 13 therapy visit group (by over 25%) and the 20 or more therapy visit group (by over 17%)

Exhibit 3.6

Predictive Ratios and Sum of Squared Prediction Errors for Four-Equation COT Index Models: 14-Therapy Visit Threshold vs. 6, 14, and 20 Therapy Visit Thresholds

Group	N	Actual Resource Use	Predicted Resource Use: Four-Equation COT Index Model: 14-Therapy Visit Threshold Only	Predicted Resource Use: Four-Equation COT Index Model: 6, 14, and 20 Therapy Visit Thresholds	Four-Equation COT Index Model: 14-Therapy Visit Threshold Only Predictive Ratio	Four-Equation COT Index Model: 6, 14, and 20 Therapy Visit Thresholds Predictive Ratio	Model with Three Thresholds Better
Episode Number							
1st Episodes	1,020,700	444,199,364	440,910,403	444,087,368	0.9926	0.9997	TRUE
2nd Episodes	238,469	99,373,078	102,629,937	99,485,077	1.0328	1.0011	TRUE
3rd Episodes	115,417	47,142,804	47,583,728	49,029,386	1.0094	1.0400	FALSE
4th Episodes	68,020	27,218,745	27,531,052	27,764,411	1.0115	1.0200	FALSE
5th Episodes	45,353	18,018,172	18,162,498	18,063,695	1.0080	1.0025	TRUE
6th Episodes	33,249	13,135,269	13,233,837	13,025,696	1.0075	0.9917	FALSE
7th+ Episodes	135,343	54,286,925	53,322,884	51,918,725	0.9822	0.9564	FALSE
Total	1,656,551	703,374,357	703,374,340	703,374,358	1.0000	1.0000	
Sum of Squared Prediction Errors			22,676,267,782,257	9,504,479,447,639			TRUE
Number of Therapy Visits							
0 to 5	1,015,606	307,211,576	357,008,118	307,211,577	1.1621	1.0000	TRUE
6 to 13	401,671	194,757,680	144,961,134	194,757,682	0.7443	1.0000	TRUE
14 to 19	146,023	105,017,167	121,837,495	105,017,166	1.1602	1.0000	TRUE
20 or More	93,251	96,387,933	79,567,604	96,387,933	0.8255	1.0000	TRUE
Total	1,656,551	703,374,356	703,374,351	703,374,358	1.0000	1.0000	
Sum of Squared Prediction Errors			5,525,238,481,973,540	6			TRUE
Facility Size (Number of 1st Episodes)							
Unknown	62	45,717	24,621	25,401	0.5385	0.5556	TRUE
1 to 5	3,370	1,527,496	1,356,478	1,310,375	0.8880	0.8579	FALSE
6 to 9	5,110	2,274,244	2,095,607	2,045,060	0.9215	0.8992	FALSE
10 to 14	7,569	3,571,660	3,133,980	3,078,389	0.8775	0.8619	FALSE
15 to 19	10,773	4,538,960	4,362,345	4,251,531	0.9611	0.9367	FALSE
20 to 29	27,760	11,377,676	11,134,803	10,790,576	0.9787	0.9484	FALSE
30 to 49	60,141	24,634,211	24,401,276	23,891,671	0.9905	0.9699	FALSE
50 to 99	168,532	69,613,535	70,798,906	70,106,344	1.0170	1.0071	TRUE
100 to 199	299,571	128,829,599	128,266,074	127,911,013	0.9956	0.9929	FALSE
200 or More	1,073,663	456,961,259	457,800,249	459,963,998	1.0018	1.0066	FALSE
Total	1,656,551	703,374,356	703,374,339	703,374,358	1.0000	1.0000	
Sum of Squared Prediction Errors			2,824,174,117,231	11,425,164,445,409			FALSE

Exhibit 3.6

Predictive Ratios and Sum of Squared Prediction Errors for Four-Equation COT Index Models: 14-Therapy Visit Threshold vs. 6, 14, and 20 Therapy Visit Thresholds

Group	N	Actual Resource Use	Predicted Resource Use: Four-Equation COT Index Model: 14-Therapy Visit Threshold Only	Predicted Resource Use: Four-Equation COT Index Model: 6, 14, and 20 Therapy Visit Thresholds	Four-Equation COT Index Model: 14-Therapy Visit Threshold Only Predictive Ratio	Four-Equation COT Index Model: 6, 14, and 20 Therapy Visit Thresholds Predictive Ratio	Model with Three Thresholds Better
Facility Type							
Unknown	397	209,072	171,911	178,855	0.8223	0.8555	TRUE
Free-Standing	384,048	161,002,090	162,090,605	161,884,087	1.0068	1.0055	TRUE
Facility-Based	490,834	199,080,293	204,831,338	204,274,360	1.0289	1.0261	TRUE
Other	781,272	343,082,901	336,280,486	337,037,055	0.9802	0.9824	TRUE
Total	1,656,551	703,374,356	703,374,340	703,374,357	1.0000	1.0000	
Sum of Squared Prediction Errors			80,533,614,261,221	64,309,417,615,590			TRUE
Facility Ownership							
Unknown	397	209,072	171,911	178,855	0.8223	0.8555	TRUE
Voluntary Non-Profit (VOL/P)	839,515	350,632,983	351,767,376	351,820,453	1.0032	1.0034	FALSE
Proprietary	699,104	305,813,327	302,128,377	302,842,377	0.9880	0.9903	TRUE
Government	117,535	46,718,974	49,306,676	48,532,672	1.0554	1.0388	TRUE
Total	1,656,551	703,374,356	703,374,340	703,374,358	1.0000	1.0000	
Sum of Squared Prediction Errors			21,563,283,810,535	13,527,043,079,186			TRUE
Facility Type and Ownership							
Unknown	397	209,072	171,911	178,855	0.8223	0.8555	TRUE
Free-Standing VOL/NP	257,316	105,149,062	106,660,131	106,390,249	1.0144	1.0118	TRUE
Free-Standing Proprietary	73,408	34,087,588	32,812,747	33,286,417	0.9626	0.9765	TRUE
Free-Standing Government	53,324	21,765,440	22,617,726	22,207,421	1.0392	1.0203	TRUE
Facility-Based VOL/NP	398,625	163,216,370	166,242,698	165,985,580	1.0185	1.0170	TRUE
Facility-Based Proprietary	37,013	14,624,300	15,799,189	15,877,537	1.0803	1.0857	FALSE
Facility-Based Government	55,196	21,239,623	22,789,452	22,411,244	1.0730	1.0552	TRUE
Other VOL/NP	183,574	82,267,551	78,864,548	79,444,625	0.9586	0.9657	TRUE
Other Proprietary	588,683	257,101,439	253,516,440	253,678,423	0.9861	0.9867	TRUE
Other Government	9,015	3,713,911	3,899,498	3,914,007	1.0500	1.0539	FALSE
Total	1,656,551	703,374,356	703,374,340	703,374,358	1.0000	1.0000	
Sum of Squared Prediction Errors			42,044,409,365,933	32,716,492,612,655			TRUE

Data set included episodes from January 2001 to September 2003 (1,656,551 episodes)

Note that facility type is based on the Online Survey and Certification System (OSCAR); the "other" category is a self-reported facility type but assumed to be freestanding.

3.3. Final Version of the Four-Equation Model for the NPRM

The modeling to this point strongly pointed to refining a four-equation model that included multiple therapy visit thresholds or some other method of capturing variations in resource utilization for episodes with different numbers of therapy visits. The following issues, however, still pointed to the need for possible further refinements:

- Assuring that independent variables were positive (coefficients >= 5) and statistically significant (10% level, two-tailed test).
- Testing and potentially incorporating diagnostic variables into the model, including interaction variables.
- Softening the "jumps" at each of the therapy thresholds.
- Simplifying the model, where possible.

3.3.1. Positive and Significant Coefficients

The first and fourth issues above were sometimes inter-related. As new versions of the models were estimated, the results were reviewed, and variables that did not pass the two statistical tests (coefficients >= 5 and significant at the 10% level) were excluded.[7] In certain cases, especially for interaction variables and variables in the fourth leg, coefficients were extremely large and statistically significant, but only a small number of episodes had the particular diagnosis or interaction (of diagnosis and some other variable). These variables were excluded in the interests of simplifying the model, as well as due to concerns that the variable (or interaction) in question might be "over-fitting" the model (i.e., the results for the variable might not hold up from sample to sample). As will be discussed below, another method of dealing with small n's was to set the coefficient for the variable in question to be equal across two or more legs (assuming that the variable was in another leg and the coefficients for the two legs were also similar).

A large number of different diagnosis variables and interactions between these diagnostic variables and other variables (diagnostic, other clinical/COT, or functional) were included in different versions of the four-equation model – often with different specifications for the number of therapy visit thresholds or other therapy visit variables – and for different data sets. Before discussing the various diagnostic variables and interactions that were tested, a number of other variables were considered; including:

- Former COT service use variables – hospital visit in the past 14 days, rehabilitation or skilled nursing visit in the past 14 days, and their interaction.
- Medicaid eligibility.

[7] Because decisions about the inclusion or exclusion of variables could affect the coefficients and statistical significance of other variables in the model, variables were first excluded only if they had coefficients =< 4.50 and t statistics < 1.50 – i.e., criteria slightly less stringent than the coefficients >= 5 and 10% significance level (t statistic >= 1.645) rules. Model estimates after excluding the first set of variables were re-checked, and then the more stringent exclusion rules were applied.

- Presence or absence of a caregiver in the home.
- Age.
- State and regional indicator variables.

Each of these variables was found to be statistically significant in at least one of the models, notably Medicaid eligibility and the absence of a caregiver. However, in some earlier work developing the COT models, adding diagnostic variables had increased the adjusted R-squared statistic by 9.9%, but including three additional variables – presence of caregiver, Medicaid eligibility, and dependence in administering medications (i.e., the patient in the episode needs help from someone else when administering prescription medications) – increased adjusted R-squared by only an additional 0.7%. Ultimately, it was decided not to include these variables for one or both of the following two reasons. First, from a public policy perspective, it is not clear if such differences across patients should be explicitly recognized in a model that ultimately determines payment for home health care. Medicaid eligibility, the presence or absence of a caregiver in the home, age, and state and regional indicator variables were excluded based on this concern. Second serious concerns were expressed whether the data used to estimate the four-equation models measured some of these variables (e.g., Medicaid eligibility) consistently and accurately.

3.3.2. Diagnostic Variables and Interactions

The original case-mix model includes four diagnostic groups (Orthopedic, Neurological, Diabetes, and Wounds) derived from the ICD-9 codes reported as the primary diagnosis for the home health episode. As part of our model refinement efforts, we tested many additional diagnostic groups and examined the impact of comorbid conditions listed as secondary diagnoses. We also tested interactions between diagnostic variables and other clinical and functional variables.

Diagnostic variables were tested in three ways:

- Primary – when an ICD-9 code in the specified diagnostic group was reported as the primary diagnosis for the episode, the diagnostic variable is set equal to one.

- Secondary or other – when an ICD-9 code in the specified diagnostic group was reported as a secondary diagnosis for the episode, a separate diagnostic variable is set equal to one.

- Both – when an ICD-9 code in the specified diagnostic group was reported as either the primary or a secondary diagnosis for the episode, the diagnostic variable is set equal to one

Coding a diagnostic (or any other indicator) variable to be equal to one "switches on" that variable – i.e., if a diagnostic variable is coded equal to one, the patient in that episode has a diagnosis in the group in question. Coding diagnostic (or any other indicator) variable to the other alternative, zero, "switches off" the variable – patients do not have a diagnosis in the group in question. The coefficient for each diagnostic (or any other indicator) variable represents the average marginal addition to mean resource use associated with having a diagnosis in the group in question, all other things being equal.

Some versions of the model that were tested allowed an individual to have both a primary and a secondary diagnosis in the same DG. In the final version of the model, however, an episode cannot have both a primary and a secondary diagnosis within the same DG, and the primary diagnosis takes precedence. For example, if an episode has both primary and secondary diagnoses in the Cardiovascular

DG, only the primary cardiovascular variable would be set to "one," with the secondary cardiovascular variable being set to "zero."

There are at least two reasons for coding primary and secondary diagnostic variables in this way. First, it avoids some possible confusion. By coding secondary diagnostic variables to be zero when the primary diagnostic variable is equal to one, the coefficient on the primary diagnostic variable represents the marginal addition to mean resource use of having a primary diagnosis in the diagnostic group in question. If primary and secondary diagnostic variables are both allowed to be coded equal to one at that time, the coefficient on the primary diagnostic variable represents a blurred combination of two effects: (1) the difference in mean resource use between individuals with only a secondary diagnosis and those with a primary and a secondary diagnosis; and (2) the marginal addition to mean resource use for those with only a primary diagnosis. This makes interpreting coefficients when both primary and secondary diagnostic variables are allowed to be coded to one extremely complicated. Second, home health agencies might be provided an incentive to code additional secondary diagnoses when a primary diagnosis in a diagnostic group has already been coded, to earn the "score" associated with a secondary diagnosis.

The following is a list of diagnostic variables and interactions that were tested in a four-equation model[8]:

- Affective, depressive, and other psychotic disorder.
- Alzheimer's, organic psychotic, and other organic psychotic disorders.
- Blindness or low vision.
- Blood diseases.
- Brain disorders and brain disorders interacted with:
  - IV therapy.
  - Urinary incontinence.
- Cancer – including various combinations (e.g., entered individually or in groups) of malignant nervous system, benign nervous system, malignant skin, malignant in situ, leukemia, malignant connective, or bone cancer, and cancer(s) interacted with:
  - Affective, depressive, and other psychotic disorders.
  - Alzheimer's, organic psychotic, and other organic psychotic disorders.
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - Gait disorders.
  - Neurological diagnoses.
  - Non-pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
  - Ostomy.

[8] Ultimately, due to changes in diagnostic coding, including primarily allowing the use of V-codes as the primary diagnosis in OASIS starting in October 2003, it was decided not to use episodes after September 30, 2003, to estimate four-equation models, when these coding changes were introduced, for CMS' regulatory proposals.

- Stroke – including up to four different types of stroke entered as a group or separately.
- Wounds, burns, post-operative wounds or other post-operative complications.

- Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use, and these diabetes variables (and diabetes/injectable drug use interactions) interacted with:
  - Affective, depressive, and other psychotic disorders.
  - Alzheimer's, organic psychotic, and other organic psychotic disorders.
  - IV therapy.
  - Neurological diagnoses.
  - Non pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
  - Pulmonary diagnoses.
  - Stroke – including up to four different types of stroke entered as a group or separately.
  - Various combinations of heart disorders including hypertension, ischemic heart disease (not MI), and myocardial infarction (MI).
  - Wounds, burns, post-operative wounds or other post-operative complications.

- Gastrointestinal (GI) disorders – sometimes combined and sometimes entered separately with dysphagia and/or abnormal weight loss, and GI (and/or dysphagia and/or abnormal weight loss) interacted with:
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - Enteral therapy.
  - Neurological diagnoses.
  - Non pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
  - Orthopedic diagnoses – these could be split up when interacted with other variables in the model (e.g., back, leg, shoulder, arthritis of the knee or hip, gait, etc.).
  - Ostomy.
  - Parenteral therapy.
  - Stroke – including up to four different types of stroke entered as a group or separately.
  - Wounds, burns, post-operative wounds, or other post-operative complications.

- Heart disorders, including various combinations of heart disorders including hypertension, ischemic heart disease (not MI), and myocardial infarction (MI), and these heart disorders interacted with:
  - Affective, depressive, and other psychotic disorders.
  - Age greater than 80.
  - Alzheimer's, organic psychotic, and other organic psychotic disorders.
  - Brain disorders.
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - Dyspnea.
  - Functional variables including problems with dressing, bathing, toileting, transferring, and locomotion.
  - IV therapy.

- Non-pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
- Orthopedic diagnoses.
- Other heart disorders – for example, for hypertension, other heart disorders could include ischemic heart disease (not MI) and/or myocardial infarction (MI).
- Stasis ulcers – including stages 2 and 3 separately.
- Stroke – including up to four different types of stroke entered as a group or separately.
- Wounds, burns, post-operative wounds or other post-operative complications.

- Multiple sclerosis.

- Neurological – including codes in neurological diagnoses, lack of coordination, neurological neglect syndrome, dystrophies, acute effect stroke, late effect stroke, and infections of the nervous system, and these neurological diagnoses or groups of these diagnoses interacted with:
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - IV therapy.
  - Non pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
  - Orthopedic diagnoses.
  - Stasis ulcers – including stages 2 and 3 separately.
  - Urinary incontinence.
  - Various combinations of heart disorders including hypertension, ischemic heart disease (not MI), and myocardial infarction (MI).
  - Wounds, burns, post-operative wounds, or other post-operative complications.

- Orthopedic codes, dislocations/sprains/strains, fractures, pathological fractures, or other 781 codes. Sometimes orthopedic codes were split up into arthritis of the knee or hip, back disorders, shoulder disorders, gait disorders, disorders of the leg, pathological fractures, and other fractures, and these orthopedic codes interacted with:
  - Brain disorders.
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - Dyspnea.
  - IV therapy.
  - Multiple pressure ulcers.
  - Neurological diagnoses.
  - Non pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
  - Orthopedic diagnoses.
  - Pressure ulcers (1 or 2).
  - Pressure ulcers (3 or 4) or any pressure ulcer.
  - Pulmonary diagnoses.
  - Stroke – including up to four different types of stroke entered as a group or separately.
  - Urinary incontinence.
  - Various combinations of heart disorders including hypertension, ischemic heart disease (not MI), and myocardial infarction (MI).

- Wounds, burns, post-operative wounds or other post-operative complications.

- Paralysis and paralysis interacted with:
  - Non-pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
  - Peripheral neurological disorder (PND).
  - Urinary incontinence.

- Pulmonary disorders, including primary chronic obstructive pulmonary disease (COPD) and other (selected) pulmonary disorders and pulmonary diagnoses interacted with:
  - Age greater than 80.
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - Dyspnea.
  - Neurological diagnoses.
  - Non-pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
  - Orthopedic diagnoses.
  - Stroke – including up to four different types of stroke entered as a group or separately.
  - Various combinations of heart disorders including hypertension, ischemic heart disease (not MI), and myocardial infarction (MI).
  - Wounds, burns, post-operative wounds, or other post-operative complications.

- Skin disorders including non-pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis, and these diagnoses interacted with:
  - Brain disorders.
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - IV therapy.
  - Multiple pressure ulcers.
  - Neurological diagnoses.
  - Orthopedic diagnoses.
  - Ostomy.
  - Stroke – including up to four different types of stroke entered as a group or separately.
  - Urinary incontinence.

- Stroke – up to four different types of stroke (diagnoses related to stroke, acute effect stroke, late effect stroke, or TIA), entered jointly, and separately, and these stroke variables interacted with:
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - Heart disorders in various combinations, including hypertension, ischemic heart disease (not MI), and myocardial infarction (MI).
  - IV therapy.
  - Non-pressure, non-stasis ulcers, other selected skin, gangrene, anal fistula/fissure/abscess, or cellulitis.
  - Orthopedic diagnoses.
  - Stasis ulcers – including stages 2 and 3 separately.

  - Urinary incontinence.
  - Wounds, burns, post-operative wounds or other post-operative complications.

- Wounds, burns, post-operative wounds or other post-operative complications, and these diagnoses interacted with:
  - Diabetes – including any diabetes, Type I and Type II diabetes separately, and diabetes variables interacted with injectable drug use.
  - IV therapy.
  - Multiple pressure ulcers.
  - Neurological diagnoses.
  - Orthopedic diagnoses.
  - Ostomy.
  - Stroke – including up to four different types of stroke entered as a group or separately.
  - Urinary incontinence.

In part, this list is so long because input into the process was provided by many different groups (CMS, the Technical Expert Panel, Abt Associates staff) and by several different clinical experts. Over time, definitions of the various diagnostic variables were repeatedly refined, to group diagnoses that were clinically similar and were shown to have similar resource use in our testing. During this process, we examined diagnostic groups that were defined by our clinical experts as having similar impact on functioning to see if these were indeed associated with similar resource use, such as groups of orthopedic diagnoses that impacted the upper body vs. the lower body. Only a small number of these functionally-defined diagnostic groups (e.g., "leg") met criteria for inclusion in the final model.

In some cases, it appeared that either miscoding or imprecise coding of home health episodes hampered efforts to create useful diagnostic groups. For example, for many diagnoses, the most frequently coded 4th or 5th digit indicated "not otherwise specified." Inaccurate coding for diabetes mellitus was also a confounder. For example, diabetes was tested as a primary or secondary diagnosis in up to eight different configurations (e.g., complicated vs. uncomplicated, Type I vs. Type II, etc.) and interacted with injectable drug use. Cross-tabulations, however, indicated that some Type I diabetics were not coded as using injectable drugs, indicating probable miscoding of the diabetes diagnosis. Concerns about this kind of miscoding led to the decision to combine diabetes in one, broader group, which was also later expanded to include diabetes manifestation codes.

Another issue is that conditions identified by clinicians as being more resource-intensive than others do not always translate into measurable increases in resource utilization for the home health episode. For example, patients with Alzheimer's disease or other types of senile dementia may be difficult to care for due to their problems with cognitive functioning, since they may have problems with understanding and/or complying with home health provider instructions. However, the diagnostic variable that includes Alzheimer's disease and other organic psychotic disorders often either had a small impact on resource use or was not statistically significant, and rarely had significant interactions with other variables in four-equation models.

One reason for expending so much effort on evaluating diagnostic variables and interactions was to capture variations in resource use for heavier care patients. As will be seen later when discussing the final version of the four-equation model, relatively few diagnostic variables and even fewer interactions (between diagnostic variables and other variables in the model) proved to be positive and statistically significant. This could have been due to a sample size ("small n") problem, but our use of over 1.6

million episodes to estimate the four-equation models (the consistent data set) should have mitigated any problems due to sample size.

The set of OASIS variables used by the four-equation model is similar to that used by the original COT model, with the following changes:

Variables Dropped:
M0175 – Inpatient discharges in 14 days preceding assessment.
M0610 – Behaviors demonstrated.

Variables Added or Modified:
M0110 – new variable to identify early (first, second) episodes vs. later (third+) episodes in a series of adjacent episodes.
M0240c through f – Other diagnoses (four-equation model uses all five secondary diagnoses).
M0245 – Replaced with M0246a through f, which allows for a case-mix diagnosis to be supplied when a V-code appears as any of the five secondary diagnoses in M0240.
M0800 – Patient management of injectable medications.
M0825 – Replaced with M0826, which collects the actual number of therapy (PT, OT, SLP) visits anticipated during the episode (rather than a particular threshold).

Another goal of the analyses related to diagnostic variables and interactions was to identify factors associated with therapy use. If these diagnostic variables and interactions could "explain" some therapy use, the very large coefficients for the therapy visit threshold variables likely would be reduced. This did not prove to be the case – therapy visit threshold variables had persistently high coefficients, even when a broad range of diagnostic variables was included in the model.

3.3.3. Therapy Visit Analyses

Three other approaches to including therapy visit variables in the four-equation model were explored. The first approach combined threshold and counter variables. (A counter variable indicates the number of therapy visits between two thresholds.) In this application, a counter variable models a constant increase in resource cost with each added therapy visit between thresholds. In particular, thresholds were set at 6, 14, and 20 therapy visits, with the counter variables tracking the number of therapy visits between 7 and 13 visits (between the 6 and 14 visit thresholds), and then between 15 and 19 visits (between the 14 and 20 visit thresholds).

If an episode had sufficient therapy visits to reach a threshold, the threshold variable was "switched on." For example, if an episode had 6 or more therapy visits, the 6-visit threshold variable was set equal to one ("switched on"). The counter visit variable was then set based on the number of additional visits above the threshold. For instance, suppose an episode had 8 therapy visits. That episode has a value of 1 for the 6-visit threshold, and then 2 for the 7 to 13 visit counter variable – one each for visits 7 and 8.

In episodes where the number of therapy visits reached the next threshold, the lower counter variable was set to zero. Thus, if an episode had 14 visits, the 14-therapy visit threshold variable was switched on, and the 7 to 13 visit counter variable, as well as the 6-visit threshold variable, was set to zero. (Note that if an episode had 14 therapy visits, it "advanced" from leg one to leg two if it was an early [first or second] episode, or from leg three to leg four if it was a later [third or higher] episode.) If an episode had more than 14 therapy visits, the 15 to 19 therapy visit counter came into play, recording the number of visits

between 15 and 19 therapy visits for episodes with therapy visit in that range. Thus, for an episode with 17 visits, the 14-therapy visit threshold variable was switched on, and the 15 to 19 therapy visit counter variable was set equal to three (one each for visits 15, 16, and 17). Finally, for an episode with at least 20 therapy visits, the 20-therapy visit threshold variable was switched on and the 15 to 19 therapy visit counter variable was set to zero.

A second approach that we explored included individual indicator variables for each visit. Legs one and three had indicator variables for up to 13 therapy visits. For legs two and four, indicator variables were included for 15 through 29 therapy visits, and a 30 or more therapy visit threshold variable was also included.

Under the first approach, episodes in legs one and three received a "jump" for reaching 6 therapy visits. Then, the coefficient on the 7 to 13 visit counter variable provided an additional, constant increment for each visit from 7 to 13. For example, suppose the coefficients in leg one were 100 for the 6 or more therapy visit threshold and 35 for the 7 to 13 visit counter variable. The predicted additional resource use for an episode with 8t therapy visits = 100 + 2*35, or 170 resource units. The difference between an episode with 13 therapy visits (top of legs one or three) and one with 14 therapy visits (bottom of legs two and four) can be inferred from the coefficients on the 6-therapy visit threshold, the 7 to 13 therapy visit counter variable, and the leg two or leg four indicator variable. Returning to the previous example, suppose the leg two indicator variable had a coefficient of 375. The predicted additional resource use for 13 therapy visits = 100 + 7*35 = 345. The increment for an episode with 14 therapy visits is the difference between this value (345) and the leg two indicator variable coefficient (375) – or 375-345 = 30 resource units.

The coefficient on the 15 to 19 visit counter variable measures the further incremental increase in predicted resource use for each therapy visit from 15 to 19. Suppose that coefficient was equal to 25 in leg two. If so, episodes with 19 therapy visits on average had 25*5 = 125 more resource use units than episodes with 14 therapy visits. Finally, the 20 or more therapy visit threshold variable measures the impact of having 20 or more therapy visits (relative to having 14 therapy visits). The increment in predicted mean resource use in moving from 19 to 20 or more therapy visits is the difference between the coefficient for the 20 or more therapy visit threshold variable and five (15, 16, 17, 18, and 19) times the coefficient on the 15 to 19 therapy visit counter variable. In this example, if the 20 or more therapy visit threshold was 200, the increment in predicted mean resource use in moving from 19 to 20 or more therapy visits = 200 - 5*25 = 200 -125 = 75 resource units.

The combination of therapy visit threshold and counter variables implies that the predicted resource use will have "jumps" in resource use at 6 and 20 therapy visits, and then increments for each additional therapy visit from 7 to 19 visits. For legs one and two (or for legs three and four) those increments are equal for seven to 13 (and for 15 to 19) therapy visits. However, the specific increments for seven to 13 therapy visits can differ between leg one (early episodes) and leg 3 (later episodes) as can increments from 15 to 19 therapy visits for legs two and four.

Te second approach, where separate indicator variables were included for one to 13 therapy visits in legs one and three, and separate indicator variables for 15 to 29 therapy visits in legs two and four, allows the incremental resource cost associated with each added therapy visit to vary. That is, the increment from 1 to 2 therapy visits could be different from the increment for 7 to 8 visits, which in turn can differ for the increment from 11 to 12 visits. These increments were also allowed to vary from visits 15 to 16 through 28 to 29 in legs two and four. The increments were equal to the differences in the coefficients for

adjacent pairs of indicator variables. For example, if the coefficient in leg one for a 1-therapy visit indicator variable was 20 and that for two visits was 45, the increment from one to two visits = 45 - 20 = 25 resource units. The one therapy visit indicator variable also indicates the increment in moving from 0 to 1 therapy visits (in this example, 20 resource units). The increment from 13 to 14 visits in legs one (three) and two (four) equals the difference between the leg one 13-therapy visit indicator variable in leg one (three) and the leg two (leg four) indicator variable.

In this model formulation, there are no "jumps" in predicted resource units until 30 or more therapy visits is reached. The increment in moving from 29 therapy visits in leg two (leg four) to 30 or more therapy visits is equal to the coefficient on the leg two (leg four) 30 or more therapy visit threshold variable minus the coefficient for the 29 therapy visit indicator variable.

When estimating effects under the second approach, one problem that can occur is that the estimated increments neither must be uniform nor even be positive. For example, suppose the coefficients for therapy indicator variables two to six in leg one were as follows:

- Two visits: 6
- Three visits: 25
- Four visits: 50
- Five visits: 45
- Six visits: 76

If so, the increments would be:

- Two to three visits: 19
- Three to four visits: 25
- Four to five visits: -5
- Five to six visits: 31

Note that these were the actual coefficients and increments estimated by our model. One option to avoid this problem is to fix, or "restrict," the coefficients, and thus the increments, to be some set value. Under the third approach, such restrictions were imposed on the therapy visit indicator variables as follows:

- Coefficients for the one to five therapy visit indicator variables were set equal to zero – this effectively restored the 6-therapy visit threshold (along with its jump in predicted resource use).

- Different "jumps" at the 6-visit threshold were set in legs one and three, and then the coefficients for the seven to 19 therapy visit indicator variables (in legs one and two or in legs three and four) were restricted to smoothly declining increments.

- The 20-therapy visit threshold in legs two and four was restored and allowed to find its own level in each leg.

Restricting coefficients in this way is offset by changes in the coefficients for other explanatory variables in a model. For instance, if one effectively reduces the coefficients for therapy indicator variables, the

coefficients for other variables in the model will increase, to assure that the mean of the predicted value for resource use will still equal the actual mean resource use. No resource use is "lost" when restrictions of this type are imposed on a model. However, imposing such restrictions may reduce the fit of a model, depending on how large a departure the restricted model is from the less-restricted model.

To illustrate the effects of the different approaches, Exhibit 3.7 provides the coefficients for the therapy visit variables (estimated or restricted) for these three alternatives for a four-equation COT index model, including adjusted R-squared statistics. Adding the counter variables (to a model that includes thresholds) increased adjusted R-squared from 0.4068 to 0.4252, or by 0.0184. Moving to therapy visit indicator variables with a 30-therapy visit threshold further increased the adjusted R-squared to 0.4432, or by 0.0180.

Further, comparing the model with the three therapy visit thresholds and two counter variables to one with no counter variables (see Exhibit 3.5), the following reductions in threshold variable coefficients were observed by moving to a model that includes the counter variables:

- Six therapy visits:
  - Leg one: From 198 to 66; and
  - Leg three: From 249 to 107;

- 14 therapy visits (leg two and leg four indicator variables):
  - Leg two: From 376 to 313; and
  - Leg four: From 391 to 338; and

- 20 therapy visits:
  - Leg two: From 303 to 218; and
  - Leg four: From 285 to 187.

The model with the three thresholds and two counter variables reduces the "jumps" associated with thresholds.

The therapy visit coefficients from the four-equation COT model with the therapy visit indicator variables and 30-therapy visit threshold, however, illustrate the problems previously cited. For example, the coefficient for five therapy visits (45) was lower than the coefficient for four therapy visits (50) in leg one. The lack of smooth increases can be shown by taking the difference in adjacent therapy visit indicator coefficients in each leg. Those differences indicate the incremental predicted increase in resource use for each additional therapy visit.

For example, in leg one, the incremental increases were as follows:

- One visit: 0 (excluded)
- Two visits: 6
- Three visits: 19
- Four visits: 25
- Five visits: -5
- Six visits: 31
- Seven visits: 37

- Eight visits: 35
- Nine visits: 34
- 10 visits: 51
- 11 visits: 31
- 12 visits: 35
- 13 visits: 37

The restrictions imposed in the last model presented in Exhibit 3.7 smoothed these incremental differences to be gradually declining across visits. It also set the effects for 20 or more therapy visits to be equal in legs two and four, effectively restoring a 20-therapy visit threshold. There was a resulting loss in adjusted R-squared from 0.4432 to 0.4248, or 0.0184.

Exhibit 3.7

Coefficients (Unrestricted and Restricted) for Therapy Visit Variables in Four-Equation Index Models

Therapy Visit Variable	6, 14, and 20 Therapy Visit Thresholds and Counter Variables				Therapy Visit Indicator Variables and 30-Therapy Visit Threshold: No Restrictions				Therapy Visit Indicator Variables and 20-Therapy Visit Threshold: With Restrictions			
	One	Two	Three	Four	One	Two	Three	Four	One	Two	Three	Four
Adjusted R Square Statistic	0.4252				0.4432				0.4248			
Six Therapy Visit Threshold	66		107									
Counter Variable: 7 to 13 Therapy Visits	38		38									
14 Therapy Visit Threshold (Leg Two or Four Indicator)		313		338		326		331		314		332
Counter Variable: 15 to 19 Therapy Visits		29		18								
20 Therapy Visit Threshold		218		187						359		340
One Therapy Visit							31		0		0	
Two Therapy Visits					6		40		0		0	
Three Therapy Visits					25		58		0		0	
Four Therapy Visits					50		77		0		0	
Five Therapy Visits					45		79		0		0	
Six Therapy Visits					76		119		80		100	
Seven Therapy Visits					113		146		116		136	
Eight Therapy Visits					148		174		151		171	
Nine Therapy Visits					182		216		185		205	
10 Therapy Visits					233		272		218		238	
11 Therapy Visits					264		294		250		270	
12 Therapy Visits					299		333		281		301	
13 Therapy Visits					336		379		311		331	
15 Therapy Visits						27		38		28		28
16 Therapy Visits						63		63		55		55
17 Therapy Visits						94		93		81		81
18 Therapy Visits						120		135		106		106
19 Therapy Visits						160		168		130		130
20 Therapy Visits						193		184				
21 Therapy Visits						221		224				

Exhibit 3.7

Coefficients (Unrestricted and Restricted) for Therapy Visit Variables in Four-Equation Index Models

Therapy Visit Variable	6, 14, and 20 Therapy Visit Thresholds and Counter Variables				Therapy Visit Indicator Variables and 30-Therapy Visit Threshold: No Restrictions				Therapy Visit Indicator Variables and 20-Therapy Visit Threshold: With Restrictions			
	One	Two	Three	Four	One	Two	Three	Four	One	Two	Three	Four
22 Therapy Visits						253		259				
23 Therapy Visits						288		281				
24 Therapy Visits						316		330				
25 Therapy Visits						340		323				
26 Therapy Visits						374		358				
27 Therapy Visits						407		423				
28 Therapy Visits						461		467				
29 Therapy Visits						501		469				
30 or More Therapy Visit Threshold						711		657				

Data set included episodes from January 2001 to September 2003 (1,656,551 episodes).

3.3.4. Simplifying the Four-Equation Model

Some of the steps taken to simplify the four-equation model – most notably, excluding some significant diagnostic or interaction variables because of very small n's, and excluding some other variables (e.g., Medicaid eligibility, presence of a caregiver, age, etc.) – have already been noted. In addition, a combination of clinical review and statistical testing was used to determine instances where some diagnostic variables and interactions could be broadened – for example, interacting all cardiovascular conditions with other variables in the model rather than interacting each separate cardiovascular condition (e.g., hypertension, ischemic heart disease [not MI], and MI) with other variables. The same variable definitions, however, were used across all four legs.

In addition, examples were noted where coefficients for the same variable or interaction across two or more legs of the model were similar in size. The following "similar" sets of coefficients were then identified:

- Coefficients that are similar across all four legs or across three legs (if a variable is included in only three legs of the model).

- Coefficients that are similar for legs one and two (early episodes) or for legs three and four (later episodes).

- Coefficients that are similar for legs one and three (less than 14 therapy visits) or for legs two and four (14 or more therapy visits).

Each set of four (all legs), three, or two such similar coefficients was tested to determine if the largest coefficient difference divided by the largest standard error exceeded 1.96. If it did not, then each set of four, three, or such similar coefficients was restricted to be equal. The resulting model results were inspected, and other such pairs of similar coefficients were identified and tested. For example, after setting the coefficients for a variable equal to each other for legs two and four, if that variable is also in leg one but not in leg three, the equivalent (leg two and leg four) coefficient and leg one coefficient were

compared, and if they did not differ by more than 1.96 times the larger of the two standard errors, all three coefficients were restricted to be equal.

Imposing the equality restrictions for coefficients across legs (after the therapy visit coefficient restrictions were imposed) did not reduce adjusted R-squared any further (to the fourth decimal point). The resulting restrictions were then retained in the final NPRM version of the four-equation model.

3.3.5. Final NPRM Version of the Model

Exhibit 3.8 provides the estimates for the final NPRM version of the four-equation model. Its adjusted R-squared statistic was 0.4393. As a group, the diagnostic variables and interactions improved adjusted R-squared by 0.0145 compared to a four-equation model that included only COT index variables. Yet the added diagnostic and interaction variables are statistically significant, and imply better payment accuracy (i.e., underpayment avoided, on average) for the groups of patients captured by these variables. Note that both these models had the restrictions imposed on the therapy visit variables.

The various definitions of each variable (including both parts of each interaction) are included. Instances where coefficients were restricted to be equal across legs can be seen where coefficients for the same variable are equal and have the same t statistics in two or more legs. Coefficients that are restricted to equal a particular value (i.e., for most of the therapy visit variables) do not have standard errors or t statistics.

There are considerations besides improving adjusted R-squared statistics when choosing between models, including how well the models perform at predicting the resource use for particular types of episodes or providers – i.e., predictive ratios. Predictive ratios for the final four-equation model are presented in the next subsection. Simpler models with fewer variables that have similar adjusted R-squared statistics and group-level performance as measured through predictive ratios are to be preferred to more-complex models. This was a key reason for restricting some model effects to be equal across legs as well as restricting the coefficients for the therapy visit indicator variables. In addition to statistical considerations, it is important to review the model's diagnostic and interaction variables from a clinical perspective to ensure that the resulting final four-equation model is clinically "coherent."

Exhibit 3.8

Final NPRM Version of the Four-Equation Model

Variable or First Variable in Interaction	Second Variable in Interaction	Leg One		Leg Two		Leg Three		Leg Four	
		Coeff	T Stat	Coeff	T Stat	Coeff	T Stat	Coeff	T Stat
Constant		171	266.54	171	266.54	171	266.54	171	266.54
2nd Leg				307	148.12				
3rd Leg						16	8.05		
4th Leg								307	148
1 Therapy Visit		-	.	-	.	-	.	-	.
2 Therapy Visits		-	.	-	.	-	.	-	.
3 Therapy Visits		-	.	-	.	-	.	-	.
4 Therapy Visits		-	.	-	.	-	.	-	.
5 Therapy Visits		-	.	-	.	-	.	-	.
6 Therapy Visits		80	.	-	.	100	.	-	.
7 Therapy Visits		116	.	-	.	136	.	-	.
8 Therapy Visits		151	.	-	.	171	.	-	.
9 Therapy Visits		185	.	-	.	205	.	-	.
10 Therapy Visits		218	.	-	.	238	.	-	.
11 Therapy Visits		250	.	-	.	270	.	-	.
12 Therapy Visits		281	.	-	.	301	.	-	.
13 Therapy Visits		311	.	-	.	331	.	-	.
15 Therapy Visits		-	.	28	.	-	.	28	.
16 Therapy Visits		-	.	55	.	-	.	55	.
17 Therapy Visits		-	.	81	.	-	.	81	.
18 Therapy Visits		-	.	106	.	-	.	106	.
19 Therapy Visits		-	.	130	.	-	.	130	.
20 Therapy Visits		-	.	357	324.17	-	.	344	112
21 Therapy Visits		-	.	357	324.17	-	.	344	112
22 Therapy Visits		-	.	357	324.17	-	.	344	112
23 Therapy Visits		-	.	357	324.17	-	.	344	112
24 Therapy Visits		-	.	357	324.17	-	.	344	112
25 Therapy Visits		-	.	357	324.17	-	.	344	112
26 Therapy Visits		-	.	357	324.17	-	.	344	112
27 Therapy Visits		-	.	357	324.17	-	.	344	112
28 Therapy Visits		-	.	357	324.17	-	.	344	112
29 Therapy Visits		-	.	357	324.17	-	.	344	112
30 or More Therapy Visits		-	.	357	324.17	-	.	344	112

Exhibit 3.8

Final NPRM Version of the Four-Equation Model

		Leg One		Leg Two		Leg Three		Leg Four	
IV or Parenteral Therapy		93	48.17	151	22.36	38	11.50	151	13
Enteral Therapy		29	13.12	123	30.50	6	3.42	61	7
Pain		5	13.62	5	13.62	5	13.62	5	14
Vision		9	16.68						
Urinary Incontinence		8	13.66	8	13.66				
Bowel Incontinence		12	16.15	26	15.43	12	16.15	26	15
Ostomy		33	15.59	63	14.09	18	7.47	63	14
Multiple Pressure Ulcers		37	10.83	37	10.83	50	15.91	50	16
Pressure Ulcer stage = 1 and/or 2		46	49.61	97	44.60	46	49.61	97	45
Pressure Ulcer stage = 3 and/or 4		142	70.46	224	47.79	107	55.16	178	21
Stasis Ulcer healing status = 2		74	47.32	132	27.16	74	47.32	132	27
Stasis Ulcer healing status = 3		111	62.21	132	27.16	111	62.21	132	27
Surgical Wound healing status = 2						29	13.15	66	10
Surgical Wound healing status = 3		64	43.56	64	43.56	64	43.56	64	44
Dyspnea 2 to 4		20	39.63	26	22.57			19	6
Dressing 1 to 3		21	35.21	33	20.58	33	27.63	59	18
Bathing >= 2		27	41.33	42	21.80	55	41.01	55	41
Toileting >= 2		13	16.83	13	16.83	13	16.83	13	17
Transferring = 1				7	4.63			7	5
Transferring >= 2		10	10.62	41	17.82	10	10.62	54	14
Locomotion = 1 or 2						13	6.93		
Locomotion >= 3		5	4.19	18	9.29	29	13.43		
Primary or Secondary MS	Bathing or Toileting	22	4.22	22	4.22	87	13.79	87	14
Primary or Secondary MS	Transferring >= 2 or Locomotion >= 3	41	6.62	41	6.62	74	11.05	74	11
Primary or Secondary Blood Disorders		13	13.83	42	19.20				
Primary Psychiatric/Affective, Depressive, Other Psychoses		59	23.09	132	12.01	21	13.11	51	8
Secondary Psychiatric/Affective, Depressive, Other Psychoses		29	24.82	52	19.55	21	13.11	51	8
Primary Psychiatric/Degenerative, Other Organic Psychoses		14	6.70	14	6.70				

Exhibit 3.8

Final NPRM Version of the Four-Equation Model

		Leg One		Leg Two		Leg Three		Leg Four	
Primary or Secondary GI and Abnormal Weight Loss		17	20.65	45	23.66	6	4.77	45	24
Primary or Secondary GI and Abnormal Weight Loss	Primary or Secondary All Neurological (With MS)	11	5.32	11	5.32	30	11.23	30	11
Primary or Secondary GI and Abnormal Weight Loss	Ostomy 1 or 2	29	8.62	29	8.62				
Primary or Secondary Dysphagia	Enteral Therapy	17	4.10						
Primary or Secondary Dysphagia	Primary or Secondary Stroke or Brain Hemorrhage	12	3.65	60	12.75	12	3.65	60	13
Primary Cancer		36	34.39	113	24.65	36	34.39	81	6
Secondary Cancer		20	15.77	46	13.67	16	7.55	16	8
Primary Paralysis, Brain Other Than Hemorrhage, or Other Neurological		25	7.69	51	9.83	53	11.65	51	10
Primary or Secondary Paralysis, Brain Other Than Hemorrhage, or Other Neurological	Urinary Incontinence					10	1.76		
Primary or Secondary Paralysis, Brain Other Than Hemorrhage, or Other Neurological	Transferring >= 2 or Locomotion >= 3	44	18.70	24	4.10	44	18.70	24	4
Primary or Secondary All Neurological Except Stroke and Brain Hemorrhage or MS	Toileting >=2	11	4.95	57	14.72	27	12.35	27	12
Primary or Secondary Stroke or Brain Hemorrhage									
Primary or Secondary Stroke or Brain Hemorrhage	Transferring = 1 or Toileting			44	39.42			15	6
Primary or Secondary Stroke or Brain Hemorrhage	Transferring >= 2 or Locomotion >= 3	6	4.58	44	39.42	6	4.58	15	6
Primary or Secondary Hypertension, AMI, Other Ischemic Heart Disease, CHF		31	61.19	61	57.40	12	14.50	61	57
Primary or Secondary AMI, Other Ischemic Heart Disease, CHF	IV or Parenteral Therapy					42	7.04		
Injectable Drug Use		8	11.79	8	11.79	12	12.59	25	6
Primary Diabetes (250.xx) and DM Manifestation Codes		53	52.30	114	37.95	21	15.32	89	14
Secondary Diabetes (250.xx) and DM Manifestation Codes		22	31.41	35	24.70	9	8.38	35	25
Primary or Secondary Pulmonary (Including COPD)				44	23.31			44	23
Primary or Secondary Pulmonary (Including COPD)	Locomotion	20	24.23						

Exhibit 3.8

Final NPRM Version of the Four-Equation Model

		Leg One		Leg Two		Leg Three		Leg Four	
Primary Other Trauma (Post-Operative Wounds)		96	76.76	196	40.88	66	30.71	155	15
Secondary Other Trauma (Post-Operative Wounds)		52	30.79	83	21.75	38	13.53	83	22
Primary or Secondary Ulcer, Skin Disorders, Cellulitis		50	45.96	74	21.35	33	20.02	66	9
Primary or Secondary Other Trauma (Post-Operative Wounds) or Ulcer, Skin Disorders, Cellulitis	IV or Parenteral Therapy	16	4.27	16	4.27	49	6.87		
Primary or Secondary All Ortho and Leg (No Gait)	IV or Parenteral Therapy	59	15.56	59	15.56	34	5.14		
Primary or Secondary Leg and Gait	Pressure Ulcer 1, 2, 3, or 4	13	5.37						
Primary or Secondary Gait	Transferring >= 2 or Locomotion >= 3								
Primary or Secondary Blindness or Low Vision		19	5.82	19	5.82	41	8.90	41	9

Data set included episodes from January 2001 to September 2003 (1,656,551 episodes).

3.4. How Well Would a One-Equation Model Work?

With the final NPRM version of the four-equation model as a starting point, we considered how well a similar model with a single equation would work (i.e., one with therapy visit restrictions and diagnostic and interaction variables included). Two alternatives were considered. The starting point for both one-equation models was a model where all 66 of the non-therapy visit variables in the current four-equation model (i.e., variables that are included in at least one of the four legs) are included in a new single-equation model. The first one-equation model included the leg indicator variables and the current set of restrictions on the therapy visit variables, including allowing the 20-therapy visit threshold values to vary between the second and fourth legs. That model had an adjusted R-squared statistic of 0.4338, representing a decline of 0.0065 from the current, final four-equation model.

This first single-equation model, however, still preserves differences across legs for therapy visit variables, as well as leg indicator variables. A second alternative was then tried, where the indicator variables were eliminated. A first version of the model was estimated without therapy visit variable restrictions, to come up with a new restricted starting point for the 6-therapy visit threshold (it had been 80 for leg one and 100 for leg three); the new starting value is 63. One reason the new starting value is less than both of the old starting values is the changes in the overall model intercept and the elimination of the leg indicator variables. Also excluded were other variables in the model (the COT, diagnostic, and interaction variables) that were no longer significant (10% level) and/or did not have coefficients that exceed 5. A total of 57 of the 66 variables from the final four-equation model were retained in this new single-equation model, whose adjusted R-squared statistic is 0.4070 – a reduction of 0.0323 from the current four-equation model.

Several F-tests were performed for the single-equation model with no leg indicator variables and the new restricted value for the 6-therapy visit threshold of 63 ("most restrictive single-equation model"). We used these F-tests to determine if restoring sets of variables or relaxing restrictions significantly improved the overall fit of the model at an individual, episode level. The F-tests included:

- Restoring the leg indicator variables – the final version of the four-equation model restricts the leg two and leg four indicator variables to be equal. This F-test considered restoring a leg three indicator and leg two and leg four indicators, but also restricted the leg two and leg four indicator variables to be equal to each other.

- Allowing separate starting values for the 6-therapy visit threshold in legs one and three (but having the same restricted increments for the seven to 19 therapy visit variables), and allowing separate 20-therapy visit threshold values in legs two and leg four.

The F-tests supported both of these specifications. Restoring the leg indicators increases adjusted R-squared from 0.4068 to 0.4183, while relaxing the restrictions on the 6- and 20-therapy visit thresholds raises adjusted R-squared from 0.4068 to 0.4077. The fact that the improved adjusted R-squared statistics (0.4183 and 0.4077) for both of these specifications were still lower than the adjusted R-squared statistic of the four-equation model (0.4393) highlights the additional improvement in fit due to the nine variables that were excluded from the one-equation model, and allowing the coefficients of these variables to differ across legs.

Finally, we calculated predictive ratios and sum of squared prediction errors for the current final four-equation model and the most restrictive one-equation model. In addition to the groups previously considered (i.e., by episode number, agency size, number of therapy visits, facility type, facility ownership, and facility type and ownership combined), two additional sets of groups were used. One issue with models of this type is how well they predict resource utilization for the lowest and highest predicted users of resources. Using each model, the 1st, 5th, 10th, 25th, 50th (median), 75th, 90th, 95th and 99th percentiles of predicted resource use were calculated. Next, ranges of predictive values (e.g., up to 1st, 1st to 5th, 5th to 10th, etc.) were formed, and predictive values calculated for both sets of ranges.

Because only two models are being compared, the predictive ratios and sum of square deviations and absolute deviations are provided in the same exhibit. The last column indicates for each group if the final four-equation model had a predictive ratio closer to 1.00 in absolute value (true) than does the most restrictive one-equation model (false). In addition, it also indicates if the sum of square prediction errors was lower for the final four-equation model (indicating it performs better across a set of groups).

Almost uniformly, the four-equation model performed better than the one-equation model. All sets of groups had a lower sum of squared prediction errors under the four-equation model. The following were the only instances where the most restrictive one-equation model performed better at a group level than the final four-equation model:

- First, third, and fourth episodes.
- For the percentile groups defined by the distribution of predicted resource use for the final four-equation model, the lowest 1 and 1 to 5 percentiles.
- For the percentile groups defined by the distribution of predicted resource use for the most restrictive one-equation model, the 75th to 90th percentile group.
- Episodes with 6 to 13 therapy visits.
- All size groups except facilities with 50 to 199 first episodes – this was the only set of groups where the sum of squared prediction errors was lower (better) for the most restrictive one-equation model.
- Voluntary/non-profit facility ownership.
- Other voluntary/non-profit facilities.

The group level results strongly point towards the superior performance of the final four-equation model compared to the most restrictive one-equation model.

Exhibit 3.9

Predictive Ratios, Sum of Square Deviations, and Sum of Absolute Deviations for the NPRM Final Four-Equation Model and the Most Restrictive* One-Equation Model

Group	N	Actual Resource Use	Predicted Resource Use: One-Equation Model	Predicted Resource Use: Final Four-Equation Model	One-Equation Model Predictive Ratio	Final Four-Equation Model Predictive Ratio	Final Four-Equation Model Performs Better
Episode Number							
1st Episodes	1,020,700	444,199,364	444,273,370	443,024,072	1.0002	0.9974	FALSE
2nd Episodes	238,469	99,373,078	101,664,075	100,569,175	1.0231	1.0120	TRUE
3rd Episodes	115,417	47,142,804	47,449,895	48,662,763	1.0065	1.0322	FALSE
4th Episodes	68,020	27,218,745	27,235,501	27,693,311	1.0006	1.0174	FALSE
5th Episodes	45,353	18,018,172	17,855,400	18,072,649	0.9910	1.0030	TRUE
6th Episodes	33,249	13,135,269	12,953,154	13,071,142	0.9861	0.9951	TRUE
7th+ Episodes	135,343	54,286,925	51,942,939	52,281,252	0.9568	0.9631	TRUE
Total	1,656,551	703,374,357	703,374,340	703,374,358	1.0000	1.0000	TRUE
Sum of Squared Prediction Errors			10,902,660,984,915	9,377,251,940,927			TRUE
Percentiles of Predictions for Final Four-Equation Model (1st to 99th Percentiles)							
Lowest 1%	15,929	3,133,009	2,930,087	2,813,718	0.9352	0.8981	FALSE
1 to 5%	65,585	13,829,454	13,973,430	13,381,649	1.0104	0.9676	FALSE
5 to 10%	84,022	19,054,693	20,320,843	18,972,024	1.0664	0.9957	TRUE
10 to 25%	248,601	64,336,592	68,130,790	64,263,365	1.0590	0.9989	TRUE
15 to 50%	414,140	126,804,828	133,914,540	129,156,250	1.0561	1.0185	TRUE
50 to 75%	414,138	169,676,864	177,229,498	173,091,905	1.0445	1.0201	TRUE
75 to 90%	248,482	151,103,623	139,107,750	146,575,010	0.9206	0.9700	TRUE
90 to 95%	82,813	67,356,584	62,278,905	67,392,383	0.9246	1.0005	TRUE
95 to 99%	66,277	67,511,452	66,807,847	67,521,768	0.9896	1.0002	TRUE
Top 1%	16,564	20,567,258	18,680,644	20,206,290	0.9083	0.9824	TRUE
Total	1,656,551	703,374,356	703,374,339	703,374,358	1.0000	1.0000	TRUE
Sum of Squared Prediction Errors			297,389,428,822,570	38,146,383,676,845			TRUE

Exhibit 3.9

Predictive Ratios, Sum of Square Deviations, and Sum of Absolute Deviations for the NPRM Final Four-Equation Model and the Most Restrictive* One-Equation Model

Group	N	Actual Resource Use	Predicted Resource Use: One-Equation Model	Predicted Resource Use: Final Four-Equation Model	One-Equation Model Predictive Ratio	Final Four-Equation Model Predictive Ratio	Final Four-Equation Model Performs Better
Percentiles of Predictions for One-Equation Model (1st to 99th Percentiles)							
Lowest 1%	16,987	3,420,359	3,064,414	3,200,262	0.8959	0.9357	TRUE
1 to 5%	65,842	14,321,388	13,817,886	14,126,648	0.9648	0.9864	TRUE
5 to 10%	82,860	19,833,562	19,556,655	19,809,946	0.9860	0.9988	TRUE
10 to 25%	248,733	68,241,895	67,188,887	68,325,335	0.9846	1.0012	TRUE
15 to 50%	413,853	130,589,269	132,599,218	131,996,259	1.0154	1.0108	TRUE
50 to 75%	414,143	166,096,666	173,087,217	169,932,961	1.0421	1.0231	TRUE
75 to 90%	248,478	146,088,269	143,516,402	142,069,102	0.9824	0.9725	FALSE
90 to 95%	83,661	67,988,573	64,834,705	67,570,242	0.9536	0.9938	TRUE
95 to 99%	65,427	66,389,549	66,844,726	66,297,972	1.0069	0.9986	TRUE
Top 1%	16,567	20,404,827	18,864,226	20,045,634	0.9245	0.9824	TRUE
Total	1,656,551	703,374,356	703,374,339	703,374,358	1.0000	1.0000	TRUE
Sum of Squared Prediction Errors			73,615,434,372,118	33,256,775,865,707			TRUE
Number of Therapy Visits							
Zero to Five	1,015,606	307,211,576	324,055,594	310,894,721	1.0548	1.0120	TRUE
Six to 13	401,671	194,757,680	193,675,148	191,074,541	0.9944	0.9811	FALSE
14 to 19	146,023	105,017,167	89,255,661	105,017,168	0.8499	1.0000	TRUE
20 or More	93,251	96,387,933	96,387,932	96,387,933	1.0000	1.0000	TRUE
Total	1,656,551	703,374,356	703,374,351	703,374,358	1.0000	1.0000	TRUE
Sum of Squared Prediction Errors			533,317,883,314,014	27,131,069,984,347			TRUE

Exhibit 3.9

Predictive Ratios, Sum of Square Deviations, and Sum of Absolute Deviations for the NPRM Final Four-Equation Model and the Most Restrictive* One-Equation Model

Group	N	Actual Resource Use	Predicted Resource Use: One-Equation Model	Predicted Resource Use: Final Four-Equation Model	One-Equation Model Predictive Ratio	Final Four-Equation Model Predictive Ratio	Final Four-Equation Model Performs Better
Facility Size (Number of 1st Episodes)							
Unknown	62	45,717	26,513	26,373	0.5799	0.5769	FALSE
1 to 5	3,370	1,527,496	1,356,234	1,337,622	0.8879	0.8757	FALSE
6 to 9	5,110	2,274,244	2,094,473	2,084,143	0.9210	0.9164	FALSE
10 to 14	7,569	3,571,660	3,165,094	3,144,987	0.8862	0.8805	FALSE
15 to 19	10,773	4,538,960	4,351,462	4,326,352	0.9587	0.9532	FALSE
20 to 29	27,760	11,377,676	11,017,338	10,948,149	0.9683	0.9622	FALSE
30 to 49	60,141	24,634,211	24,428,899	24,271,142	0.9917	0.9853	FALSE
50 to 99	168,532	69,613,535	70,919,101	70,857,089	1.0188	1.0179	TRUE
100 to 199	299,571	128,829,599	128,617,302	128,679,531	0.9984	0.9988	TRUE
200 or More	1,073,663	456,961,259	457,397,919	457,698,976	1.0010	1.0016	FALSE
Total	1,656,551	703,374,356	703,374,339	703,374,358	1.0000	1.0000	TRUE
Sum of Squared Prediction Errors			2,374,707,627,194	2,729,301,460,502			FALSE
Facility Type							
Unknown	397	209,072	182,385	185,738	0.8724	0.8884	TRUE
Free-Standing	384,048	161,002,090	161,972,562	161,866,293	1.0060	1.0054	TRUE
Facility-Based	490,834	199,080,293	203,721,548	202,580,444	1.0233	1.0176	TRUE
Other	781,272	343,082,901	337,497,839	338,741,888	0.9837	0.9873	TRUE
Total	1,656,551	703,374,356	703,374,340	703,374,357	1.0000	1.0000	TRUE
Sum of Squared Prediction Errors			53,676,693,614,953	31,842,842,221,936			TRUE

Data set included episodes from January 2001 to September 2003 (1,656,551 episodes).

Note: Facility type is based on the Online Survey and Certification System (OSCAR); the "other" category is a self-reported facility type but assumed to be freestanding.

* "Most restrictive one-equation model = · No leg dummies; therapy visit variables for legs 1 and 3 and legs 2 and 4 set equal to each other; and nine variables from four-equation model excluded because they had coefficients less than 5 and/or were insignificant. R-squared = .4070.

4. Analysis of Therapy Use and Therapy Thresholds

4.1. Objectives

The original HH PPS model includes a 10-visit therapy threshold. If a patient had 10 or more therapy visits during a home health payment episode, the home health agency would receive a large and discrete payment adjustment. There has been evidence that agencies may be providing patients who otherwise might have been just below the threshold enough therapy to qualify for the therapy adjustment. To decrease or eliminate the financial incentive for agencies providing unnecessary care, we developed and tested alternatives to the current therapy threshold, including using another variable or variables to proxy for a therapy threshold or having more than one threshold.

In earlier analysis, we had identified a few clinical conditions that were associated with increased therapy use. The clinical conditions were mainly primary and secondary diagnoses of stroke. By adding the conditions in the current COT model, we observed only a slight increase in the model performance in explaining the between-episode variations in resource use. For patients with the same diagnoses or functional status, the amount of therapy use per episode differed substantially. To better align the episode payment with the actual cost, we tested changing the number of visits that defined the therapy threshold.

Another option would be to include multiple therapy thresholds instead of just one in the PPS model. Multiple thresholds could be used to create a payment ladder – agencies will receive a small payment increment if a patient exceeds each of the therapy thresholds. Under a PPS with multiple thresholds, agencies would have less financial incentive to provide unnecessary services than under a PPS with a single threshold.

This section summarizes our work on two tasks: (1) assessing/recalibrating the current therapy threshold variable; and (2) assessing the option of using multiple therapy thresholds. The first part of this section examines the use of therapy services, defined by numbers of visits and minutes, in home health (HH) episodes. The second tests the impact of different therapy thresholds on model fit for early (first and second combined) and later (third and later) episodes, respectively.

4.2. Data

The analyses for this task were based on the third wave PPS file (July 2002 – March 2003) from which we extracted information on a 20% random sample of Medicare beneficiaries. The data contain information on health care utilization and health outcomes at the level of home health payment episode. One beneficiary may have one or more home health payment episodes during a year. For this analysis, we excluded episodes with incomplete or inaccurate data, such as RAPs, no matched OASIS, missing dates, no program payment (denied episodes), etc. The remaining 694,597 episodes composed our analytical sample.

4.3. Patterns of Therapy Utilization

The level of therapy use varied substantially in the 694,597 home health episodes. On average, there were 5.6 therapy visits (standard deviation: 7.32; range: 0 to 111) or 260 minutes of therapy (SD: 363; range: 0

to 11,070)[9] in a 60-day HH episode. The distribution of the therapy use per episode was highly skewed: about half (46.9%) did not have any therapy visits; fewer than 25% of the episodes had more than 10 therapy visits, and fewer than 1% of episodes had more than 30 therapy visits (Exhibit 4.1). This suggested that a small proportion of episodes account for a disproportionate share of therapy visits.

To examine the high-therapy-use episodes more closely, we examined the subset of episodes that had more than 6,000 therapy minutes. The number of therapy visits per episode for this group was reasonable (13 to 41 visits per episode), with less than one visit per day on average. However, the average length per therapy visit of these episodes was very high – usually over 240 minutes (4 hours) and sometimes as long as 8 hours. A few patients have two episodes with over 6,000 therapy minutes. It is unclear whether data on these episodes are accurate or reflect data errors. Since therapy visits and minutes were included in our analysis as categorical variables, the extreme values do not substantially influence our results.

Exhibit 4.1

Distribution of Number of Therapy Visits Per Episode

	Percent of Episodes		
Number of Therapy Visits per Episode	All Episodes (n=694,597)	Episodes w/ Sequence Number<=2 (n=513,943)	Episodes w/ Sequence Number>2 (n=180,654)
0	46.9	36.8	75.4
1	3.3	3.7	2.1
2	2.3	2.6	1.3
3	2.3	2.8	1.1
4	2.6	3.1	1.1
5	3.3	4.1	1.1
6	3.3	4.1	1.1
7	2.7	3.3	0.9
8	2.4	2.9	0.9
9	2.1	2.6	0.8
10	4.8	5.6	2.3
11-15	14.1	16.6	7
16-20	5.7	6.6	2.9
21-25	2.5	3	1.2
26-30	1	1.1	0.4
31-40	0.6	0.8	0.3
41-50	0.1	0.2	0.1
51 or more	0	0	0

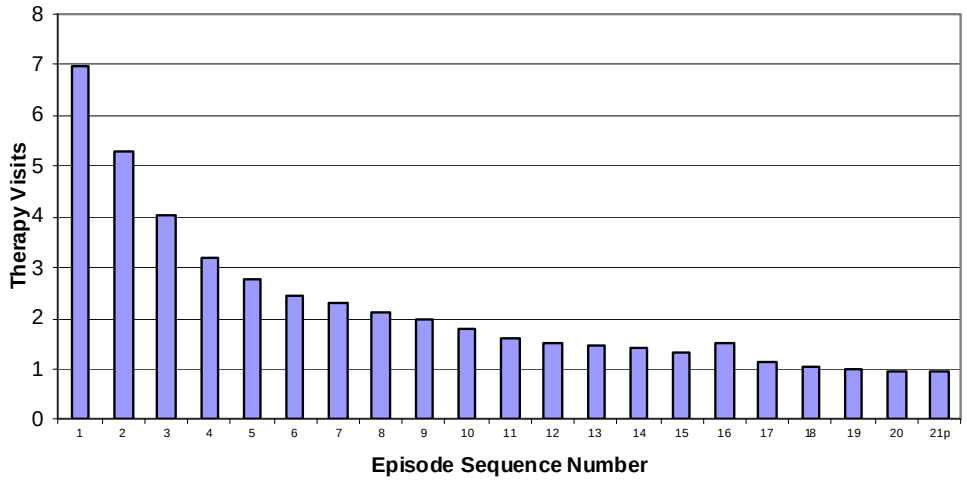
Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments).

The level of therapy use differed between early and later episodes, which suggested that it may be appropriate to have different thresholds for early and later episodes. Exhibits 4.2 and 4.3 show the average number of therapy visits or minutes per episode by the episode number. Therapy use was highest in the first episodes, and decreased steadily in later episodes. Between the first and fifth episodes, the average number of visits decreased from 6.96 to 2.75, and the average therapy minutes per episode decreased from 325 to 125.

[9] The highest therapy minutes per episode in the sample (11,070 minutes/episode) represents approximately 3 therapy hours per day in a 60-day HH episode.

Exhibit 4.2

Average Number of Therapy Visits per Episode, by Episode Sequence Number

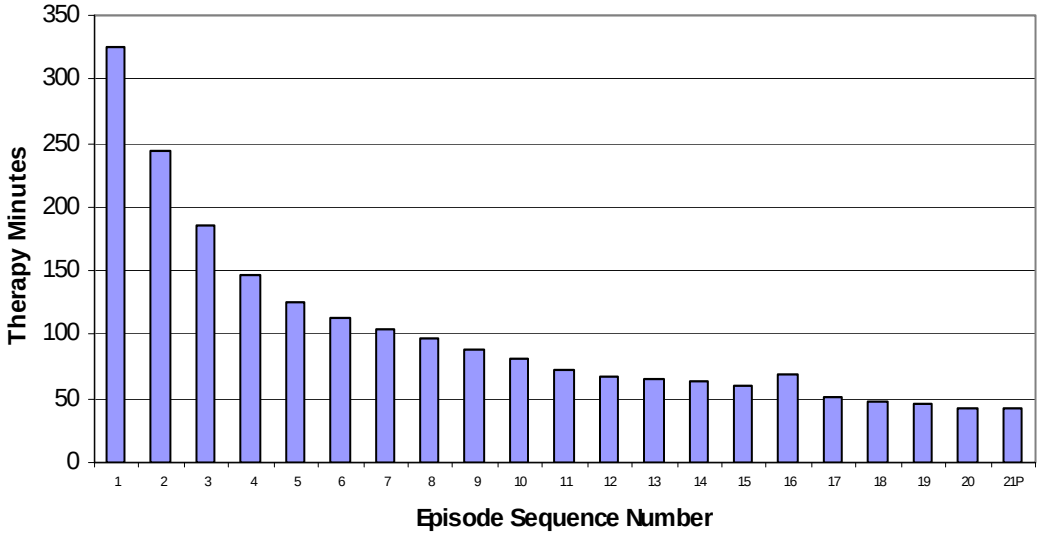


Note: Analyses were based on all episodes with and without therapy visits.

Sources: Abt Associates Inc. analysis of PPS Wave 3 Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Exhibit 4.3

Average Number of Therapy Minutes per Episode, by Episode Sequence Number



Note: Analyses were based on all episodes with and without therapy visits.

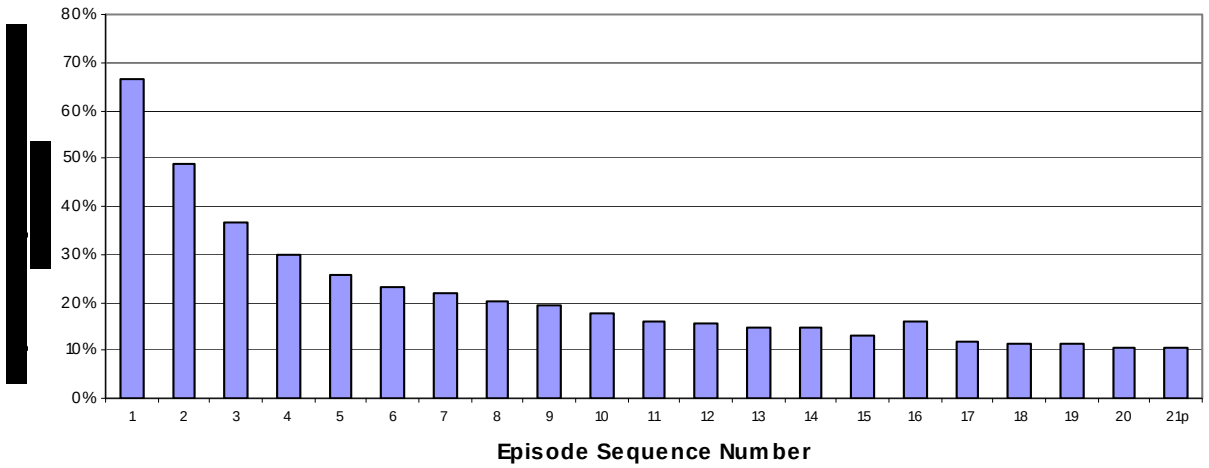
Sources: Abt Associates Inc. analysis of PPS Wave 3 Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

The decrease in therapy use for later episodes has several potential explanations. It could result from a lower proportion of patients receiving any therapy services in later episodes, fewer therapy visits among the subset of episodes with at least one therapy visit, and/or shorter therapy visits for later episodes. We examined all three possibilities.

Proportion of therapy users. The proportion of episodes with at least one therapy visit decreased steadily after the first episode (Exhibit 4.4), mirroring the patterns shown in Exhibits 4.2 and 4.3. Over 65% of first episodes included one or more therapy visits. The proportion dropped to 30% by the fourth episode and to under 20% by the ninth episode.

Exhibit 4.4

Proportion of Episodes with One or More Therapy Visits, by Episode Sequence Number



Note: Analyses were based on all episodes with and without therapy visits.

Sources: Abt Associates Inc. analysis of PPS Wave 3 Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Number and length of visits for therapy users. In episodes with at least one therapy visit, the mean number of therapy visits or minutes per episode was relatively constant across episodes. Initial episodes had an average of 10 therapy visits per episode; this increased to 11 for episodes 2 through 7 but was 10 for episodes 8 through 17. (See Exhibit 4.5.) The average length of a visit was also stable across episodes: the average minutes per visit for initial and later episodes varied narrowly around 46 minutes. These results indicate that the lower therapy use in later episodes is due mainly to the fact that a lower proportion of patients received therapy services.

Within each episode group, the amount of therapy use varied widely; the standard deviation of visits per episode or minutes per episode was only moderately smaller than the mean. In general, however, the amount of variability was fairly stable across episode sequence numbers, based on the coefficient of variation, which is the standard deviation divided by the mean.

We also found that episodes with 1 to 4 therapy visits had the highest proportion of short visits,(i.e., therapy visits less than 30 minutes; see Exhibit 4.6). Likely reflecting greater patient needs, the proportion of short visits was lower in episodes with more therapy visits. For example, 7.7% of therapy visits for those with 10 to 14 therapy visits in an episode were 30 minutes or less, compared to 15.9% of therapy visits for those with 1 to 4 visits.

Exhibit 4.5

Comparison of Therapy Use in Early and Later Episodes Among Therapy Users

Episode Sequence Number	Number of Episodes	Visits per Episode		Minutes per Episode		Minutes per Visit	
		mean	(SD)	mean	(SD)	Mean	(SD)
1	276,011	10	(7)	487	(366)	47	(15)
2	48,733	11	(7)	501	(384)	46	(16)
3	16,346	11	(7)	505	(382)	46	(15)
4	7,915	11	(7)	495	(373)	46	(14)
5	4,636	11	(7)	489	(358)	46	(13)
6	3,086	11	(7)	491	(365)	46	(14)
7	2,272	11	(7)	480	(340)	46	(15)
8	1,686	10	(7)	473	(331)	45	(14)
9	1,345	10	(7)	453	(330)	45	(13)
10	1,036	10	(7)	454	(321)	46	(16)
11	808	10	(7)	457	(341)	46	(20)
12	663	10	(6)	440	(316)	46	(14)
13	550	10	(7)	448	(323)	46	(14)
14	473	10	(7)	435	(325)	46	(12)
15	380	10	(7)	452	(335)	46	(13)
16	540	10	(7)	434	(342)	46	(12)
17	686	10	(7)	432	(358)	46	(13)
18	580	9	(7)	413	(324)	46	(17)
19	492	9	(7)	402	(325)	45	(13)
20	393	9	(7)	399	(322)	45	(12)
21 or higher	529	9	(7)	408	(326)	46	(12)

Note: Analyses were based on all episodes with and without therapy visits.

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments).

Exhibit 4.6

Association Between the Level of Therapy Use per Episode and the Length of Therapy Visit

No. of Therapy Visits per Episode	Average Length of Therapy Visit (Unit: minute)						
	No visit	11-20	21-30	31-40	41-50	51-60	61p
	(%)*	(%)	(%)	(%)	(%)	(%)	(%)
No visit	100	.	.	.	.	.	.
1-4 visits	.	6.3	9.6	11.2	38.0	26.8	8.2
5-9	.	5.7	3.4	15.9	40.2	26.1	8.7
10-14	.	5.0	2.7	14.5	45.8	26.3	5.9
15-19	.	4.5	2.7	15.9	45.3	25.3	6.3
20-24	.	4.8	2.2	15.5	44.3	26.6	6.7
25-30	.	4.8	1.9	15.0	43.3	28.1	6.9
30 or more	.	4.8	1.0	15.5	40.5	31.1	7.1

Row percentages add up to 100%.

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments).

4.4. Identifying Therapy Thresholds

4.4.1. Identifying Therapy Thresholds for Early Episodes (n=513,943)

Because the level of therapy use differed between early (first and second) and later (third+) episodes, we conducted separate analyses to identify therapy thresholds for early and later episodes, respectively. We conducted two analytical steps to identify the thresholds:

- First, we obtained the unexplained resource use (referred to as residuals) that could not be explained by selected clinical, functional, and service use (other than therapy) variables.

- Second, using the residuals as the outcome variable, we fit Analyses of Variance (ANOVA) models to identify the therapy use thresholds that best explained the variation in the residuals.

Examining the association between therapy use per episode and the variation in HH resource use not explained by clinical, functional, and service use variables may provide guidance in choosing therapy thresholds. Therefore, we began the analysis of alternative therapy thresholds by first fitting a Clinical-On-Top (COT)-type index model without the 10-visit therapy threshold variable on all "early" episodes. The dependent variable in these models was a measure of total resource use (see Section 2.1). Explanatory variables were clinical, functional, and health service use variables in the then-"original" COT model except for the 10-visit therapy threshold variable, plus a few additional clinical variables that we previously found to be associated with resource use during the COT model refining process. We refer to this COT-type model as the enhanced COT model throughout this section. The R-squared of the enhanced COT model was 0.0989.

Next we studied the residuals derived from this model. Residuals are the difference between the resource use predicted by the model (i.e., based on the episode's clinical, functional, and service use characteristics), and actual resource use. A positive residual suggests that the actual resource use was greater than the resource use predicted by the model (thus, a payment system based on the model would

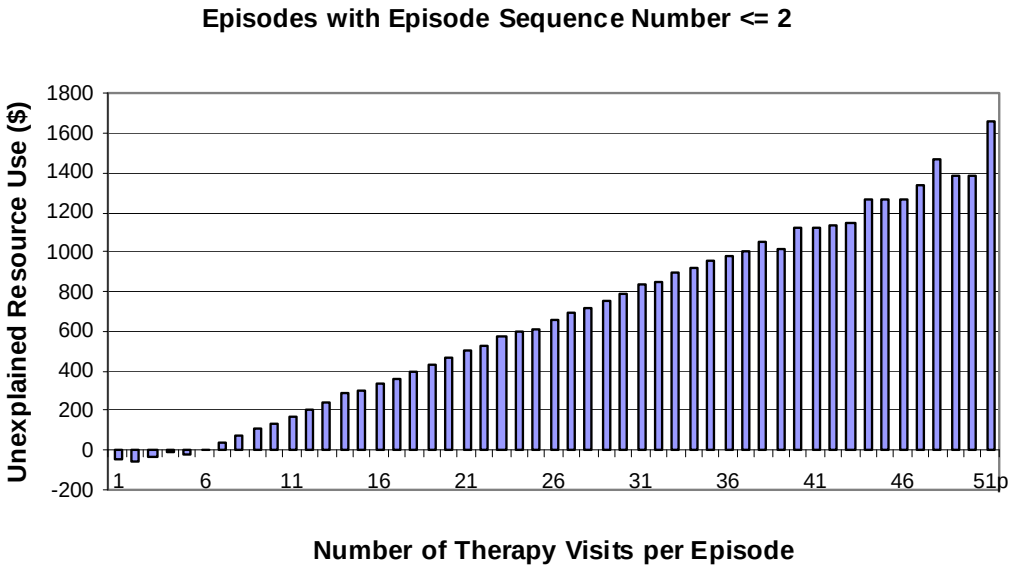
underpay the episode); a negative residual suggested that the actual resource use was less than the predicted resource use (thus, a payment system based on the model would overpay the episode).

If the explanatory variables in the enhanced COT model were able to explain most of the variation in the level of therapy use between episodes, then we should not observe a systematic association between the residuals and the episode therapy use. To test this, we plotted the residuals against the volume of therapy use per episode.

We observed a steep and steady increment in the average residual in episodes with more therapy visits per episode (Exhibit 4.7). Of the episodes with four or fewer visits during an episode, the actual cost was on average less than the model-predicted cost; of the episodes with six or more therapy visits, the actual cost was on average more than the predicted cost. We observed a similarly positive and linear association between the residuals and therapy minutes per episode (data not shown). The consistent linear and positive association between residuals and therapy use suggested that there was no obvious cut point for a threshold.

Exhibit 4.7

Comparison of Residuals in Episodes with Different Number of Therapy Visits



Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments).

To identify the most appropriate thresholds to be included in PPS, we estimated Analysis of Variance models of the residuals, and tested the impact on model fit of various values and combinations of therapy use thresholds. The model with the largest R-squared was considered the "best model" and, in the absence of clinical validation, we identified the threshold(s) included in this model as good threshold candidates.

For example, to identify the single best therapy visit threshold, we developed a set of indicator variables on the level of therapy use per episode. We then fit a set of ANOVA models by including one indicator variable (representing a distinct threshold) in each model. The model with the highest R-squared was selected and the level of therapy included in the model was considered a candidate for the single therapy threshold. Similarly, to identify two thresholds, we included two indicator variables on therapy use each

time in the ANOVA model. After testing all possible ways of pairing the thresholds, we compared the R-squared from the ANOVA models and selected the one with the highest R-squared. The analyses were conducted in SAS® PROC ANOVA with the option MAXR.

We tested three types of therapy thresholds:

- Therapy visit thresholds. 50 indicator variables were created, from >=1 therapy visit per episode to >=50 therapy visits per episode. The increment between adjacent thresholds was 1 visit.

- Therapy minutes/episode. 50 indicator variables were created, from >=20 therapy minutes per episode to >=1000 therapy minutes per episode. The increment between adjacent thresholds was 20 minutes.

- Mixed visit and minute thresholds. An episode was categorized into the higher therapy use category if its therapy use exceeded a certain number of visits *or* minutes. The increment between adjacent categories was 1 visit or 46 minutes, where the 46 minutes was the average minutes per visit derived from the whole sample.

Exhibit 4.8 lists the identified thresholds from best-fit ANOVA models. In general, including additional thresholds in the model improved the R-squared, as did the use of a measure of therapy minutes as opposed to visit thresholds.

Exhibit 4.8

Impact of Different Therapy Thresholds on Model Fit, Episodes with Sequence Number <= 2

Number of Thresholds	Threshold			Partial R-squared
Visit threshold				
One	13			0.1972
Two	10	19		0.2531
Three	9	16	27	0.2712
Minute threshold				
One	580			0.2326
Two	440	960		0.3002
Three	420	780	1420	0.3259
Mixed threshold (visit / minute)				
One	14 / 644			0.2152
Two	12 / 552	26 / 1196		0.2751
Three	10 / 460	18 / 828	31 / 1426	0.2995

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

The decision on whether to include a third therapy threshold depends in part on how a high-visit threshold interacts with the outlier payments. We found that the proportion of outlier episodes was considerably higher in episodes with either no therapy use or with very high therapy use than in episodes with 1 to 24 therapy visits (Exhibit 4.9). Outlier payments may not be available to episodes with a medium to high level of therapy use. Whether to include a third therapy threshold also depends on the home health resource groups (HHRG) payment rate. If the payment rates are relatively high for the high-therapy use HHRG categories, then fewer of these episodes would reach the outlier threshold, and an additional threshold might give them more reimbursement.

Exhibit 4.9

Therapy Visits in Outlier Episodes

Therapy visits/episode	All Episodes	Outlier Episodes	
		No	Yes
	(n)	(%)	(%)
No therapy visit	325,437	95.52	4.48
1-4 therapy visits	72,705	98.63	1.37
5-9	96,046	98.97	1.03
10-14	118,662	99.21	0.79
15-19	46,458	99.01	0.99
20-24	20,108	98.54	1.46
25-29	8,553	97.98	2.02
30 or more	6,628	91.84	8.16

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

4.4.2. Identifying Therapy Thresholds for the Third and Higher Episodes (n=180,654)

We repeated these analyses on the subset of third and higher episodes. The R-squared of the enhanced COT model on this group of episodes was higher, at 0.1539 (as compared to 0.0989 for earlier episodes). We found a similar relationship between residuals and therapy use per episode as was observed for early episodes: the average residual tended to be larger in episodes with more therapy visits, at least for episodes with less than 35 visits per episode (Exhibit 4.10). There were fewer than 1,000 episodes with 35 or more therapy visits, making it impossible to develop stable estimates of the residual for these episodes.

Exhibit 4.10

Comparison of Residuals in Episodes with Different Therapy Visits, Episodes with Sequence Number > 2

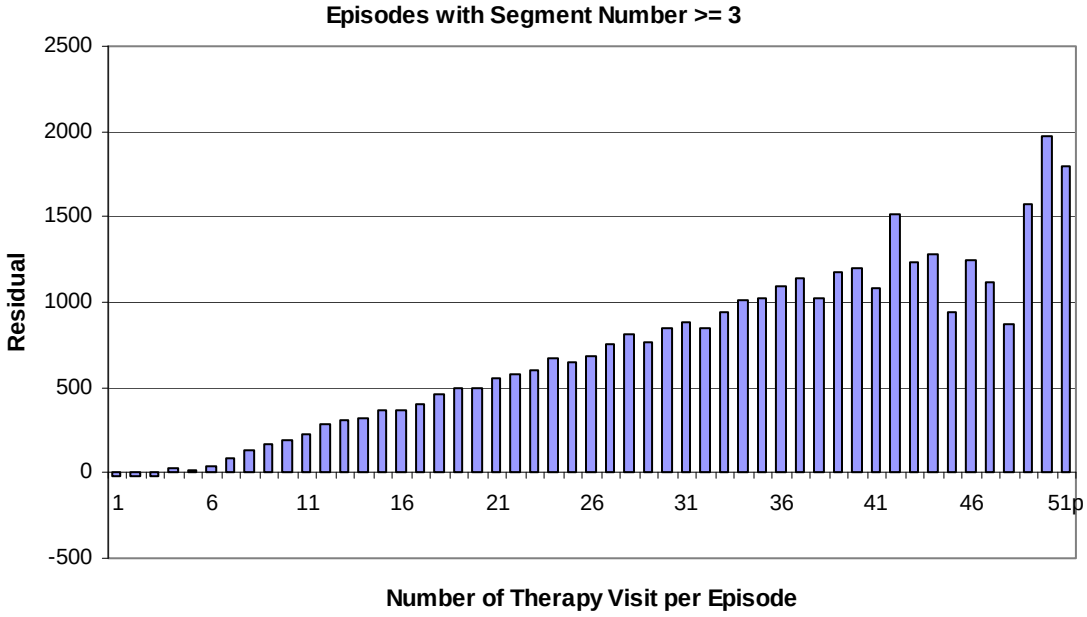


Exhibit 4.11 summarizes the fit of various models with different therapy use thresholds for later episodes. The results derived from early and later episodes were similar except for the identified single threshold. The single threshold was smaller for the later episodes than for the early episodes (10 vs. 13 therapy visits, or 480 vs. 580 therapy minutes). The ANOVA models fit on the early episodes had better performance than the ANOVA models fit on the later episodes. The inclusion of therapy thresholds explained up to 10% of the variance of the residuals in the later episodes, which was only about one-third the explanatory power of models estimated on early episodes. These results are consistent with the higher variability in the relationship between resources and therapy visits suggested by Exhibit 4.10.

We further examined the agreement between the three types of therapy use thresholds in categorizing the HH episodes. The results resembled our findings for the early episodes. The extent of agreement was close. Visit thresholds were more likely to categorize episodes into higher use categories than minute and mixed thresholds.

Exhibit 4.11

The Impact of Different Therapy Thresholds on Model Fit, Episodes with Sequence Number > 2

Number of Thresholds	Threshold			Partial R-squared
Visit threshold				
One	10			0.0701
Two	9	19		0.0836
Three	9	18	28	0.0875
Minute threshold				
One	480			0.0823
Two	380	840		0.0980
Three	360	660	1240	0.1043
Mixed threshold (visit / minute)				
One	13 / 598			0.0752
Two	10 / 460	23 / 1058		0.0888
Three	9 / 414	15 / 690	27 / 1242	0.0950

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

4.4.3. Characteristics of Patients, by Threshold Category

We compared the distribution of patient and agency characteristics between episode groups that were created based on the identified therapy thresholds. We observed episode categories with increasing use of therapy also showed increases in the proportion of episodes with longer length of stay, neurological or orthopedic conditions, and dependency in Activities of Daily Living (ADL) (Exhibit 4.12).

For all three therapy thresholds, we observed a similar association between the patient and agency characteristics and therapy use, suggesting the similarity of visit, minute, and mixed thresholds in categorizing the HH episodes (data not shown).

Exhibit 4.12

Comparison of Patient Characteristics by the Level of Therapy Use per Episode

	Number of Therapy Visits per Episode			
	0-8	9-15	16-26	27+
Early Episodes	(n=326067)	(n=127291)	(n=51472)	(n=9113)
Ortho DG fm OASIS M0230a & M0240b (or M0245)	10.5%	30.2%	32.2%	25.5%
Diabetes DG fm OASIS M0230a (or M0245a)	8.4	3.9	3.1	2.4
Modified Neuro DG with late effects CV disease or myopathy	5.1	8.3	13.0	29.0
New burn/trauma DG: add wnds NP-ulcer	9.7	3.3	3.3	2.8
Therapy at home: IV/Infusion	2.8	0.7	0.7	0.9
Therapy at home: Parenteral	0.2	0.0	0.1	0.1
Therapy at home: Enteral	1.7	0.9	1.5	4.6
M0390 (Vision >= 1)	28.8	29.1	29.5	29.0
M0420 (pain 2 or 3)	49.7	59.2	56.5	46.7
Multiple Pressure Ulcers (M0450)	0.6	0.3	0.3	0.6
M0460 (pressure ulcer stage 1,2)	5.4	4.6	5.8	7.7
M0460 (pressure ulcer stage 3,4)	2.1	1.0	1.5	2.0
M0476 (stasis ulcer healing status 2)	1.7	0.6	0.7	0.5
M0476 (stasis ulcer healing status 3)	1.4	0.4	0.4	0.2
M0488 (surgical wound healing status 2)	17.1	16.5	12.3	8.2
M0488 (surgical wound healing status 3)	3.1	1.3	1.1	1.0
M0490 (dyspnea 2, 3, or 4)	42.7	39.3	37.7	36.0
M0530 (urinary incontinence 1 or 2)	24.2	27.8	29.6	33.9
M0540 (bowel incontinence 2 - 5)	9.5	9.0	10.7	15.9
M0550 (ostomy 1 or 2)	2.3	1.2	1.2	1.2
Any behavior observed sum(M06101 -- M06106) > 0	22.3	22.1	23.3	27.0
M0650 or M0660 (dressing= 1,2,3)	62.9	78.2	83.4	91.2
M0670 (bathing >= 2)	72.1	85.5	89.9	94.6
M0680 (Toileting >= 2)	11.9	14.8	20.8	31.8
M0690 (Transferring >= 1)	65.7	84.5	87.6	92.2
M0690 (Transferring >= 2)	10.7	13.9	20.6	35.5
M0700 (Ambulation >= 1)	83.4	97.0	97.6	98.6
M0700 (Ambulation >= 3)	9.3	8.9	14.2	25.3
Used Short Term Care Hosp: Past 14 days (claims)	40.1	33.5	24.5	17.0
Used LTC Hosp, Inpatient Rehab or SNF: Past 14 Days (claims)	7.2	13.8	11.9	9.2
Used STC Hosp & LTC Hosp or Inp Rehab or SNF: Past 14 Days (claims)	3.3	6.3	4.4	3.0

Exhibit 4.12

Comparison of Patient Characteristics by the Level of Therapy Use per Episode

	Number of Therapy Visits per Episode			
	0-8	9-15	16-26	27+
Later Episodes	(n=153397)	(n=18346)	(n=7764)	(n=1147)
Ortho DG fm OASIS M0230a & M0240b (or M0245)	7.1%	25.2%	26.2%	20.7%
Diabetes DG fm OASIS M0230a (or M0245a)	15.7	9.7	6.4	4.7
Modified Neuro DG with neu/late myopathy	7.6	10.3	13.3	23.4
New burn/trauma DG: add wnds NP-ulcer	8.8	5.4	5.0	4.8
Therapy at home: IV/Infusion	2.5	1.4	1.7	1.6
Therapy at home: Parenteral	0.3	0.1	0.2	0.1
Ther at home: Enteral	4.4	2.1	2.8	5.6
M0390 (Vision >= 1)	49.8	49.8	42.2	37.0
M0420 (pain 2 or 3)	51.8	62.8	58.6	51.4
Multiple wounds (Pressure Ulcers M0450)	2.2	0.9	1.2	0.6
M0460 (pressure ulcer stage 1,2)	8.6	7.2	8.9	8.3
M0460 (pressure ulcer stage 3,4)	6.6	3.2	4.0	4.0
M0476 (stasis ulcer healing status 2)	3.4	1.7	1.8	1.7
M0476 (stasis ulcer healing status 3)	2.3	1.1	1.1	0.8
M0488 (surgical wound healing status 2)	3.8	4.4	5.0	6.7
M0488 (surgical wound healing status 3)	1.7	1.3	1.3	0.8
M0490 (dyspnea 2, 3, or 4)	59.7	62.1	53.5	46.5
M0530 (urinary incontinence 1 or 2)	39.7	45.0	41.3	39.1
M0540 (bowel incontinence 2 - 5)	24.4	19.9	19.8	23.3
M0550 (ostomy 1 or 2)	2.8	1.7	1.9	2.6
Any behavior observed sum(M06101 -- M06106) > 0	36.8	36.8	32.2	29.6
M0650 or M0660 (dressing= 1,2,3)	74.4	83.9	86.2	91.5
M0670 (bathing >= 2)	82.5	89.5	92.2	95.0
M0680 (Toileting >= 2)	29.7	27.7	31.5	42.6
M0690 (Transferring >= 1)	80.9	89.4	90.2	92.9
M0690 (Transferring >= 2)	26.3	24.7	29.1	44.6
M0700 (Ambulation >= 1)	93.3	98.2	98.5	99.2
M0700 (Ambulation >= 3)	27.3	19.4	23.6	33.9
Used Short Term Care Hosp: Past 14 days (claims)	6.7	12.4	11.2	12.6
Used LTC Hosp, Inpatient Rehab or SNF: Past 14 Days (claims)	0.8	3.2	3.8	4.2
Used STC Hosp & LTC Hosp or Inpatient Rehab or SNF: Past 14 Days (claims)	0.3	1.0	1.0	0.7

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

4.4.4. Testing the Model Fit by Forcing Specific Thresholds into the Model

Based on the above results, we estimated ANOVA models on residuals from the enhanced COT model by forcing specific thresholds into the models. The purpose of this exercise was to see whether the alternative thresholds fit nearly as well as the ones that yielded the best model fit. Specific thresholds being tested were 6, 7, 8, and 9 therapy visits/episode. The threshold of 6 visits per episode was selected because "underpayment," as indicated by the positive average residuals of resource use, starts at 6 visits

(Exhibits 4.7 and 4.10) and because a strong positive association between average residual vs. therapy visits per episode was observed in episodes with 6 or more therapy visits. We also studied the thresholds in between 6 and 10 therapy visits per episode, and compared their fit with the current threshold (10 therapy visits per episode) and the one with 6 therapy visits per episode.

One specific threshold was included in a model each time, and the best-fit 2-threshold and 3-threshold models were identified conditional on the specific threshold's remaining in the model. SAS® commands PROC ANOVA and MAXR were used to identify the best-performance models. Consistent with findings presented in Exhibits 4.9 and 4.11, the inclusion of additional therapy thresholds led to better model fit. Among the four groups of models we show in Exhibit 4.13, those with a threshold at 9 visits fit best.

Exhibit 4.13

Model Fit of Models with Specific Thresholds

Number of Thresholds	Therapy Visit Threshold(s)			Partial R-squared
Forcing 6 visits per episode in the model				
One threshold	6			0.1313
Two thresholds	6	17		0.2322
Three thresholds	6	13	23	0.2614
Forcing 7 visits per episode in the model				
One threshold	7			0.1527
Two thresholds	7	19		0.2425
Three thresholds	7	14	23	0.2669
Forcing 8 visits per episode in the model				
One threshold	8			0.1673
Two thresholds	8	19		0.2491
Three thresholds	8	16	27	0.2653
Forcing 9 visits per episode in the model				
One threshold	9			0.1772
Two thresholds	9	19		0.2525
Three thresholds	9	16	27	0.2712

4.4.5. Testing a Specific Set of Therapy Thresholds After the TEP Meeting

On December 15, 2005, the Abt team presented the results of the therapy threshold analysis to TEP members. TEP members agreed that more therapy thresholds in the HH PPS provide less financial incentive to agencies to provide unnecessary care. Some TEP members also suggested that we test 6, 10, and 20 as the therapy thresholds. Selection of these thresholds was based on the following considerations that were noted at the TEP meeting:

- The therapy bonus would be smaller using the 6-visit threshold, giving agencies less of a financial incentive to provide unnecessary therapy visits to obtain a higher payment.

- For a 60-day HH episode, one visit per week for 60 days would result in eight or nine visits during the episode. However, agencies may provide a few additional visits to meet the 10-visit threshold. There was concern that a 10-visit threshold would be subject to gaming.

- The use of a third therapy threshold at 20 visits would make it more difficult for agencies to game the system because it would be difficult for agencies to justify providing this high level of therapy to a patient if the level of therapy is unnecessary.

Some TEP members also suggested that we focus on therapy thresholds based on visits rather than minutes. This was because of a belief that would be harder for agencies to game a therapy visit threshold than the therapy minute thresholds. In response to TEP suggestions, and after consultation with CMS, we tested therapy thresholds for early and later episodes at 6, 14, and 20 therapy visits per episode. The results are summarized below.

Among the early episodes, 53% of episodes had less than 6 therapy visits and only 6% had 20 or more therapy visits (Exhibit 4.14).

Exhibit 4.14

Number of Episodes in Each Threshold Category, Episodes with Sequence Number <= 2

No. of therapy visits/episode	No. of Episodes	%
0-5	272,744	53.1
6-13	157,451	30.6
14-19	52,681	10.3
20 or more	31,067	6.0

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

We used methods similar to those described earlier in this section to examine the performance of a model that included the 6, 14, and 20 threshold model. First, we obtained the residuals from the enhanced COT model without any therapy thresholds. We studied the distribution of the residuals by the level of therapy use per episode. The residuals varied substantially, ranging from -882 to over 13,602 (Exhibit 4.15). Based on the payments proxy (i.e., resource cost) predicted from the enhanced COT model, on average, episodes with 0 to 5 therapy visits were overpaid by $117 (in resource cost units). Episodes with more visits were underpaid, and the amount of the underpayment increased with increases in the number of therapy visits. Episodes with 6-13 therapy visits were underpaid by an average of $20, those with 14-19 visits were underpaid by $230, and episodes with 20 or more therapy visits were underpaid by $540.

Exhibit 4.15

Distribution of Residuals (Measured in Resource Cost Dollar Amount) Obtained from the Enhanced Clinical-on-Top (COT) Model, Episodes with Sequence Number <=2

a. Distributional statistics

Therapy Visits per Episode	Number of Episodes	%	Distributional Statistics of Residuals						
			Mean	Std	Minimum	25th percentile	Median	75th percentile	Maximum
0-5	272,744	53	-117	287	-882	-264	-162	-43	13062
6-13	157,451	31	20	266	-846	-141	-13	134	5608
14-19	52,681	10	230	317	-630	47	191	363	8180
20 or more	31,067	6	540	447	-637	274	477	734	7305

b. Proportion of episodes with negative or positive residuals.

Therapy Visits per Episode	Number of Episodes	Distribution of residuals					
		Residual<0			Residual>=0		
		%	Mean	(Std)	%	Mean	(Std)
0-5	272,744	81	-209	(120)	19	270	(428)
6-13	157,451	53	-153	(110)	47	211	(258)
14-19	52,681	18	-127	(112)	82	310	(291)
20 or more	31,067	6	-170	(119)	94	586	(421)

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Next, using the residuals as the dependent variable, we fit an ANOVA model that included the 6, 14, and 20 therapy visit thresholds as the explanatory variables. The R-squared was 0.2575, which was similar to other models with three thresholds as shown in this section.[10]

We also calculated the predictive ratios (PR) for episodes that were grouped by the number of therapy visits per episode. A PR was defined as the ratio of the sum of predicted resource use over all episodes in an episode category to the sum of the actual resource use over all episodes in the same group. A PR greater than 1 suggests that on average episodes in an episode category are overpaid; a PR less than 1 suggests that on average episodes in a group are underpaid. For our estimation, we plugged in the residuals as the actual resource because the residuals were a risk-adjusted version of actual resource use. The predicted resource use was derived from the ANOVA model with three therapy thresholds. The values of PR are listed in Exhibit 4.16 and presented visually in Exhibit 4.17.

The PR is the highest in episodes with six therapy visits (PR=1.389), and then gradually decreases in episodes with more therapy visits until the therapy level hits the 14-visit threshold. A similar pattern was observed for episodes with 14 or more therapy visits, with the predictive ratio gradually decreasing until the 20-visit threshold is reached. These results suggest that payment would exceed costs for episodes that are at or just above the therapy thresholds, and providers would lose money for episodes that have a level of therapy that is just below the threshold.

[10] Note that this level of performance cannot be compared to those of the four-equation models discussed in the previous section. This is because (a) this model includes only the therapy threshold variables and does not reflect explanatory power of the nontherapy variables (e.g., COT variables); (b) the dependent variable is residuals, not total resource use; (c) this analysis is not using the four-equation structure; and (d) this is based on early episodes (sequence 1 and 2) only.

Exhibit 4.16

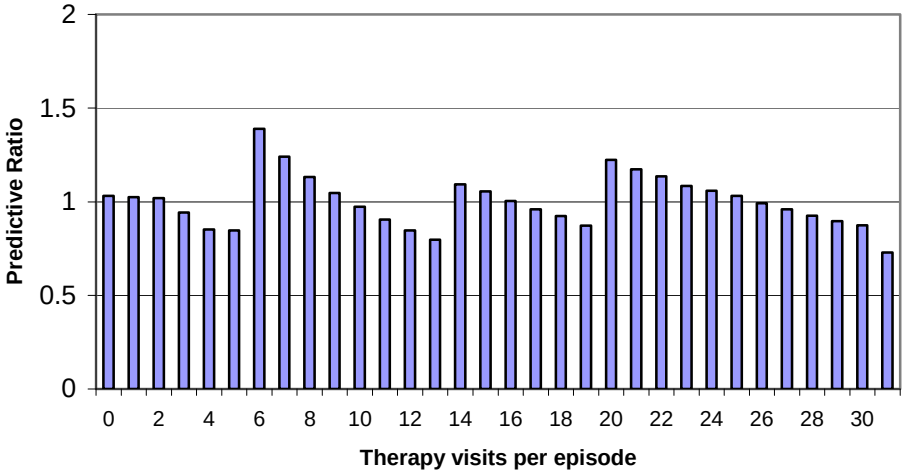
Predictive Ratios for a PPS Model with Three Therapy Visit Thresholds (6, 14, and 20 Therapy Visits per Episode) by Number of Therapy Visits per Episode, Episodes with Sequence Number <= 2)

Visits per Episode	Predictive Ratio	Visits per Episode	Predictive Ratio
0	1.031	16	1.005
1	1.026	17	0.960
2	1.020	18	0.925
3	0.942	19	0.872
4	0.852	20	1.224
5	0.848	21	1.174
6	1.389	22	1.136
7	1.241	23	1.085
8	1.133	24	1.059
9	1.047	25	1.032
10	0.973	26	0.993
11	0.905	27	0.959
12	0.848	28	0.926
13	0.797	29	0.896
14	1.093	30	0.875
15	1.056	31p	0.730

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Exhibit 4.17

Predictive Ratio Derived from PPS with Three Therapy Visit Thresholds (6, 14, and 20 Visits per Episode), Episodes with Sequence Number <= 2

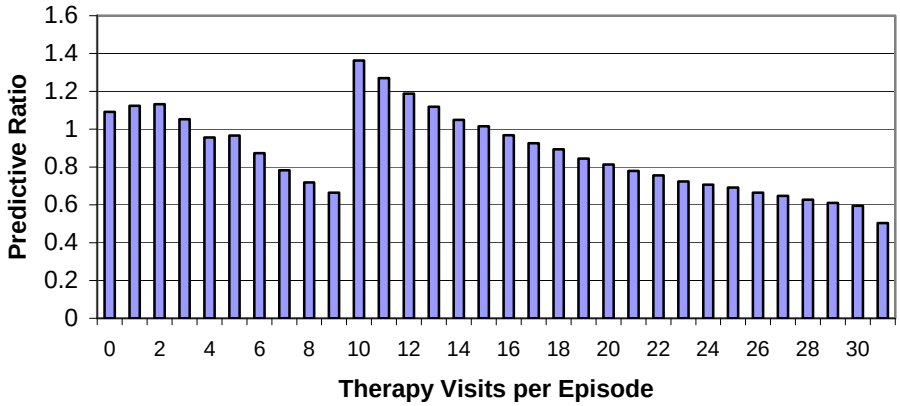


We compared the PR derived from the PPS with three therapy visit thresholds (6,14, and 20 visits per episode) to that derived from the PPS with only one therapy visit threshold (10 visit per episode). This

model was estimated on first and second episodes and was identical to the other models described in this section except for the use of the single therapy threshold. There was a larger change in PR around the 10-visit threshold in the single threshold model (Exhibit 4.18).

Exhibit 4.18

Predictive Ratio Derived from PPS with One Therapy Visit Threshold (10 Visits per Episode), Episodes with Sequence Number <= 2



We repeated the same analytical steps for later episodes (i.e., episodes with episode sequence number > 2). More than 80% of these episodes had fewer than 6 therapy visits per episode, and only 2% had more than 20 visits (Exhibit 4.19). We used the enhanced COT model on total resource use and analyzed the distribution of residuals from the model.

Exhibit 4.19

Number of Episodes in Each Threshold Category, Episodes with Sequence Number > 2

Number of Visits / Episode	No. of Episodes	%
0-5	148,275	82.1
6-13	19,833	11.0
14-19	8,324	4.6
20 or more	4,222	2.3

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Episodes with five or fewer therapy visits on average were overpaid, and episodes with more therapy visits were on average underpaid (Exhibit 4.20). For episodes with five or fewer therapy visits, the average residual was -55; this was considerably lower than the 117 average overpayment amount for early episodes (see Table 4.15). For episodes with more than six therapy visits, the average amount of the underpayment was larger for later episodes than for early episodes in all threshold categories.

Exhibit 4.20

Distribution of Residuals (Measured in Dollar Amount) Obtained from the Enhanced Clinical-on-Top (COT) Model, Episodes with Sequence Number >2

a. Distributional statistics

Therapy Visits per Episode	Number of Episodes	%	Distributional Statistics of Residuals						
			Mean	Std	Minimum	25th percentile	Median	75th percentile	Maximum
0-5	148,275	82	-55	457	-1548	-269	-137	23	11697
6-13	19,833	11	142	410	-1227	-77	91	277	7376
14-19	8,324	5	328	420	-1259	95	277	483	6876
20 or more	4,222	2	632	511	-1088	334	561	846	5063

b. Proportion of episodes with negative or positive residuals.

Therapy Visits per Episode	Number of Episodes	Distribution of residuals					
		Residual<0			Residual>=0		
		%	Mean	(Std)	%	Mean	(Std)
0-5	148,275	72	-240	(184)	28	430	(586)
6-13	19,833	36	-177	(158)	64	318	(400)
14-19	8,324	15	-162	(161)	85	413	(392)
20 or more	4,222	6	-188	(182)	94	686	(478)

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

With resource use residuals as the dependent variable, we fit an ANOVA model with the three visit thresholds (6, 14, 20) as independent variables. The PRs from the model with thresholds 6, 14, and 20 therapy visits per episode are listed in Exhibit 4.21. As for this model estimated on earlier episodes, the PRs were highest for episodes with 6 therapy visits and gradually decreased until the next therapy threshold was reached. The R-squared of this model was 0.0854, only slightly lower than the best-fit model with three visit thresholds (thresholds: 9, 18, 28; R-squared=0.0875; see Table 4.11).

Exhibit 4.21

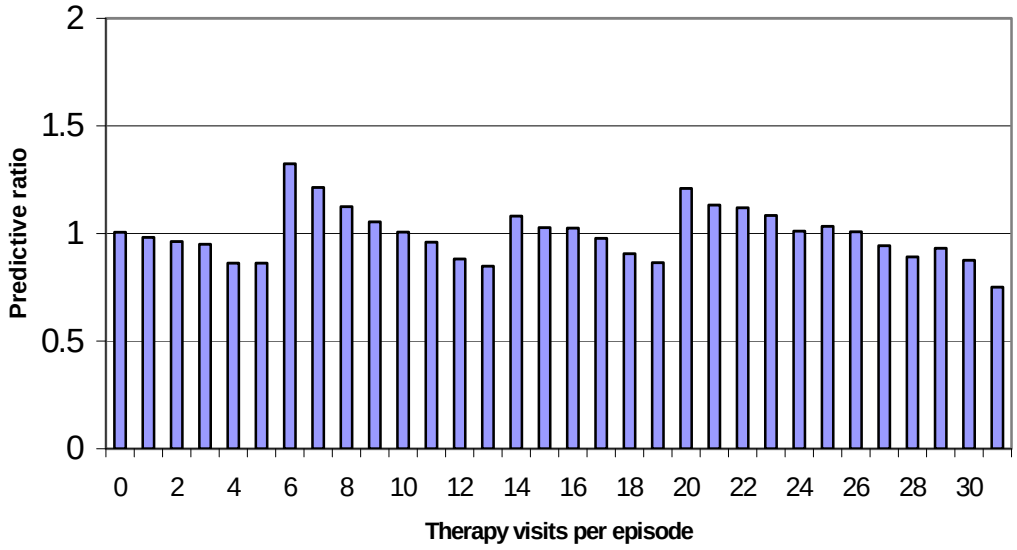
Predictive Ratio Derived from a PPS Model with Three Therapy Thresholds (6, 14, and 20 Therapy Visits per Episode) by Number of Therapy Visits per Episode, Episodes with Sequence Number > 2

Visits per Episode	PR	Visits per Episode	PR
0	1.006	16	1.025
1	0.982	17	0.977
2	0.962	18	0.906
3	0.950	19	0.865
4	0.862	20	1.209
5	0.862	21	1.132
6	1.324	22	1.119
7	1.214	23	1.084
8	1.125	24	1.011
9	1.054	25	1.034
10	1.007	26	1.008
11	0.959	27	0.944
12	0.881	28	0.891
13	0.848	29	0.931
14	1.080	30	0.876
15	1.027	31	0.751

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Exhibit 4.22

Predictive Ratio Derived from PPS with 3-Therapy Visit Thresholds (6, 14, and 20 Visits per Episode), Episodes with Episode Sequence Number >2



4.5. Therapy Use in Individuals with Hip and Knee Replacement

We examined the use of therapy use for patients with hip and knee replacement in post-acute home care. For this analysis we linked the claims of inpatient stay to data on home health (HH) episodes that occurred between October 2000 and May 2004.

First, we identified the target populations of episodes following a hip/knee replacement using the hospital claims information that is included in the Home Health Data Link file, the data source for this analysis. This file contains information on up to 10 inpatient stays that occurred prior to a HH episode. Episodes were selected based on the procedures that patients received during inpatient stays that preceded the home health episode and the time interval between hospital discharge and start dates of HH episodes. From the file, we identified 74,233 episodes that started within 14 days of an inpatient stay with a primary or secondary procedure of hip (81.51-81.53) and/or knee (81.54-84.55) replacement (Exhibit 4.23). Almost 9,000 of these episodes also had a second episode during the same spell. The number of episodes following the knee/hip replacement increased between 2001 and 2003. We also examined the proportion of patients with multiple institutional stays, which may be a proxy for severity. The proportion of patients with multiple institutional stays remained relatively stable over this period.

Note that there are only two second episodes from October-December 2000 following hip/knee replacement. Given the small sample size, we do not report results for this cohort in the tables that follow.

Exhibit 4.23

Number of HH Episodes Following a Hip or Knee Replacement by Calendar Year

	HH episodes following hip replacement			HH episodes following knee replacement		
	Number of episodes	Multiple Institutional stay		Number of episodes	Multiple Institutional stay	
Year	N	No (%)	Yes (%)	n	No (%)	Yes (%)
a. First episodes following the hip/knee replacement inpatient stay.						
2000 (Oct-Dec)	704	64	36	1,161	64	36
2001	7,412	62	38	11,738	64	36
2002	7,771	61	39	12,735	64	36
2003	7,990	61	39	14,348	65	35
2004 (Jan-May)	3,688	64	36	6,706	68	32
Total	27,565*	62	38	46,688	65	35
b. Second episodes following the hip/knee replacement inpatient stay.						
2000 (Oct-Dec)	2	100	0	0		
2001	585	79	21	777	81	19
2002	947	77	23	1,554	75	25
2003	1236	75	25	2,136	76	24
2004 (Jan-May)	593	78	22	1,145	78	22
Total	3363**	77	23	5,612	77	23

* 20 episodes had prior inpatient stay(s) related to both hip and knee replacement.

** 4 episodes had prior inpatient stay(s) related to both hip and knee replacement.

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

We linked the Home Health Data Link file to OASIS data so that we could examine characteristics of these episodes including

- resource use;
- therapy use;
- clinical diagnoses; and
- predicted resource use under the current model and the enhanced COT model with visit thresholds 6, 10, and 20.

To determine the relevance of these episodes to the hip and knee procedures that patients received during their inpatient stays, we examined the primary and secondary diagnoses reported on the OASIS assessments. To our surprise, only half of the episodes identified by inpatient stay procedures had a primary or secondary diagnosis related to orthopedic conditions (Exhibit 4.24).

Exhibit 4.24
Number of Episodes Following an Inpatient Stay with Hip or Knee Replacement

	Hip Replacement (n)	Knee replacement (n)
First episode following hip/knee replacement		
Identified by inpt stay procedures	27,565	46,688
Identified by inpt stay procedures and HH diagnoses	14,887	22,413
Second episodes following hip/knee replacement		
Identified by inpt stay procedures	3,363	5,612
Identified by inpt stay procedures and HH diagnoses	1,934	2,986

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

We described the resource and therapy use for HH episodes identified by inpatient stay procedures only (referred to as the whole sample) and the episodes identified by both inpatient stay procedures and home health diagnoses (referred to as the sub-sample).

We observed a small increase in total resource use and total therapy visits between 2001 and 2003 (Exhibits 4.25 and 4.26). For example, among the whole sample, total resource use for those with hip replacement and no multiple institutional stays increased from 351.1 in 2001 to 382.3 in 2003. The increase among the sub-sample was smaller, increasing from 378.3 in 2001 to 399.4 in 2004. Patients with multiple institutional stays prior to the home health episode had higher resource and therapy use than patients without multiple institutional stays. The multiple institutional stay group also received more aide visits and physical therapy visits.

We did not observe an obvious trend in the resource use or therapy use over time in the second HH episodes following a hip/knee replacement. Patients with multiple institutional stays had a heavier use of total resources and therapy than those without multiple institutional stays. The difference was larger than what we observed in the first episodes. For example, in 2003, in second episodes, patients with multiple institutional stays had 1.7 more therapy visits than patients without multiple institutional stays (Exhibit 4.26). For initial episodes, this difference was only 0.5 (see Exhibit 4.25).

Exhibit 4.25

Resource and Therapy Use During the *First* Home Health Episode Following a Hip or Knee Replacement

	Whole Sample				Sub-Sample			
	Multiple Institutional Stays				Multiple Institutional Stays			
	No		Yes		No		Yes	
	Mean	(Std)	Mean	(Std)	Mean	(Std)	Mean	(Std)
A. Hip Replacement (whole sample n=27,565, sub-sample n=14,887)								
Total Resource								
2000 (Oct-Dec)	339.5	(250.5)	334.7	(224.5)	363.6	(276.9)	344.1	(215.3)
2001	351.1	(244.6)	369.8	(246.3)	378.3	(267.0)	395.8	(259.7)
2002	372.7	(246.5)	389.3	(247.8)	395.9	(259.8)	420.2	(261.0)
2003	382.3	(257.2)	392.5	(281.1)	399.4	(274.4)	403.7	(311.1)
2004 (Jan-May)	374.5	(275.0)	385.9	(230.5)	390.3	(267.3)	388.4	(226.0)
Total HH Visits								
2000 (Oct-Dec)	14.3	(11.3)	14.0	(9.2)	15.6	(13.1)	14.2	(9.3)
2001	13.9	(10.0)	14.7	(9.9)	15.0	(10.9)	15.7	(10.5)
2002	13.9	(9.6)	14.7	(9.6)	14.8	(10.5)	15.8	(10.4)
2003	13.8	(9.5)	14.4	(9.2)	14.4	(10.1)	14.8	(9.6)
2004 (Jan-May)	13.0	(8.3)	13.8	(8.3)	13.6	(8.9)	14.0	(8.5)
Therapy Visits								
2000 (Oct-Dec)	7.8	(5.6)	8.4	(5.4)	8.4	(6.2)	8.6	(5.6)
2001	7.9	(5.6)	8.6	(5.5)	8.6	(6.0)	9.2	(5.8)
2002	8.1	(5.6)	8.8	(5.5)	8.8	(5.9)	9.5	(5.6)
2003	8.2	(5.5)	8.7	(5.3)	8.8	(5.6)	9.1	(5.4)
2004 (Jan-May)	8.0	(5.0)	8.6	(5.0)	8.4	(5.2)	8.8	(5.0)
Aide Visits								
2000 (Oct-Dec)	1.7	(4.8)	1.6	(3.9)	2.1	(5.4)	1.6	(4.0)
2001	1.3	(4.1)	1.7	(4.5)	1.5	(4.5)	1.9	(4.5)
2002	1.2	(3.9)	1.4	(3.9)	1.4	(4.2)	1.6	(4.3)
2003	0.9	(3.3)	1.4	(3.8)	1.0	(3.6)	1.5	(4.0)
2004 (Jan-May)	0.8	(2.8)	1.1	(3.2)	0.9	(3.1)	1.1	(3.4)
Occupational Visits								
2000 (Oct-Dec)	0.4	(1.5)	0.5	(1.5)	0.6	(2.0)	0.6	(1.7)
2001	0.4	(1.3)	0.7	(1.8)	0.5	(1.6)	0.9	(2.0)
2002	0.4	(1.5)	0.8	(1.9)	0.5	(1.7)	0.9	(2.0)
2003	0.5	(1.5)	0.7	(1.7)	0.5	(1.7)	0.8	(1.8)
2004 (Jan-May)	0.5	(1.4)	0.8	(1.8)	0.5	(1.5)	0.7	(1.8)
Physical Therapy								
2000 (Oct-Dec)	7.3	(5.2)	7.9	(4.9)	7.7	(5.4)	7.9	(4.8)
2001	7.5	(5.3)	7.8	(4.9)	8.1	(5.5)	8.4	(5.1)
2002	7.7	(5.2)	8.0	(4.9)	8.3	(5.3)	8.6	(4.9)
2003	7.8	(5.0)	8.0	(4.8)	8.3	(5.1)	8.3	(4.8)
2004 (Jan-May)	7.5	(4.7)	7.9	(4.5)	7.9	(4.8)	8.1	(4.4)
Skilled Nursing								
2000 (Oct-Dec)	4.7	(4.8)	3.9	(3.9)	5.1	(5.8)	4.0	(3.6)
2001	4.7	(5.1)	4.4	(4.4)	4.8	(5.5)	4.5	(4.9)
2002	4.6	(4.5)	4.4	(4.5)	4.6	(4.7)	4.6	(5.2)
2003	4.6	(4.9)	4.3	(4.4)	4.5	(5.2)	4.2	(4.7)
2004 (Jan-May)	4.2	(4.0)	4.1	(3.9)	4.3	(4.2)	4.1	(4.2)

Exhibit 4.25

Resource and Therapy Use During the *First* Home Health Episode Following a Hip or Knee Replacement

	Whole Sample				Sub-Sample			
	Multiple Institutional Stays				Multiple Institutional Stays			
	No		Yes		No		Yes	
	Mean	(Std)	Mean	(Std)	Mean	(Std)	Mean	(Std)
B. Knee Replacement (whole sample n=46,888, sub-sample n=22,413)								
Total Resource								
2000 (Oct-Dec)	353.0	(234.7)	346.0	(188.9)	350.9	(200.3)	358.3	(185.7)
2001	369.5	(209.9)	380.1	(247.1)	382.2	(216.5)	394.3	(227.3)
2002	390.2	(229.3)	409.7	(246.8)	398.5	(232.7)	423.2	(257.2)
2003	396.3	(220.3)	406.3	(233.1)	402.4	(219.6)	412.4	(235.2)
2004 (Jan-May)	396.2	(219.7)	417.4	(245.1)	394.1	(227.7)	420.3	(255.5)
Total HH Visits								
2000 (Oct-Dec)	13.5	(10.3)	13.7	(7.8)	13.4	(8.4)	13.7	(7.0)
2001	13.5	(7.9)	14.2	(8.3)	13.8	(8.0)	14.6	(8.7)
2002	13.7	(8.1)	14.6	(8.9)	14.0	(8.3)	14.8	(8.9)
2003	13.5	(7.6)	14.2	(8.2)	13.6	(7.4)	14.3	(8.4)
2004 (Jan-May)	13.1	(7.3)	14.2	(7.9)	13.1	(7.6)	14.4	(8.0)
Therapy Visits								
2000 (Oct-Dec)	9.0	(5.7)	9.1	(4.8)	8.9	(4.9)	9.6	(5.0)
2001	9.1	(5.0)	9.4	(5.0)	9.6	(5.2)	10.0	(5.2)
2002	9.2	(5.0)	9.6	(5.1)	9.6	(5.0)	10.0	(5.1)
2003	9.1	(4.9)	9.5	(5.0)	9.5	(4.8)	9.8	(4.8)
2004 (Jan-May)	8.9	(4.6)	9.7	(5.0)	9.0	(4.6)	9.8	(4.9)
Aide Visits								
2000 (Oct-Dec)	0.8	(3.2)	0.9	(2.7)	0.9	(2.9)	0.7	(2.3)
2001	0.6	(2.6)	0.9	(3.2)	0.7	(2.8)	1.0	(3.2)
2002	0.6	(2.9)	1.0	(3.6)	0.7	(3.0)	1.0	(3.6)
2003	0.5	(2.3)	0.8	(3.0)	0.5	(2.2)	0.8	(3.0)
2004 (Jan-May)	0.4	(1.9)	0.7	(2.8)	0.4	(2.0)	0.8	(3.0)
Occupational Visits								
2000 (Oct-Dec)	0.1	(0.6)	0.3	(0.9)	0.1	(0.6)	0.3	(0.9)
2001	0.1	(0.7)	0.3	(1.1)	0.1	(0.7)	0.3	(1.2)
2002	0.2	(0.8)	0.4	(1.2)	0.2	(0.8)	0.4	(1.3)
2003	0.2	(0.7)	0.4	(1.2)	0.1	(0.7)	0.4	(1.2)
2004 (Jan-May)	0.2	(0.7)	0.4	(1.2)	0.2	(0.8)	0.4	(1.3)
Physical Therapy								
2000 (Oct-Dec)	8.9	(5.6)	8.9	(4.7)	8.8	(4.8)	9.3	(4.9)
2001	9.0	(4.9)	9.1	(4.8)	9.4	(5.2)	9.7	(5.0)
2002	9.0	(4.9)	9.2	(4.9)	9.5	(4.9)	9.6	(4.8)
2003	9.0	(4.8)	9.1	(4.7)	9.4	(4.8)	9.4	(4.6)
2004 (Jan-May)	8.8	(4.5)	9.3	(4.7)	8.9	(4.5)	9.4	(4.6)
Skilled Nursing								
2000 (Oct-Dec)	3.8	(4.5)	3.7	(4.4)	3.6	(4.6)	3.4	(3.6)
2001	3.8	(4.2)	3.8	(3.8)	3.6	(4.1)	3.6	(4.0)
2002	3.8	(4.3)	4.0	(4.0)	3.6	(4.4)	3.7	(4.1)
2003	3.9	(3.7)	3.9	(4.1)	3.6	(3.6)	3.7	(4.6)
2004 (Jan-May)	3.8	(4.0)	3.7	(3.6)	3.7	(4.2)	3.8	(3.6)

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Exhibit 4.26

Resource and Therapy Use of the *Second* Home Health Episode Following a Hip or Knee Replacement

	Whole Sample				Sub-Sample			
	Multiple Institutional Stays				Multiple Institutional Stays			
	No		Yes		No		Yes	
	Mean	(Std)	Mean	(Std)	Mean	(Std)	Mean	(Std)
A. Hip Replacement (whole sample n=3,363, sub-sample n=1,934)								
Total Resource								
2001	347.8	(302.9)	404.8	(259.9)	362.0	(333.5)	403.8	(275.9)
2002	354.7	(284.8)	390.0	(319.0)	366.0	(303.7)	388.7	(307.6)
2003	367.1	(272.0)	395.7	(229.4)	375.8	(260.6)	422.4	(240.5)
2004 (Jan-May)	355.6	(237.1)	403.5	(244.3)	349.9	(253.2)	384.6	(241.2)
Total HH Visits								
2001	14.9	(12.9)	16.7	(13.6)	15.6	(13.8)	17.1	(17.0)
2002	14.1	(11.2)	15.4	(13.3)	14.7	(12.3)	15.1	(12.9)
2003	13.8	(11.5)	14.2	(8.5)	14.0	(11.2)	15.3	(9.1)
2004 (Jan-May)	13.1	(9.4)	14.3	(9.3)	12.7	(9.7)	13.4	(8.6)
Therapy Visits								
2001	6.8	(6.3)	9.5	(5.9)	7.4	(6.4)	9.2	(5.4)
2002	7.2	(6.1)	9.0	(6.1)	7.9	(6.4)	9.3	(6.1)
2003	7.1	(5.9)	8.8	(5.5)	7.8	(6.0)	9.5	(5.7)
2004 (Jan-May)	7.3	(5.5)	8.5	(4.9)	7.4	(5.5)	8.3	(4.9)
Aide Visits								
2001	2.4	(5.8)	2.5	(8.3)	3.0	(6.5)	3.2	(11.4)
2002	1.6	(5.1)	2.1	(6.2)	1.9	(5.5)	2.3	(7.0)
2003	1.3	(4.4)	1.0	(3.0)	1.3	(4.2)	1.2	(3.4)
2004 (Jan-May)	1.0	(3.6)	1.2	(3.9)	1.0	(3.5)	1.0	(3.5)
Occupational Visits								
2001	0.3	(1.3)	0.5	(1.6)	0.4	(1.6)	0.5	(1.3)
2002	0.4	(1.5)	0.6	(2.3)	0.4	(1.6)	0.6	(2.3)
2003	0.3	(1.4)	0.6	(1.6)	0.3	(1.4)	0.6	(1.8)
2004 (Jan-May)	0.3	(1.2)	0.6	(1.5)	0.3	(1.2)	0.6	(1.3)
Physical Therapy								
2001	6.5	(6.0)	9.0	(5.4)	7.0	(6.0)	8.7	(5.1)
2002	6.8	(5.7)	8.4	(5.6)	7.5	(6.0)	8.8	(5.5)
2003	6.8	(5.5)	8.3	(4.9)	7.4	(5.6)	8.9	(5.0)
2004 (Jan-May)	7.0	(5.2)	7.9	(4.6)	7.1	(5.1)	7.8	(4.6)
Skilled Nursing								
2001	5.6	(8.4)	4.7	(5.3)	5.1	(8.7)	4.7	(6.6)
2002	5.2	(6.3)	4.2	(5.7)	4.9	(6.4)	3.5	(4.6)
2003	5.3	(7.6)	4.4	(3.9)	4.8	(7.2)	4.5	(4.0)
2004 (Jan-May)	4.7	(5.6)	4.6	(4.8)	4.3	(5.1)	4.0	(3.5)

Exhibit 4.26

Resource and Therapy Use of the *Second* Home Health Episode Following a Hip or Knee Replacement

	Whole Sample				Sub-Sample			
	Multiple Institutional Stays				Multiple Institutional Stays			
	No		Yes		No		Yes	
	Mean	(Std)	Mean	(Std)	Mean	(Std)	Mean	(Std)
B. Knee Replacement (whole sample n=5,612, sub-sample n=2,986)								
Total Resource								
2001	366.3	(299.0)	377.8	(225.4)	377.7	(317.2)	387.7	(237.4)
2002	368.3	(250.6)	407.5	(236.8)	386.7	(278.3)	430.6	(258.2)
2003	389.8	(246.8)	392.9	(231.7)	396.2	(256.1)	399.0	(222.1)
2004 (Jan-May)	384.7	(238.4)	408.7	(228.5)	388.9	(224.9)	414.1	(228.4)
Total Visits								
2001	14.3	(11.5)	14.8	(10.5)	15.1	(12.6)	14.5	(11.0)
2002	13.7	(9.6)	15.0	(9.4)	14.2	(10.5)	15.6	(10.0)
2003	13.9	(9.8)	14.5	(9.2)	14.0	(10.2)	14.7	(9.1)
2004 (Jan-May)	13.2	(8.2)	14.2	(8.5)	13.3	(7.9)	14.1	(8.6)
Therapy Visits								
2001	8.3	(6.5)	9.0	(5.2)	8.8	(6.9)	9.2	(5.3)
2002	8.2	(5.8)	9.7	(5.6)	8.7	(6.1)	10.3	(5.6)
2003	8.5	(5.4)	9.3	(5.4)	8.8	(5.4)	9.5	(4.9)
2004 (Jan-May)	8.4	(5.1)	9.1	(4.9)	8.8	(5.0)	9.3	(5.0)
Aide Visits								
2001	1.1	(4.2)	1.4	(4.3)	1.5	(4.7)	1.8	(5.4)
2002	0.9	(3.7)	1.1	(3.7)	0.9	(3.8)	1.2	(4.2)
2003	0.9	(4.0)	0.9	(3.8)	0.9	(4.3)	1.0	(4.2)
2004 (Jan-May)	0.7	(2.9)	0.7	(2.9)	0.8	(3.1)	0.6	(2.8)
Occupational Visits								
2001	0.2	(1.4)	0.1	(0.6)	0.3	(1.5)	0.2	(0.9)
2002	0.1	(0.8)	0.3	(1.2)	0.2	(1.0)	0.3	(1.1)
2003	0.2	(1.1)	0.4	(1.2)	0.2	(1.2)	0.4	(1.2)
2004 (Jan-May)	0.2	(1.1)	0.3	(1.3)	0.2	(1.2)	0.3	(1.5)
Physical Therapy								
2001	8.1	(6.2)	8.8	(5.1)	8.5	(6.5)	9.0	(5.2)
2002	8.0	(5.5)	9.4	(5.3)	8.5	(5.6)	10.1	(5.3)
2003	8.3	(5.2)	8.9	(5.0)	8.7	(5.1)	9.0	(4.7)
2004 (Jan-May)	8.2	(4.9)	8.8	(4.6)	8.6	(4.7)	9.0	(4.5)
Skilled Nursing								
2001	4.8	(7.2)	4.4	(6.3)	4.8	(7.8)	3.6	(3.9)
2002	4.6	(6.1)	4.2	(4.8)	4.5	(6.5)	4.1	(5.4)
2003	4.5	(6.0)	4.2	(4.2)	4.3	(6.4)	4.2	(4.3)
2004 (Jan-May)	4.1	(4.7)	4.4	(4.5)	3.7	(4.0)	4.2	(4.3)

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Exhibit 4.27 lists the predictive ratio (PR) for the first episodes following a knee or hip replacement inpatient stay. Two groups of PRs are shown: one from the current model with one therapy threshold – 10 therapy visits/episode; the other from the enhanced model with three thresholds – 6, 14, and 20 therapy visits/episode. On average, both models over-predicted the resource use for patients with hip or knee replacement; however, the enhanced model with three therapy visit thresholds better predicted resource use (i.e. had PRs that were closer to 1) than the single threshold model for episodes following a hip or knee replacement in patients with multiple institutional stays. The performance of both models in predicting resource use for patients without multiple institutional stays was similar.

Exhibit 4.27

Predictive Ratios of the *First* Home Health Episodes Following Hip/Knee Replacement

	PR from current model with visit threshold 10		PR from enhanced model with visit thresholds 6, 14, and 20	
	Multiple Institutional Stays		Multiple Institutional Stays	
	No	Yes	No	Yes
a. First HH episodes following *hip* replacement (whole sample)				
2000 (Oct-Dec)	1.19	1.27	1.21	1.15
2001	1.20	1.21	1.22	1.12
2002	1.12	1.15	1.13	1.05
2003	1.12	1.16	1.10	1.03
2004 (Jan-May)	1.18	1.19	1.15	1.07
b. First HH episodes following *hip* replacement (sub-sample)				
2000 (Oct-Dec)	1.15	1.17	1.20	1.10
2001	1.16	1.17	1.18	1.08
2002	1.10	1.12	1.10	1.01
2003	1.10	1.14	1.07	1.01
2004 (Jan-May)	1.15	1.20	1.14	1.07
c. First HH episodes following *knee* replacement (whole sample)				
2000 (Oct-Dec)	1.26	1.32	1.27	1.22
2001	1.23	1.24	1.25	1.16
2002	1.14	1.16	1.16	1.06
2003	1.14	1.16	1.13	1.06
2004 (Jan-May)	1.18	1.18	1.15	1.08
d. First HH episodes following *knee* replacement (sub-sample)				
2000 (Oct-Dec)	1.26	1.29	1.27	1.18
2001	1.21	1.22	1.23	1.14
2002	1.14	1.15	1.15	1.02
2003	1.14	1.15	1.12	1.04
2004 (Jan-May)	1.18	1.17	1.15	1.09

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

Exhibit 4.28 lists the predictive ratio (PR) of second episodes following a knee or hip replacement. As for first episodes, both models over-predicted the resource use for patients with hip or knee replacement. The enhanced model with three therapy thresholds better predicted the resource use than the current model for patients with multiple institutional stays.

These analyses suggest that the multiple threshold model reduces the amount of the average overpayment for patients with hip/knee replacement and multiple institutional stays prior to HH admission, a group that accounts for one-third of the patients with hip/knee replacement. Patients with multiple institutional stays received more therapy and aide visits, but fewer skilled nursing visits, than patients without multiple institutional stays.

Exhibit 4.28

Predictive Ratios of the *Second* Home Health Episodes Following Hip/Knee Replacement

	PR from current model with visit threshold 10		PR from enhanced model with visit thresholds 6, 14, and 20	
	Multiple Institutional Stays		Multiple Institutional Stays	
	No	Yes	No	Yes
a. First HH episodes following *hip* replacement (whole sample)				
2001	1.16	1.13	1.19	1.11
2002	1.17	1.10	1.15	1.06
2003	1.08	1.14	1.08	1.04
2004 (Jan-May)	1.21	1.17	1.16	1.00
b. First HH episodes following *hip* replacement (sub-sample)				
2001	1.12	1.04	1.16	1.09
2002	1.16	1.12	1.16	1.08
2003	1.07	1.11	1.08	1.02
2004 (Jan-May)	1.21	1.19	1.18	1.02
c. First HH episodes following *knee* replacement (whole sample)				
2001	1.16	1.20	1.23	1.14
2002	1.14	1.18	1.15	1.08
2003	1.11	1.16	1.11	1.07
2004 (Jan-May)	1.18	1.14	1.16	1.05
d. First HH episodes following *knee* replacement (sub-sample)				
2001	1.15	1.15	1.23	1.14
2002	1.11	1.18	1.12	1.05
2003	1.11	1.17	1.09	1.05
2004 (Jan-May)	1.19	1.10	1.17	1.07

Sources: Abt Associates Inc. analysis of Home Health Datalink file (linked Medicare home health claims and OASIS assessments)

5. CY 2005 Validation Analyses of the Four-Equation Model for the Final Payment Rule

The initial goal of the home health payment system refinement project was to develop the analyses and payment parameters presented in the proposed regulation on HH PP refinements (CMS-1541-P, dated May 4, 2007), using the most recent year of data available. After the publication of the proposed rule, newer data became available and further analyses and refinements were pursued using data from 2005. One question examined in doing these analyses was whether, due to changes in OASIS instructions related to V-codes, the prevalence of the diagnosis codes contained on OASIS assessments (M0230/M0240/M0245) might have changed between 2003 and 2005. In this section, we describe these analyses, which supported the payment system parameters published in the Final Rule (CMS-1541-FC, dated August 29, 2007).

5.1. Data Sources

The data source for these analyses was home health episodes that ended in calendar year 2005 (CY2005) for a 20% random sample of Medicare beneficiaries (n= 790,358). Consistent with prior analyses (see Section 2.4), we excluded outlier episodes and episodes with payment adjustments.[11] Unlike the analyses for the NPRM, this file included episodes with V-code ICD-9-CM codes in the diagnosis fields.

5.2. Models

The same basic approach was adopted for the four-equation model analysis as that described in Chapter 3. First, a general model ("kitchen sink model") with a large set of clinical, diagnostic, and functional variables and interactions between these variables were estimated as a Chow Model across the four legs of the normal episodes.[12] As before, the four legs of the model were:

- 1st and 2nd (early) episodes, 0-13 therapy visits (leg one);
- 1st and 2nd (early) episodes, 14 or more therapy visits (leg two);
- 3rd+ (later) episodes, 0-13 therapy visits (leg three); and
- 3rd+ (later) episodes, 14 or more therapy visits (leg four).

There were also leg dummy variables for legs two, three, and four,[13] to capture the increased resource use associated with being a later and/or a high-therapy episode The kitchen sink model also included therapy visit indicator variables at six (legs 1 and 3) and 20 (legs 2 and 4) visits. Therapy visit counter dummy variables were included for seven, eight, nine, 10, 11, 12, and 13 therapy visits (legs 1 and 3) and 15, 16,

[11] Note that the Chapter 7 impact analyses used all episodes, including normal (no payment adjustments) episodes, SCIC, PEP, SCIC/PEP, LUPA and outlier episodes.

[12] A Chow Model is a model where variables in the model are fully interacted with a set of indicator variables – in this case, with the set of indicator variables representing four legs of episodes. This meant that all the episode records could be analyzed using a single pooled file, but each variable occurred in four versions – once for each leg – and could therefore take on a different coefficient for each leg.

[13] The leg two and leg four dummy variables implicitly serve as 14 therapy visit dummy variables.

17, 18, and 19 therapy visits (legs 2 and 4), as before, resource use (res_tot_updt) is the dependent variable in these four-equation models.

The resulting estimates are presented in Appendix Exhibit A.1. The exhibit is quite long, given the large number of variables and interactions included in all four legs. Results are presented first for legs one and two, followed by corresponding estimates for legs three and four. Overall, the adjusted R-squared statistic of the kitchen sink model was 0.4718, indicating that this model accounted for just over 47% of the variation in resource use across normal, non-outlier episodes. In addition to the leg and therapy visit dummy variables, more than 400 variables and interactions were included in each of the four legs of the model.

The purpose of estimating a four-equation kitchen sink model is to identify those clinical, diagnostic, and functional variables associated with statistically significant increases in resource use in one or more legs of the model, as well as to see if such variables could be combined or simplified. In short, we are hoping to identify variables that are good candidates for inclusion in a simpler four-equation model on both statistical and clinical grounds. The results show many instances of statistically weak or negative regression coefficients, especially for interaction terms. The process of pruning the model is described next.

To be included in the model, a variable must have a coefficient of 5 or more[14] and be significant in a two-tailed test at the 10% level (equivalent to having a t statistic of 1.645 or more). The clinical criteria used to select and/or refine variables was somewhat more subjective but no less important. Some of the clinical justifications for including a variable in the model included:

- Robustness – these are variables with a reasonable degree of prevalence in the two decile sample that often were significant in more than one leg in the model. For example, a variable with low prevalence (e.g., fewer than 25 occurrences within a leg) was viewed with suspicion, particularly if such a variable was an interaction of two or more variables. Such variables were often excluded from the model or at least combined with other related variables with greater prevalence, for fear that including such suspicious variables would over-fit the data.[15]

- Clinical coherence – in many cases, the kitchen sink model included pairs of diagnostic variables – one based on primary diagnoses, and the other based on secondary diagnoses. If such variables had similar coefficients, or if the primary member of the pair was statistically significant and the secondary member with a similar impact on resource use was not (or vice versa), the pair of variables often was replaced by a single variable indicating the presence of either a primary or secondary occurrence of a set of diagnoses.

[14] Once again, the cutoff at 5 is to identify variables that after being converted into points during the payment weight regression analysis (i.e., coefficients divided by 10 and rounded to the nearest whole number) will have a point score of at least 1 point.

[15] Variables with extremely low prevalence but with large and significant coefficients may represent a small set of episodes with an unmeasured characteristic(s) related to higher resource use. It is highly likely that such relationships will not persist for other sets of episodes.

- Simplicity – in general, fewer rather than greater numbers of variables were preferred. This often meant collapsing related sets of variables (e.g., all heart diagnoses or all hypertension diagnoses), especially when these variables were interacted with other variables in the model.

Several versions of the four-equation model were then estimated and evaluated using the CY 2005 data. In successive versions, variables were combined, simplified, or eliminated for statistical and clinical reasons, and the remaining variables were then assessed to determine if they met the statistical criteria for inclusion in the model.

Ultimately, two sets of simplifying restrictions were imposed on the four-equation models. The first set of restrictions smoothed and gradually decelerated the added resource cost predicted from using the therapy visit dummy variables for six to 13 visits (legs one and three) and 15 to 19 visits (legs two and four). There were two reasons for imposing these restrictions. First, if the coefficients were not restricted, the differences between adjacent sets of therapy visit indicator variables (i.e., between the six and seven therapy visit dummy variables in legs one and three), which indicate the incremental increase in resource use for an additional therapy visit, were not consistent across equations, or legs, of the model. For example, in the Kitchen Sink Model, these differences were as follows:

- Leg one
  - Six to Seven Visits: 43
  - Seven to Eight Visits: 39
  - Eight to Nine Visits: 41
  - Nine to 10 Visits: 51
  - 10 to 11 Visits: 36
  - 11 to 12 Visits: 40
  - 12 to 13 Visits: 37

- Leg two
  - 15 to 16 Visits: 37
  - 16 to 17 Visits: 31
  - 17 to 18 Visits: 38
  - 18 to 19 Visits: 41

- Leg three
  - Six to Seven Visits: 43
  - Seven to Eight Visits: 24
  - Eight to Nine Visits: 42
  - Nine to 10 Visits: 74
  - 10 to 11 Visits: 36
  - 11 to 12 Visits: 30
  - 12 to 13 Visits: 56

- Leg four
  - 15 to 16 Visits: 20
  - 16 to 17 Visits: 23
  - 17 to 18 Visits: 49
  - 18 to 19 Visits: 35

One would expect the relationship between differences in resource use and the number of therapy visits used in a home health episode to be more consistent both within legs (e.g., similar for all visit differences in leg one) and across legs (e.g., the differences in resource use for an episode in leg one between 9 and 10 visits would be similar, if not identical, to that for leg three). This clearly was not the case. It also would seem plausible that the increment in resource use would tend to decline as the number of therapy visits increased within an episode, but this also was definitely not what happened here.

To address this issue, restrictions were imposed on the regression procedure that typically slightly reduced the impact of therapy visits on resource use in the four-equation model, as well as having the increments trend downward as the number of therapy visits increased. Such restrictions were resource neutral – that is, in the course of the regression procedure of estimating the model subject to the restrictions, other coefficients adjust. In this case, other variables in the model tended to have their coefficients increase to offset these restrictions on therapy visit variables. The ultimate increments selected were as follows:

- Leg One
  - Six to Seven Visits: 42
  - Seven to Eight Visits: 40.5
  - Eight to Nine Visits: 39
  - Nine to 10 Visits: 37.5
  - 10 to 11 Visits: 36
  - 11 to 12 Visits: 34.5
  - 12 to 13 Visits: 33

- Leg Two
  - 15 to 16 Visits: 27.5
  - 16 to 17 Visits: 26.0
  - 17 to 18 Visits: 24.5
  - 18 to 19 Visits: 23

- Leg Three
  - Six to Seven Visits: 42
  - Seven to Eight Visits: 40.5
  - Eight to Nine Visits: 39
  - Nine to 10 Visits: 37.5
  - 10 to 11 Visits: 36
  - 11 to 12 Visits: 34.5
  - 12 to 13 Visits: 33

- Leg Four
  - 15 to 16 Visits: 27.5
  - 16 to 17 Visits: 26.0
  - 17 to 18 Visits: 24.5
  - 18 to 19 Visits: 23

The increments, 1.5 resource cost units, are the same in legs one and three and in legs two and four. In addition, the implicit jumps from 13 to 14 therapy visits (between legs one and two and legs three and

four) were 31.5, and between 14 and 15 therapy visits (in legs two and four) were 29 – maintaining the smoothed, declining relationship.

The second set of restrictions were cross-leg restrictions for the same variables. In many cases, the estimated coefficients for an individual clinical, functional, diagnostic, or interaction variable were similar across two or more legs. To further simplify the model, variables were restricted to be equal across two or more related legs as follows:

- Across all four legs (or three legs, if a variable was included in only three legs of the model);
- Across pairs of related legs (e.g., across legs one and two (all early (first and second) episodes), across legs one and three (all episodes with 13 or fewer therapy visits), across legs two and four (all episodes with 14 or more therapy visits), or across legs three and four (all later (3^{rd}+) episodes);

In evaluating potential restrictions, either a statistical test or clinical judgment needed to be met:

- Statistical test - for each set of legs being considered, the largest difference in coefficients across the legs was calculated, and divided by the largest standard error for these legs – if the resulting ratio was 1.96 or less, the statistical test was met and the equality restriction was imposed.
- Clinical judgment - Where legs with similar coefficients did not meet the statistical test, or in cases where coefficients were similar for two or more legs but much higher for another, equality could be imposed based on clinical judgment (e.g., for blindness and low vision).

In some instances, after an equality restriction across legs was imposed, another equality restriction was justified. For example, suppose an equality restriction was imposed across legs one and two, where the variable in question was also included in leg four. Whereas imposing equality across all three legs initially did not make sense (the ratio of the largest coefficient difference to the largest standard error did not justify such a restriction), after the restriction across legs one and two was imposed, it was possible that a restriction across legs one, two, and four now passed the statistical test. If so, such a restriction was then imposed.

5.3. Results

We examined the diagnoses fields on the OASIS assessments (M0230/M0240/M0245) for indications that some diagnoses groups in the proposed model might be reported at differing rates in 2005 than in 2003, and we did find some changes. For example, we observed lower rates of reporting primary diagnoses for the neurological diagnosis groups, orthopedic groups other than gait abnormality, cardiac group, and some of the cancer diagnosis codes. We observed somewhat higher primary diagnosis rates for the diabetes, hypertension, and degenerative and other organic psychiatric groups. Secondary diagnosis reporting typically decreased only by about 1 percentage point for each of the proposed diagnosis groups. Moreover, a preliminary validation of the model on FY 2005 data indicated that the results were substantially the same as the results of modeling resources in the four-equation structure using FY 2003 data.

Major differences in the 2005 data compared to the 2003 data concerned a small number of the primary and secondary diagnosis groups we identified for the case-mix model in the proposed rule: Cancer and psychiatric conditions [affective and other psychoses, depression (Psych 1 Group) and degenerative and other organic psychiatric disorders (Psych 2 Group)].

When we examined the model's estimates of the marginal resources associated with cancer and the Psych 1 group, we found that a distinction between primary and secondary diagnoses was not needed, as scores were generally similar across the equations. For Psych 2, our initial analyses had indicated that secondary diagnosis did not contribute to the statistical performance of the model. However, because the updated estimates suggested that secondary diagnoses should be considered, we combined secondary with primary diagnoses into a new group for these psychiatric conditions. Because these changes eliminated distinctions between primary and secondary diagnosis positioning on OASIS M0230/M0240, we welcomed them as a simplification of the case-mix model.

Interactions involving three of the neurological groups also reflected some changes. For example, we found that separating the interactions of functional limitations with multiple sclerosis (Neuro 4) into two line items in the proposed Table 2A in the Proposed Rule did not work well with the new data. However, combining all four functional limitation interactions recognized in the proposed model produced useful results. Based on estimates from the new data, we also modified the interaction of toileting with the remaining neurological groups, brain disorders and paralysis (Neuro 1), and peripheral neurological disorders (Neuro 2). The data revealed that peripheral neurological disorders (Neuro 2) in this interaction were no longer statistically significant, so this group was removed from the interaction.

In the 2005 data, incontinence was not associated with higher resource use, so it was deleted from the four-equation model. An interaction in the proposed model involving incontinence and certain neurological conditions [brain disorders and paralysis (Neuro 1)] was no longer statistically significant, and this variable was removed as well. Other differences in the four-equation model generally were limited to small point changes for specific scores. For example, a primary diagnosis of diabetes incurred an increase of one point in three of the four equations, while the interaction of stroke and dysphagia incurred a loss of one point in the third equation and a gain of one point in the first equation.

We also tested a suggestion from a commenter to include V-codes from ICD–9–CM for stoma. We defined variables using selected V-codes to serve as markers for patients with stoma other than colostomies and gastrostomies, which were already measured or proxied in our variable set. This change resulted in the addition of two major types of stoma. Specifically, we added appropriate variables to capture patients with resource needs due to tracheostomy and urostomy/cystostomy.

The final four-equation model, including the therapy visits and cross-leg equality restrictions, is presented in Exhibit 5.1. This is the model that was used for the Final Payment Rule.

As with the Kitchen Sink Model, the exhibit first provides results for legs one and two, followed by the corresponding results for legs three and four. The adjusted R-squared statistic was 0.4634, indicating that eliminating variables from the Kitchen Sink Model (for statistical and/or clinical reasons) and then imposing the additional restrictions on the model resulted in a loss of less than 1 percentage point in the ability of the Four-equation Model to account for variation in resource use. Variables whose coefficients have been restricted to be equal across two or more legs can be identified where coefficients and standard errors for two or more legs are identical for a given variable.

Exhibit 5.1—Legs One and Two (Early Episodes)

Four-equation "Final" Model Estimated for CY05 Two Decile File – for Final Payment Rule

Variable Name	Variable or 1st Variable in Interaction	Interaction Variable (Diagnostic Variables Are Secondary)	Leg One			Leg Two		
			N	Coeff	T Stat	N	Coeff	T Stat
Adjusted R Square			0.4634					
Mean Resource Use				392.48			904.52	
Intercept				152.92	93.75			
leg2	2nd Leg					94,789	388.53	118.50
leg3	3rd Leg							
leg4	4th Leg							
ther_01_01	1 Therapy Visit		21,931	-	NA	-		
ther_02_01	2 Therapy Visits		15,350	-	NA	-		
ther_03_01	3 Therapy Visits		15,894	-	NA	-		
ther_04_01	4 Therapy Visits		17,636	-	NA	-		
ther_05_01	5 Therapy Visits		23,344	-	NA	-		
ther_06_01	6 Therapy Visits		23,476	100.00	Infty	-		
ther_07_01	7 Therapy Visits		18,884	142.00	Infty	-		
ther_08_01	8 Therapy Visits		16,173	182.50	Infty	-		
ther_09_01	9 Therapy Visits		14,281	221.50	Infty	-		
ther_10_01	10 Therapy Visits		35,064	259.00	Infty	-		
ther_11_01	11 Therapy Visits		28,819	295.00	Infty	-		
ther_12_01	12 Therapy Visits		27,684	329.50	Infty	-		
ther_13_01	13 Therapy Visits		19,312	362.50	Infty	-		
ther_15_01	15 Therapy Visits		-			12,418	29.00	NA
ther_16_01	16 Therapy Visits		-			11,312	56.50	NA
ther_17_01	17 Therapy Visits		-			9,705	82.50	NA
ther_18_01	18 Therapy Visits		-			7,718	107.00	NA
ther_19_01	19 Therapy Visits		-			6,018	130.00	NA
ther_20_01	20 Therapy Visits		-			5,138	375.45	212.52
ther_21_01	21 Therapy Visits		-			4,297	375.45	212.52
ther_22_01	22 Therapy Visits		-			3,780	375.45	212.52
ther_23_01	23 Therapy Visits		-			3,327	375.45	212.52
ther_24_01	24 Therapy Visits		-			2,776	375.45	212.52
ther_25_01	25 Therapy Visits		-			2,363	375.45	212.52
ther_26_01	26 Therapy Visits		-			1,998	375.45	212.52
ther_27_01	27 Therapy Visits		-			1,467	375.45	212.52
ther_28_01	28 Therapy Visits		-			1,139	375.45	212.52
ther_29_01	29 Therapy Visits		-			970	375.45	212.52
ther_30_01	30 or More Therapy Visits		-			5,486	375.45	212.52
ther_IP_01	IV or Parenteral Therapy		11,169	82.06	28.37	703	153.31	15.73

Exhibit 5.1—Legs One and Two (Early Episodes)

Four-equation "Final" Model Estimated for CY05 Two Decile File – for Final Payment Rule

Variable Name	Variable or 1st Variable in Interaction	Interaction Variable (Diagnostic Variables Are Secondary)	Leg One			Leg Two		
			N	Coeff	T Stat	N	Coeff	T Stat
ther_e_01	Enteral Therapy		6,714	38.49	10.25	1,519	117.97	17.02
pain23_01	Pain		256,116	6.43	8.40	54,633		
vis_ge1_01	Vision		135,625	9.04	10.49	26,722		
bcont2_5_01	Bowel Incontinence		45,582	11.87	10.95	10,590	23.59	8.19
ostomy12_01	Ostomy		9,000	54.44	17.27	1,145	87.60	13.03
multpulc_01	Multiple Pressure Ulcers		2,113	30.20	5.06	263	30.20	5.06
press12_01	Pressure Ulcer stage = 1 and/or 2		24,031	47.53	32.15	5,508	114.35	35.11
press34_01	Pressure Ulcer stage = 3 and/or 4		7,782	157.00	46.27	1,139	262.23	33.73
stasis2_01	Stasis Ulcer healing status = 2		5,399	75.12	30.58	501	75.12	30.58
stasis3_01	Stasis Ulcer healing status = 3		5,083	108.35	39.70	371	108.35	39.70
surg2_01	Surgical Wound healing status = 2		78,382			12,201	18.44	7.28
surg3_01	Surgical Wound healing status = 3		15,127	41.36	21.80	1,370	41.36	21.80
dysp234_01	Dyspnea 2 to 4		204,631	19.80	27.01	37,288	19.80	27.01
dress13_01	Dressing 1 to 3		324,165	17.96	21.51	79,530	37.71	14.05
bth_ge2_01	Bathing >= 2		357,622	26.80	26.68	85,100	33.23	10.94
toi_ge2_01	Toileting >= 2		59,404	16.24	14.35	19,203	25.30	9.31
tfr_ge1_01	Transferring = 1		292,435			64,267		
tfr_ge2_01	Transferring >= 2		56,312			20,286	15.01	5.34
loco_ge1_01	Locomotion = 1 or 2		375,613	11.55	10.00	79,668		
loco_ge3_01	Locomotion >= 3		41,758	27.75	14.15	13,229	35.02	10.60
i_bms_bth_toi_tfr2_loco3_01	Primary or Secondary MS (Updated)	Bathing, Toileting, Transferring >= 2, Locomotion >= 3	2,126	33.59	6.98	757	33.59	6.98
Bblood_01	Primary or Secondary Blood Disorders		21,880	17.82	10.03	2,961	46.36	9.69
new_bpsych1_01	Primary or Secondary Psych 1 -- Affective Disorders and Paralysis		20,875	33.23	18.35	2,919	48.81	11.42
new_bpsych2_dd2_01	Primary or Secondary Psych 2 -- Degenerative and Other Organic Psychiatric Disorders		33,157	10.56	7.08	5,421	24.74	7.54
bgi_dd_01	Primary or Secondary GI and Abnormal Weight Loss		36,789	19.37	13.52	4,241	56.24	13.97
i_bgi_dd_anyneuro_01	Primary or Secondary GI and Abnormal Weight Loss	Neuro 1, Neuro 2, Neuro 3 or Neuro 4	2,945			766		
i_bgi_dd_ostomy12_01	Primary or Secondary GI and Abnormal Weight Loss	Ostomy 1 or 2	2,240	25.14	3.94	185		
I_bdysphagia_ther_e_01	Primary or Secondary Dysphagia	Enteral Therapy	1,842			566	57.90	4.47
i_bdysphagia_bstroke_dd2_01	Primary or Secondary Dysphagia	Primary or Secondary Stroke or Brain	1,043	18.67	2.68	1,016	62.99	7.84

Exhibit 5.1—Legs One and Two (Early Episodes)

Four-equation "Final" Model Estimated for CY05 Two Decile File – for Final Payment Rule

Variable Name	Variable or 1st Variable in Interaction	Interaction Variable (Diagnostic Variables Are Secondary)	Leg One			Leg Two		
			N	Coeff	T Stat	N	Coeff	T Stat
		Hemorrhage						
bcancer_l_01	Primary or Secondary Cancer		32,786	35.18	23.45	2,842	74.81	15.35
new_pneuro1_01	Primary Paralysis, Brain Other Than Hemorrhage, or Other Neurological (Neuro1)		1,902	25.36	4.23	734	76.48	8.05
i_bneuro1_bneuro2_dress13_01	Primary or Secondary Neuro 1 or Neuro 2	Dressing 1 to 3	18,813	15.09	9.46	6,902	38.15	11.25
i_new_bneuro1_toi_ge2_01	Primary or Secondary Paralysis, Brain Other Than Hemorrhage, or Other Neurological (Neuro1)	Toileting >=2	2,237	34.27	9.38	590	97.60	9.60
bstroke_dd2_01	Primary or Secondary Stroke (Neuro 3)		31,618			14,529	14.67	2.27
l_bstroke_dd2_loco_ge3_01	Primary or Secondary Stroke (Neuro 3)	Locomotion >= 3	6,031	9.50	2.35	3,224	53.24	9.06
i_bstroke_dd2_dress13_01	Primary or Secondary Stroke (Neuro 3)	Dressing 1 to 3	24,018	9.37	4.78	12,756	28.25	4.04
bheart_all_bhyper_all_01	Primary or Secondary Heart A, B, or C or Hypertension A, B, or C		220,977	33.62	43.48	33,330	67.89	38.38
v_trach_01	Tracheotomy		935	37.37	5.85	118	37.37	5.85
v_uro_stoma_01	Urinary or Cyst		1,599	56.70	8.86	121	225.16	12.26
injmeduse_0_01	Injectable Drug Use = 0		341,424	29.66	27.29	73,923	29.66	27.29
injmeduse_1_01	Injectable Drug Use = 1 (excluded category is missing)		69,963	36.24	25.53	13,620	42.83	15.97
pdm_all_01	Primary Diabetes (250.xx) and DM Manifestation Codes		35,933	47.66	32.37	2,874	117.71	23.86
sdm_all_01	Secondary Diabetes (250.xx) and DM Manifestation Codes		82,448	23.99	23.31	15,350	39.69	18.55
new_bpulm_01	Primary or Secondary Pulmonary (Including COPD)		53,964	9.69	6.52	7,013	48.01	16.66
i_bpulm_loco_01	Primary or Secondary Pulmonary (Including COPD)	Locomotion (1, 2, and >= 3)	46,828	11.36	5.83	6,813		
ptrauma_l2_01	Primary Skin 1		14,849	102.00	46.95	738	196.96	23.81
strauma_l2_01	Secondary Skin 1		7,805	64.55	23.87	1,366	64.55	23.87
new_btrauma2_01	Primary or Secondary Skin 2		25,311	59.37	34.19	2,072	119.79	24.01
i_b_alltrauma_ther_ip_01	Primary or Secondary Skin 1 or Skin 2	IV or Parenteral Therapy	2,529	23.87	4.64	131		
i_bortho_leg_ther_ip_01	Primary or Secondary All Ortho and Leg (No Gait)	IV or Parenteral Therapy	1,768	47.57	7.44	125	47.57	7.44
l_bleg_gait_press1234_01	Primary or Secondary Leg and Gait	Pressure Ulcer 1, 2, 3, or 4	6,776	18.53	5.50	3,176		
new_blind_l_01	Primary or Secondary Blindness or Low Vision		2,540	31.70	8.64	330	31.70	8.64

Exhibit 5.1—Legs Three and Four (Later Episodes)

Four-Equation "Final" Model Estimated for CY05 Two Decile File – for Final Payment Rule

Variable Name	Variable or 1st Variable in Interaction	Interaction Variable (Diagnostic Variables Are Secondary)	Leg One			Leg Two		
			N	Coeff	T Stat	N	Coeff	T Stat
Adjusted R Square			0.4634					
Mean Resource Use				372.22			940.92	
Intercept								
leg2	2nd Leg							
leg3	3rd Leg		207,525	39.93	18.39			
leg4	4th Leg					16,990	424.78	91.67
ther_01_01	1 Therapy Visit		4,977		NA	-		
ther_02_01	2 Therapy Visits		2,734		NA	-		
ther_03_01	3 Therapy Visits		2,493		NA	-		
ther_04_01	4 Therapy Visits		2,551		NA	-		
ther_05_01	5 Therapy Visits		2,594		NA	-		
ther_06_01	6 Therapy Visits		2,510	135.00	NA	-		
ther_07_01	7 Therapy Visits		2,112	177.00	NA	-		
ther_08_01	8 Therapy Visits		2,006	217.50	NA	-		
ther_09_01	9 Therapy Visits		1,927	256.50	NA	-		
ther_10_01	10 Therapy Visits		6,610	294.00	NA	-		
ther_11_01	11 Therapy Visits		5,223	330.00	NA	-		
ther_12_01	12 Therapy Visits		5,422	364.50	NA	-		
ther_13_01	13 Therapy Visits		3,527	397.50	NA	-		
ther_15_01	15 Therapy Visits		-			2,582	29.00	NA
ther_16_01	16 Therapy Visits		-			2,367	56.50	NA
ther_17_01	17 Therapy Visits		-			2,107	82.50	NA
ther_18_01	18 Therapy Visits		-			1,384	107.00	NA
ther_19_01	19 Therapy Visits		-			825	130.00	NA
ther_20_01	20 Therapy Visits		-			738	356.40	81.32
ther_21_01	21 Therapy Visits		-			657	356.40	81.32
ther_22_01	22 Therapy Visits		-			596	356.40	81.32
ther_23_01	23 Therapy Visits		-			483	356.40	81.32
ther_24_01	24 Therapy Visits		-			489	356.40	81.32
ther_25_01	25 Therapy Visits		-			383	356.40	81.32
ther_26_01	26 Therapy Visits		-			299	356.40	81.32
ther_27_01	27 Therapy Visits		-			195	356.40	81.32
ther_28_01	28 Therapy Visits		-			162	356.40	81.32
ther_29_01	29 Therapy Visits		-			136	356.40	81.32
ther_30_01	30 or More Therapy Visits		-			759	356.40	81.32
ther_IP_01	IV or Parenteral Therapy		5,224	47.40	12.83	288	116.24	7.61

Exhibit 5.1—Legs Three and Four (Later Episodes)

Four-Equation "Final" Model Estimated for CY05 Two Decile File – for Final Payment Rule

Variable Name	Variable or 1st Variable in Interaction	Interaction Variable (Diagnostic Variables Are Secondary)	Leg One			Leg Two		
			N	Coeff	T Stat	N	Coeff	T Stat
ther_e_01	Enteral Therapy		7,147			461	117.97	17.02
pain23_01	Pain		118,685			10,138		
vis_ge1_01	Vision		102,967			7,219	10.80	2.68
bcont2_5_01	Bowel Incontinence		46,541	11.87	10.95	3,386		
ostomy12_01	Ostomy		5,374	32.93	9.08	334	87.60	13.03
multpulc_01	Multiple Pressure Ulcers		3,737	50.37	10.25	147	50.37	10.25
press12_01	Pressure Ulcer stage = 1 and/or 2		14,685	47.53	32.15	1,328	114.35	35.11
press34_01	Pressure Ulcer stage = 3 and/or 4		10,931	124.59	40.41	536	227.09	19.84
stasis2_01	Stasis Ulcer healing status = 2		5,490	75.12	30.58	255	75.12	30.58
stasis3_01	Stasis Ulcer healing status = 3		3,730	108.35	39.70	145	108.35	39.70
surg2_01	Surgical Wound healing status = 2		6,664	31.66	9.63	764		
surg3_01	Surgical Wound healing status = 3		3,145	41.36	21.80	165	41.36	21.80
dysp234_01	Dyspnea 2 to 4		131,110			9,632		
dress13_01	Dressing 1 to 3		156,075	17.96	21.51	14,655	17.96	21.51
bth_ge2_01	Bathing >= 2		169,426	57.47	37.42	15,477	57.47	37.42
toi_ge2_01	Toileting >= 2		55,180	16.24	14.35	4,928		
tfr_ge1_01	Transferring = 1		124,438			10,685		
tfr_ge2_01	Transferring >= 2		49,294			4,842		
loco_ge1_01	Locomotion = 1 or 2		148,594	11.55	10.00	13,048		
loco_ge3_01	Locomotion >= 3		47,105	36.93	18.02	3,710	51.40	10.30
i_bms_bth_toi_tfr2_loco3_01	Primary or Secondary MS (Updated)	Bathing, Toileting, Transferring >= 2, Locomotion >= 3	4,934	123.51	32.18	386	178.47	13.18
Bblood_01	Primary or Secondary Blood Disorders		23,695			1,080		
new_bpsych1_01	Primary or Secondary Psych 1 -- Affective Disorders and Paralysis		14,121	17.05	7.62	774	48.81	11.42
new_bpsych2_dd2_01	Primary or Secondary Psych 2 -- Degenerative and Other Organic Psychiatric Disorders		20,124			1,165	24.74	7.54
bgi_dd_01	Primary or Secondary GI and Abnormal Weight Loss		18,442	6.41	3.00	863	39.82	4.46
i_bgi_dd_anyneuro_01	Primary or Secondary GI and Abnormal Weight Loss	Neuro 1, Neuro 2, Neuro 3 or Neuro 4	2,659	22.88	4.20	193		
i_bgi_dd_ostomy12_01	Primary or Secondary GI and Abnormal Weight Loss	Ostomy 1 or 2	900			47		
I_bdysphagia_ther_e_01	Primary or Secondary Dysphagia	Enteral Therapy	1,656			147		
i_bdysphagia_bstroke_dd2_01	Primary or Secondary Dysphagia	Primary or Secondary Stroke or Brain	693			134	62.99	7.84

Exhibit 5.1—Legs Three and Four (Later Episodes)

Four-Equation "Final" Model Estimated for CY05 Two Decile File – for Final Payment Rule

Variable Name	Variable or 1st Variable in Interaction	Interaction Variable (Diagnostic Variables Are Secondary)	Leg One			Leg Two		
			N	Coeff	T Stat	N	Coeff	T Stat
		Hemorrhage						
bcancer_l_01	Primary or Secondary Cancer		9,633	25.79	9.55	477	104.66	8.81
new_pneuro1_01	Primary Paralysis, Brain Other Than Hemorrhage, or Other Neurological (Neuro1)		1,070	53.96	6.63	167	76.48	8.05
i_bneuro1_bneuro2_dress13_01	Primary or Secondary Neuro 1 or Neuro 2	Dressing 1 to 3	16,132	15.09	9.46	1,615	22.12	3.23
i_new_bneuro1_toi_ge2_01	Primary or Secondary Paralysis, Brain Other Than Hemorrhage, or Other Neurological (Neuro1)	Toileting >=2	4,645	34.27	9.38	228	97.60	9.60
bstroke_dd2_01	Primary or Secondary Stroke (Neuro 3)		17,799			2,524		
l_bstroke_dd2_loco_ge3_01	Primary or Secondary Stroke (Neuro 3)	Locomotion >= 3	7,065			785		
i_bstroke_dd2_dress13_01	Primary or Secondary Stroke (Neuro 3)	Dressing 1 to 3	15,460	16.82	7.63	2,317	78.91	13.57
bheart_all_bhyper_all_01	Primary or Secondary Heart A, B, or C or Hypertension A, B, or C		114,190	9.79	8.27	7,085	79.40	19.63
v_trach_01	Tracheotomy		566	37.37	5.85	32		
v_uro_stoma_01	Urinary or Cyst		2,190	36.78	6.63	73	225.16	12.26
injmeduse_0_01	Injectable Drug Use = 0		28,247	34.13	20.65	5,610	49.06	11.36
injmeduse_1_01	Injectable Drug Use = 1 (excluded category is missing)		9,609	49.20	18.17	1,634	87.40	12.66
pdm_all_01	Primary Diabetes (250.xx) and DM Manifestation Codes		28,045	13.70	8.16	973	77.88	9.10
sdm_all_01	Secondary Diabetes (250.xx) and DM Manifestation Codes		46,292	12.55	9.16	3,799	39.69	18.55
new_bpulm_01	Primary or Secondary Pulmonary (Including COPD)		27,306	9.69	6.52	1,654	48.01	16.66
i_bpulm_loco_01	Primary or Secondary Pulmonary (Including COPD)	Locomotion (1, 2, and >= 3)	25,605			1,634		
ptrauma_l2_01	Primary Skin 1		6,406	77.69	23.29	226	196.96	23.81
strauma_l2_01	Secondary Skin 1		3,263	36.18	8.37	336	36.18	8.37
new_btrauma2_01	Primary or Secondary Skin 2		13,186	51.86	21.68	691	119.79	24.01
i_b_alltrauma_ther_ip_01	Primary or Secondary Skin 1 or Skin 2	IV or Parenteral Therapy	713	23.87	4.64	30		
i_bortho_leg_ther_ip_01	Primary or Secondary All Ortho and Leg (No Gait)	IV or Parenteral Therapy	724			70		
l_bleg_gait_press1234_01	Primary or Secondary Leg and Gait	Pressure Ulcer 1, 2, 3, or 4	2,245			674		
new_blind_l_01	Primary or Secondary Blindness or Low Vision	1,942	31.70	8.64	84	31.70	8.64	

6. New Groups, Relative Payment Weights, and Derivation of the Payment Rates

This section discusses how the versions of the four-equation model developed in Chapter 3 (for the Notice of Proposed Rulemaking (NPRM) and Chapter 5 (for the Final Payment Rule) were used to develop a new set of episode groups and relative payment weights This process includes the following steps:

- Calculate clinical, functional, and therapy use scores from the four-equation model.
- Convert those scores into clinical, functional, and therapy use "severity" levels to define payment groups.
- Calculate relative payment weights for the resulting episode groups.

These calculations are presented in the this chapter, first the calculations for the NPRM (Section 6.1) and then the calculations for the Final Payment Rule (Section 6.2)

6.1. Calculations for the NPRM

6.1.1. Clinical, Functional, and Therapy Use Scores

The coefficients from the final NPRM four-equation model (see Chapter 3) as estimated on the 2001-2003 data (Exhibit 3.8) were divided by 10 and rounded to the nearest whole number (or set equal to one if less than one). The resulting point values were then used to create clinical and functional scores. One issue was how to deal with interaction variables between a clinical and a functional variable. Placing all such clinical/functional interaction scores in the clinical score or in the functional score were both tested, before ultimately deciding to include clinical/functional interactions in the clinical scores. Exhibit 6.1 presents the resulting points for each variable in each leg of the model.

Similar point scores could also have been calculated for the therapy use variables. The purpose of such scores, however, is to define ranges of scores, or levels, for clinical, functional, and therapy use variables, that in turn define the new episode groups. It proved to be both easier and more direct to use the number of therapy visits directly to define therapy use severity levels for each of the four legs.

Exhibit 6.1

Clinical and Functional Point Scores by Leg: NPRM Four-Equation Model

Episode number within sequence of adjacent episodes: Therapy visits: *Leg:*	1 or 2 0-13 *1*	1 or 2 14+ *2*	3+ 0-13 *3*	3+ 14+ *4*
Clinical Variables				
Primary Diagnosis = Neuro 1 - Brain disorders and paralysis	3	5	5	5
Primary Diagnosis = Cancer, selected benign neoplasms	4	11	4	8
Primary Diagnosis = Diabetes, selected manifestations	5	11	2	9
Primary Diagnosis = Psych 1 - Affective and other psychoses, depression	6	13	2	5
Primary Diagnosis = Psych 2 - Degenerative and other organic psychiatric disorders	1	1		
Primary Diagnosis = Skin 1 -Traumatic wounds, burns, and post-operative complications	10	20	7	15
Primary or Other Diagnosis = Skin 2 - Ulcers and other skin conditions	5	7	3	7
Primary or Other Diagnosis = Blindness/Low Vision	2	2	4	4
Primary or Other Diagnosis = Blood disorders	1	4		
Primary or Other Diagnosis = Dysphagia	1	6	1	6
AND				
Primary or Other Diagnosis = Neuro 3 – Stroke				
Primary or Other Diagnosis = Dysphagia	2			
AND				
M0250 (Therapy at home) = 3 (Enteral)				
Primary or Other Diagnosis = Gastrointestinal disorders	2	5	1	5
Primary or Other Diagnosis = Gastrointestinal disorders	3	3		
AND				
M0550 (ostomy)= 1 or 2				
Primary or Other Diagnosis = Gastrointestinal disorders	1	1	3	3
AND				
Primary or Other Diagnosis = Neuro 1 - Brain disorders and paralysis, OR Neuro 2 - Peripheral neurological disorders, OR Neuro 3 - Stroke, OR Neuro 4 - Multiple Sclerosis				
Primary or Other Diagnosis = Heart Disease OR Hypertension	3	6	1	6
Primary or Other Diagnosis = Heart Disease			4	
AND				
M0250 (Therapy at home) = 1 (IV/Infusion) or 2(Parenteral)				
Primary or Other Diagnosis = Neuro 1 - Brain disorders and paralysis			1	
AND				
M0530 (Urinary incontinence) = 1 or 2				
Primary or Other Diagnosis = Neuro 1 - Brain disorders and paralysis	4	2	4	2
AND AT LEAST ONE OF THE FOLLOWING:				
M0690 (Transferring) = 2 or more				
OR				
M0700 (Ambulation) = 3 or more				
Primary or Other Diagnosis = Neuro 1 - Brain disorders and paralysis OR Neuro 2 - Peripheral neurological disorders	1	6	3	3
AND				
M0680 (Toileting) = 2 or more				
Primary or Other Diagnosis = Neuro 3 - Stroke		4		2
AND AT LEAST ONE OF THE FOLLOWING:				
M0690 (Transferring) = 1				
OR				
M0680 (Toileting) = 2 or more				
Clinical Variables (continued)				

Exhibit 6.1

Clinical and Functional Point Scores by Leg: NPRM Four-Equation Model

Episode number within sequence of adjacent episodes: Therapy visits: *Leg:*	1 or 2 0-13 *1*	1 or 2 14+ *2*	3+ 0-13 *3*	3+ 14+ *4*
Primary or Other Diagnosis = Neuro 3 - Stroke	1	4	1	2
AND AT LEAST ONE OF THE FOLLOWING:				
M0690 (Transferring) = 2 or more				
OR				
M0700 (Ambulation) = 3 or more				
Primary or Other Diagnosis = Neuro 4 - Multiple Sclerosis **AND AT LEAST ONE OF THE FOLLOWING:**	2	2	9	9
M0670 (bathing) = 2 or more				
OR				
M0680 (Toileting) = 2 or more				
Primary or Other Diagnosis = Neuro 4 - Multiple Sclerosis **AND AT LEAST ONE OF THE FOLLOWING:**	4	4	7	7
M0690 (Transferring) = 2 or more				
OR				
M0700 (Ambulation) = 3 or more				
Primary or Other Diagnosis = Ortho 1 - Leg Disorders or Gait Disorders	1			
AND				
M0460 (most problematic pressure ulcer stage)= 1, 2, 3 or 4				
Primary or Other Diagnosis = Ortho 1 - Leg OR Ortho 2 - Other orthopedic disorders	6	6	3	
AND				
M0250 (Therapy at home) = 1 (IV/Infusion) or 2 (Parenteral)				
Primary or Other Diagnosis = Pulmonary disorders		4		4
Primary or Other Diagnosis = Pulmonary disorders	2			
AND				
M0700 (Ambulation) = 1 or more				
Primary or Other Diagnosis = Skin 1 -Traumatic wounds, burns, and post-operative complications OR Skin 2 - Ulcers and other skin conditions	2	2	5	
AND				
M0250 (Therapy at home) = 1 (IV/Infusion) or 2 (Parenteral)				
Other Diagnosis = Cancer, selected benign neoplasms	2	5	2	2
Other Diagnosis = Diabetes, selected manifestations	2	4	1	4
Other Diagnosis = Psych 1 - Affective and other psychoses, depression	3	5	2	5
Other Diagnosis = Skin 1 - Traumatic wounds, burns, post-operative complications	5	8	4	8
M0250 (Therapy at home) = 1 (IV/Infusion) or 2 (Parenteral)	9	15	4	15
M0250 (Therapy at home) = 3 (Enteral)	3	12	1	6
M0390 (Vision) = 1 or more	1			
M0420 (Pain)= 2 or 3	1	1	1	1
M0450 = Two or more pressure ulcers at stage 3 or 4	4	4	5	5
M0460 (Most problematic pressure ulcer stage)= 1 or 2	5	10	5	10
M0460 (Most problematic pressure ulcer stage)= 3 or 4	14	22	11	18
M0476 (Stasis ulcer healing status)= 2	7	13	7	13

Exhibit 6.1

Clinical and Functional Point Scores by Leg: NPRM Four-Equation Model

Episode number within sequence of adjacent episodes: Therapy visits: *Leg:*	1 or 2 0-13 *1*	1 or 2 14+ *2*	3+ 0-13 *3*	3+ 14+ *4*
Clinical Variables (continued)				
M0476 (Stasis ulcer healing status)= 3	11	13	11	13
M0488 (Surgical wound healing status)= 2			3	7
M0488 (Surgical wound healing status)= 3	6	6	6	6
M0490 (Dyspnea) = 2, 3, or 4	2	3		2
M0530 (Urinary incontinence) = 1 or 2	1	1		
M0540 (Bowel Incontinence) = 2 to 5	1	3	1	3
M0550 (Ostomy)= 1 or 2	3	6	2	6
M0800 (Injectable Drug Use) = 0, 1, or 2	1	1	1	3
Functional Variables				
M0650 or M0660 (Dressing upper or lower body)= 1, 2, or 3	2	3	3	6
M0670 (Bathing) = 2 or more	3	4	6	6
M0680 (Toileting) = 2 or more	1	1	1	1
M0690 (Transferring) = 1		1		1
M0690 (Transferring) = 2 or more	1	4	1	5
M0700 (Ambulation) = 1 or 2			1	
M0700 (Ambulation) = 3 or more		2	3	

Sample: Episodes from January 2001 to September 2003 (1,656,551 episodes).

6.1.2. Clinical, Functional, and Therapy Use Levels

The four legs were first converted into five "steps" as follows:

- Step One – leg one (first and second episodes, 0-13 therapy visits) – early episodes, low therapy
- Step Two-1 – leg two (first and second episodes), 14-19 therapy visits. – early episodes, high therapy.
- Step Two-2 – leg four (3rd+ episodes), 14-19 therapy visits) – later episodes, high therapy
- Step Three – leg three (3rd+ episodes, 0 to 13 therapy visits) – later episodes, low therapy
- Step Four – legs two and four (all episodes), 20 or more therapy visits.- early AND later episodes, very high therapy

Originally, there were six steps, with Step Four (legs two and four, 20 or more therapy visits) divided into two parts – leg two, 20 or more therapy visits, and leg four, 20 or more therapy visits. The best ranges for clinical, functional, and therapy use scores for these two groups of episodes were so similar, however, that for convenience and simplicity they were combined.

Within each of the five steps, the clinical and functional scores and number of therapy visits were analyzed. Break points were then identified to divide episodes into relatively large, mutually exclusive ranges, or levels. In addition, the break points were selected to be reasonably consistent across steps. The ranges/levels for each of the five steps appear in Exhibit 6.2.

Exhibit 6.2

Clinical and Functional Score and Therapy Visit Ranges by Step – NPRM

Ranges/Levels	Step One (1st and 2nd Episodes, 0-13 Therapy Visits)	Step Two-1 (1st and 2nd Episodes, 14-19 Therapy Visits)	Step Two-2 (3rd+ Episodes, 14-19 Therapy Visits)	Step Three (3rd+ Episodes, 0-13 Therapy Visits)	Step Four (All Episodes, 20 or More Therapy Visits
Clinical	0-4	0-4	0-4	0-2	0-4
	5-9	5-12	5-12	3-4	5-12
	10 or More	13 or More	13 or More	5 or More	13 or More
Functional	0-3	0-5	0-8	0-8	0-5
	4-5	6-8	9-13	9-13	6-8
	6-8	9 or More	14 or More	14 or More	9 or More
Therapy Visits	0-5	14-15	14-15	0-5	20 or More
	6	16-17	16-17	6	
	7-9	18-19	18-19	7-9	
	10			10	
	11-13			11-13	

While the ranges vary across the five steps, the ranges in each step are combinations of the following:

- Clinical scores – 0-2, 3-4, 5-9, 10-12, and 13 or more.
- Functional scores – 0-3, 4-5, 6-8, 9-13, and 14 or more.
- Therapy visits – 0-5, 6, 7-9, 10, 11-13, 14-15, 16-17, 18-19, and 20 or more.

The various levels can be combined into 153 groups:

- Step One – 3 clinical * 3 functional * 5 therapy visit = 45 groups.
- Step Two-1 – 3 clinical * 3 functional * 3 therapy visit = 27 groups.
- Step Two-2 – 3 clinical * 3 functional * 3 therapy visit = 27 groups.
- Step Three – 3 clinical * 3 functional * 5 therapy visit = 45 groups.
- Step Four – 3 clinical * 3 functional * 1 therapy visit = 9 groups.

6.1.3. Relative Payment Weights for the 153 Episode Groups - NPRM

A series of indicator variables were then created to represent the groups, including:

- Step Two-1, Step Two-2, Step Three, and Step Four Indicator Variables. (Step One is the excluded group) – this allows each step's set of episode groups to differ from each other.

- Indicator variables for each clinical group within each step (lowest clinical level within each step is excluded).

- Indicator variables for each functional group within each step (lowest clinical level within each step is excluded).

- Indicator variables for each therapy visit group within each step (lowest therapy visit group within each step is excluded).

These indicator variables were then used as the independent, explanatory variables in a new regression model of total resource units (Exhibit 6.3). The overall adjusted R-squared statistic was 0.4277 (compared to 0.4393 for the final NPRM four-equation model).

Exhibit 6.3

Clinical, Functional, and Therapy Visit Group Regression Equation Results – NPRM

Description	Original Coefficient	Std. Error	T-Stat	Sig Level
Constant	194	0.55	355.97	<.0001
1st and 2nd Episodes, 14-19 Therapy Visits (Step Two-1)	335	1.99	168.25	<.0001
3rd+ Episodes, 14-19 Therapy Visits (Step Two-2)	338	6.13	55.16	<.0001
3rd+ Episodes, 0-13 Therapy Visits (Step Three)	39	1.12	34.93	<.0001
All Episodes, 20 or More Therapy Visits (Step Four)	633	2.48	255.40	<.0001
1st and 2nd Episodes, 6 Therapy Visits	81	1.16	69.47	<.0001
1st and 2nd Episodes, 7-9 Therapy Visits	149	0.81	183.35	<.0001
1st and 2nd Episodes, 10 Therapy Visits	235	1.05	224.46	<.0001
1st and 2nd Episodes, 11 to 13 Therapy Visits	299	0.75	399.45	<.0001
1st and 2nd Episodes, 16-17 Therapy Visits	65	1.59	41.09	<.0001
1st and 2nd Episodes, 18-19 Therapy Visits	126	1.75	72.04	<.0001
3rd+ Episodes, 16-17 Therapy Visits	63	4.29	14.63	<.0001
3rd+ Episodes, 18-19 Therapy Visits	134	5.09	26.42	<.0001
3rd+ Episodes, 6 Therapy Visits	120	3.81	31.45	<.0001
3rd+ Episodes, 7-9 Therapy Visits	177	2.43	72.81	<.0001
3rd+ Episodes, 10 Therapy Visits	270	2.90	93.24	<.0001
3rd+ Episodes, 11 to 13 Therapy Visits	330	2.00	165.05	<.0001
Step 1, Clinical Score 5 to 9	58	0.58	101.47	<.0001
Step 1, Clinical Score 10 or More	132	0.66	201.75	<.0001
Step 1, Functional Score 4 to 5	34	0.54	62.56	<.0001
Step 1, Functional Score 6 to 8	58	0.72	80.44	<.0001
Step Two-1, Clinical Score 5 to 12	82	1.68	48.90	<.0001
Step Two-1, Clinical Score 13 or More	191	1.80	106.25	<.0001
Step Two-1, Functional Score 6 to 8	41	1.75	23.46	<.0001
Step Two-1, Functional Score 9 or More	65	2.06	31.76	<.0001
Step Two-2, Clinical Score 5 to 12	103	5.29	19.50	<.0001
Step Two-2, Clinical Score 13 or More	214	5.25	40.68	<.0001
Step Two-2, Functional Score 9 to 13	60	5.34	11.22	<.0001
Step Two-2, Functional Score 14 or More	105	5.66	18.62	<.0001
Step 3, Clinical Score 3 to 4	21	1.09	19.58	<.0001
Step 3, Clinical Score 5 or More	94	0.97	97.08	<.0001
Step 3, Functional Score 9 to 13	64	0.99	64.18	<.0001
Step 3, Functional Score 14 or More	125	1.19	105.83	<.0001
Step 4, Clinical Score 5 to 12	89	2.06	43.17	<.0001
Step 4, Clinical Score 13 or More	212	2.14	98.94	<.0001
Step 4, Functional Score 6 to 8	74	2.44	30.58	<.0001
Step 4, Functional Score 9 or More	160	2.53	63.32	<.0001
Sample: Episodes from January 2001 to September 2003 (1,656,551 episodes).				

These "payment weight" regression results were then be used to calculate relative payment weights. To do this, we added the coefficients for the relevant indicator variables together and then divided these by the overall mean total resource units across all episodes (424.60 units). For example, for the Step Two-1 group with the second lowest clinical and functional levels and 15 to 16 therapy visits, the sum of coefficients is 652 (the 194 [constant] + 335 [Step Two-1 indicator] + 82 [second lowest clinical level is a score of 5 to 12] + 41 [second lowest functional level is a score of 41]). The resulting sum of these coefficients = 652 (with rounding), so the relative payment weight for this episode group would be = 652/424.60 = 1.5364.

One issue with weight calculations of this type is that they do not reflect the restrictions of the therapy visit coefficients from the four-equation model. To reflect these restrictions in the payment weight calculations, an alternative version of the final four-equation model was estimated where these restrictions were relaxed. For each number of therapy visits and each step, the number of episodes with that number of therapy visits was multiplied by the restricted coefficients and then by the unrestricted coefficients. These dot products (N*restricted coefficient and N*unrestricted coefficients) were then summed for each therapy visit level. The resulting ratio of the restricted to unrestricted sum of the dot products was then calculated. The resulting "payment weight adjustment ratio" was then applied to the initial relative payment weight increment for each therapy visit level for each step, to reduce the impact of therapy visits. Without these adjustments, the payment regression would fail to reflect the gradually declining cost per added therapy visit assumed in the estimation of the four-equation model.

Exhibit 6.4 presents the regression coefficients before and after these adjustments. While most of the unadjusted and adjusted coefficients were nearly equal, as one would expect, the adjusted coefficients for the service use variables were lower, often much lower, than the unadjusted service use variable coefficients. To offset these reductions, the adjusted coefficients for all other variables (clinical and functional level indicators, step indicators, and the intercept) were higher than their unadjusted coefficients.

Exhibit 6.4

NPRM Payment Weight Regression Coefficients: Before ("Original") and After ("Adjusted") Adjustment to Reflect Restrictions on Therapy Visit Variables

Variable Name	Description	Original Coefficient	Adjusted Coefficient
Intercept		194	198
step2_1	1st and 2nd Episodes, 14-19 Therapy Visits	335	340
step2_2	3rd+ Episodes, 14-19 Therapy Visits	338	341
step3	3rd+ Episodes, 0-13 Therapy Visits	39	33
step4	All Episodes, 20 or More Therapy Visits	633	626
ser_1_2	1st and 2nd Episodes, 6 Therapy Visits	81	78
ser_1_3	1st and 2nd Episodes, 7-9 Therapy Visits	149	146
ser_1_4	1st and 2nd Episodes, 10 Therapy Visits	235	215
ser_1_5	1st and 2nd Episodes, 11 to 13 Therapy Visits	299	275
ser_2_1_2	1st and 2nd Episodes, 16-17 Therapy Visits	65	67
ser_2_1_3	1st and 2nd Episodes, 18-19 Therapy Visits	126	109
ser_2_2_2	3rd+ Episodes, 16-17 Therapy Visits	63	46
ser_2_2_3	3rd+ Episodes, 18-19 Therapy Visits	134	112
ser_3_2	3rd+ Episodes, 6 Therapy Visits	120	101
ser_3_3	3rd+ Episodes, 7-9 Therapy Visits	177	170
ser_3_4	3rd+ Episodes, 10 Therapy Visits	270	236
ser_3_5	3rd+ Episodes, 11 to 13 Therapy Visits	330	296

Exhibit 6.4

NPRM Payment Weight Regression Coefficients: Before ("Original") and After ("Adjusted") Adjustment to Reflect Restrictions on Therapy Visit Variables

Variable Name	Description	Original Coefficient	Adjusted Coefficient
clin1_grp_r_1_2	Step 1, Clinical Score 5 to 9	58	60
clin1_grp_r_1_3	Step 1, Clinical Score 10 or More	132	135
func1_grp_r_1_2	Step 1, Functional Score 4 to 5	34	34
func1_grp_r_1_3	Step 1, Functional Score 6 to 8	58	59
clin1_grp_r_2_1_2	Step 2_1, Clinical Score 5 to 12	82	84
clin1_grp_r_2_1_3	Step 2_1, Clinical Score 13 or More	191	195
func1_grp_r_2_1_2	Step 2_1, Functional Score 6 to 8	41	42
func1_grp_r_2_1_3	Step 2_1, Functional Score 9 or More	65	67
clin1_grp_r_2_2_2	Step 2_2, Clinical Score 5 to 12	103	105
clin1_grp_r_2_2_3	Step 2_2, Clinical Score 13 or More	214	218
func1_grp_r_2_2_2	Step 2_2, Functional Score 9 to 13	60	61
func1_grp_r_2_2_3	Step 2_2, Functional Score 14 or More	105	108
clin1_grp_r_3_2	Step 3, Clinical Score 3 to 4	21	22
clin1_grp_r_3_3	Step 3, Clinical Score 5 or More	94	96
func1_grp_r_3_2	Step 3, Functional Score 9 to 13	64	65
func1_grp_r_3_3	Step 3, Functional Score 14 or More	125	128
clin1_grp_r_4_2	Step 4, Clinical Score 5 to 12	89	91
clin1_grp_r_4_3	Step 4, Clinical Score 13 or More	212	217
func1_grp_r_4_2	Step 4, Functional Score 6 to 8	74	76
func1_grp_r_4_3	Step 4, Functional Score 9 or More	160	163
Sample: Episodes from January 2001 to September 2003 (1,656,551 episodes).			

Relative payment weights should average 1.0000 across all the episodes. If the therapy visit increments are reduced, the increments for the clinical and functional levels must be increased. The same percentage amount (2.056%) was applied to increase all the other payment weight increments in the model. This resulted in a set of relative payment weights for the 153 episode groups used for the NPRM (the base payment weights presented in Exhibit 6.5).

Instead of using payment regressions to calculate relative payment weights, another option would be to first define the various episode groups using the clinical, functional, and service use scores/visits, and then use a measure of resource use for each episode group, such as the mean (or median) number of actual total resource use units for each episode group. There are two main reasons against using this alternative approach:

- The effect of each clinical, functional, or service use "level" is not equal – under a payment weight regression approach, the incremental effect of moving to a higher clinical, functional, or service use level is the same across groups. For example, in Step One, the effect on weights of moving from a clinical score level of 0 to 4 points to a level of 5 to 9 points levels is the same for all combinations of functional and service use levels. This would not be the case if mean (or median) total resource use units were used.

- Weights may not steadily increase as clinical, functional, or service use levels increase – for example, suppose functional and service use levels are the same for two different episode groups, but that one group has a higher clinical level than the other group. There is no

assurance when using mean (or median) total resource use units that weights for the episode group with the higher clinical level will have a higher weight.

For these reasons, the payment weight regression approach was used to calculate relative payment weights.

6.1.4. Calculation of Payment Weights and Rates for the NPRM

Having developed the relative payment weights for the 153 payment groups, additional calculations were needed to translate these to payment rates that would meet CMS statutory and policy needs – for regular episodes and for episodes with payment adjustments – within existing budgetary targets.

To develop the payment weights and rates (and subsequent impact analysis) shown in the NPRM, a new data set was employed, consisting of a 20% random sample of episodes with starting dates from August 1, 2002 to September 30, 2003.[16] In contrast with the consistent data set used to develop case-mix refinements, which included only normal episodes, the data set used for the impact analyses included all episodes, including normal, SCIC, PEP, LUPA, and outlier episodes. The data set included a total of 817,679 episodes, and we excluded 129 episodes because they could not be linked to their 2007 wage index values. Thus, 817,550 episodes were included in these analyses.

The first step in these analyses was to estimate payments under the original PPS model. Original system payments equal the sum of base payments and outlier payments (where outlier payments exist only for normal, SCIC, and PEP episodes). Base payments were calculated using the following equations:

- Normal episodes:
  - basepay = stdamt*cwgt1*(cbsaindx*wageadj + 1 - wageadj)

- SCIC and PEP episodes:
  - basepay = stdamt*(wageadj*cbsaindx + 1 - wageadj) * (payday1*cwgt1+payday2*cwgt2+payday3*cwgt3+ *cwgt4+payday5*cwgt5+payday6*cwgt6)/60

- LUPA episodes:
  - basepay = (cbsaindx*wageadj + 1 - wageadj)*(totaid*aidamt + totmss*mssamt + totocc*occamt + totphy*phyamt + totskn*sknamt + totspc*spcamt)

where:

- Basepay = base payment amount.

- Stdamt = standardized payment amount.

[16] A second set of analyses was conducted when this data set was limited to FY 2003 (October 1, 2002 to September 30, 2003), but the results were qualitatively almost identical.

- Cwgt1 to Cwgt6 = current relative payment weights (based on HHRGs) for up to six segments within each episode (there are multiple segments for SCIC episodes). No episode has more than six segments. Cwgt2 to Cwgt6 are equal to zero if these segments do not exist.

- Wageadj – the wage adjustment percentage – all payments are adjusted to reflect differences in local wages by geographic area, and wage adjustment percentage is an estimate of labor's share of total costs for home health agencies.

- CBSAindx – is the (2007) Medicare hospital CBSA wage index value that CMS reports in its annual HHA payment update regulation.

- Payday1 to Payday6 – number of days for each segment within an episode for SCIC and PEP episodes (these are divided by 60 [60-day episodes] to calculate per diem payments).

- Totaid, totmss, totocc, totphy, totskn, and totspc – the total number of aide visits, MSS visits, occupational visits, physical therapy visits, skilled nursing visits, and speech therapy visits, respectively. These are used to help determine LUPA base payment amounts as well as outlier payments (see below).

- Aidamt, mssamt, occamt, phyamt, sknamt, and spcamt – these are the aide, MSS, occupational therapy, physical therapy, skilled nursing, and speech therapy per visit amounts. LUPA payments are equal to visits times per visit amounts summed across visit types, which are then wage adjusted.

For normal, SCIC, and PEP episodes, the following calculation is made:

tvcost = (cbsaindx*wageadj + 1 - wageadj)*(totaid*aidamt + totmss*mssamt + totocc*occamt + totphy*phyamt + totskn*sknamt + totspc*spcamt)

Where tvcost is total variable cost. That is, for each of these episodes, its costs, estimated at the per visit payment amounts (wage adjusted), are calculated. That total variable cost is then compared to the following amount:

out_thresh = sum(basepay,outamt*(wageadj*cbsaindx + 1 - wageadj))

This is the outlier threshold amount, which is equal to sum of the episode's base payment amount and the outlier amount (outamt), also called the fixed dollar loss (FDL) threshold, a constant value established each year by CMS. The FDL is also wage adjusted. If the episode's total variable cost exceeds its outlier threshold amount, additional outlier payments are made equal to 80% of the difference between the episode's total variable cost and outlier threshold. Please note that for LUPA episodes, total variable costs and base payment amounts are equal – the outlier threshold can never be exceeded for LUPA episodes.

The following parameters were used to simulate current payments for calendar years 2007 and 2008:

CY07:

- Standardized payment amount: $2,339.00

- Fixed dollar loss threshold: $1,567.13 (67% of standardized payment amount)
- Wage adjustment percentage: 76.775%
- Aide visit payment: $46.24
- MSS visit payment: $163.68
- OT visit payment: $112.40
- PT visit payment: $111.65
- Skilled nursing visit payment: $102.11
- Speech therapy visit payment: $121.32

CY08:

- Standardized payment amount: $2,406.83
- Fixed dollar loss threshold: $1,612.58 (67% of standardized payment amount)
- Wage adjustment percentage: 77.082%
- Aid visit payment: $47.58
- MSS visit payment: $168.43
- OT visit payment: $115.66
- PT visit payment: $114.89
- Skilled nursing visit payment: $105.07
- Speech therapy visit payment: $124.74

These two calculations served as comparisons for subsequent simulated payment amounts.

In addition, we calculated episode payment amounts using the new relative payment weights, but with the following additional changes:

- Treating SCIC episodes (including episodes that are both SCIC and PEP) as normal episodes – i.e., the relative payment weight for the first segment is maintained throughout the entire episode.

- Making separate payments for non-routine supplies for all non-LUPA episodes.

- Giving an additional payment to LUPA episodes that are also first episodes (a LUPA add-on amount).

- Fixing the outlier fixed dollar loss percentage at 67% of the standardized payment amount.

The first step was to establish an initial budget target. The CY08 payments calculated above were used, excluding outlier payments. These payments were then multiplied by 1.05 to allow for outlier payments. Next, all payments except LUPA payments were reduced by 2.75%, CMS's estimate of nominal case-mix change. The case-mix change adjustment was not applied to LUPA payments, because these payments do not depend on case-mix. The resulting initial budget target for these calculations was $2,004.968 million.

CMS provided the following additional parameters:

- NRS relative payment weights and an NRS payment conversion factor ($53.91). Each non-LUPA episode was assigned to one of five NRS payment groups with the following NRS relative payment weights:
  - 1: 0.2456
  - 2: 1.0356
  - 3: 2.0746
  - 4: 4.0776
  - 5: 6.9612

- LUPA add-on amount – $92.03

A first set of payments was simulated that excluded outlier payments. All wage adjustments used the CY08 77.082% wage adjustment percentage. NRS payments were equal to the relative payment weights times the conversion factor ($53.91) times 1.05 (to allow for outlier payments in the second simulation). Non-routine supplies are assumed to be purchased at national prices, so no wage adjustment was applied. The LUPA add-on amount ($92.03) was also multiplied by 1.05 and wage adjusted, and then added to LUPA episodes that were first episodes. LUPA base payment amounts were then calculated using the CY08 per visit amounts, again multiplied by 1.05 (to allow for outlier payments), and wage adjusted.

The normal, PEP, and SCIC base payment amounts were then calculated using the new relative payment weights for the 153 episode groups. Before using the payment weights calculated from the consistent data set, the following two adjustment factors were applied:

- Weight normalization factor = 0.996326 – this is the factor needed so that relative payment weights for the 153 groups average 1.0000 for the payment simulation/impact analysis file.[17]

- Weight equalization factor – 1.194227 – over time, the current average case-mix weight has exceeded 1.0000; this factor, sometimes called a budget neutrality adjustment to the weights, is applied to the normalized relative payment weights for the 153 groups, so that average case-mix for the current HHRGs equals that for the 153 groups.

Exhibit 6.5 presents the relative payment weights for the 153 new episode groups – base weight, normalized weight (with the weight normalization factor applied), and final weight (with the weight normalization and weight equalization factors applied).

[17] A weight normalization factor was required for two reasons. First, the data set used to estimate the payment weight regressions, and thus to calculate relative payment weights, was not the same as the data set used for the payment simulation analyses. Even if the same data set were used to estimate the payment weight regressions and to estimate the impact analyses, there is still another reason why a weight normalization factor is required. That is because the four-equation models and payment weight regression models were estimated excluding SCIC and PEP episodes, while the payment simulation/impact analyses included these episodes. There is no reason why the average relative payment weights for SCIC and PEP episodes would be the same as that for normal and outlier episodes (i.e., the episodes used in the four-equation and payment weight regression models).

Exhibit 6.5

NPRM Relative Payment Weights for 153 Episode Groups

Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	Base Wgt	Normalized Wgt	Final Wgt
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	0 to 3	0-5 Therapy Visits	0.4664	0.4647	0.5549
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	0 to 3	6 Therapy Visits	0.6507	0.6483	0.7742
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	0 to 3	7-9 Therapy Visits	0.8111	0.8081	0.9650
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	0 to 3	10 Therapy Visits	0.9734	0.9698	1.1582
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	0 to 3	11 to 13 Therapy Visits	1.1137	1.1096	1.3251
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	4 to 5	0-5 Therapy Visits	0.5473	0.5453	0.6512
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	4 to 5	6 Therapy Visits	0.7316	0.7289	0.8705
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	4 to 5	7-9 Therapy Visits	0.8920	0.8887	1.0613
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	4 to 5	10 Therapy Visits	1.0543	1.0504	1.2544
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	4 to 5	11 to 13 Therapy Visits	1.1946	1.1902	1.4213
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	6 to 8	0-5 Therapy Visits	0.6061	0.6039	0.7212
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	6 to 8	6 Therapy Visits	0.7904	0.7875	0.9405
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	6 to 8	7-9 Therapy Visits	0.9508	0.9473	1.1313
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	6 to 8	10 Therapy Visits	1.1131	1.1090	1.3244
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	0 to 4	6 to 8	11 to 13 Therapy Visits	1.2534	1.2488	1.4914
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	0 to 3	0-5 Therapy Visits	0.6067	0.6045	0.7219
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	0 to 3	6 Therapy Visits	0.7910	0.7881	0.9412
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	0 to 3	7-9 Therapy Visits	0.9514	0.9479	1.1320
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	0 to 3	10 Therapy Visits	1.1137	1.1096	1.3251
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	0 to 3	11 to 13 Therapy Visits	1.2540	1.2494	1.4921
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	4 to 5	0-5 Therapy Visits	0.6876	0.6851	0.8181
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	4 to 5	6 Therapy Visits	0.8719	0.8687	1.0374
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	4 to 5	7-9 Therapy Visits	1.0323	1.0285	1.2282
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	4 to 5	10 Therapy Visits	1.1946	1.1902	1.4214
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	4 to 5	11 to 13 Therapy Visits	1.3349	1.3300	1.5883
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	6 to 8	0-5 Therapy Visits	0.7464	0.7437	0.8881
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	6 to 8	6 Therapy Visits	0.9307	0.9273	1.1074
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	6 to 8	7-9 Therapy Visits	1.0911	1.0871	1.2983
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	6 to 8	10 Therapy Visits	1.2534	1.2488	1.4914
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	5 to 9	6 to 8	11 to 13 Therapy Visits	1.3937	1.3886	1.6583
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	0 to 3	0-5 Therapy Visits	0.7840	0.7812	0.9329
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	0 to 3	6 Therapy Visits	0.9683	0.9648	1.1522
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	0 to 3	7-9 Therapy Visits	1.1287	1.1246	1.3430
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	0 to 3	10 Therapy Visits	1.2911	1.2863	1.5362
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	0 to 3	11 to 13 Therapy Visits	1.4313	1.4261	1.7031

Exhibit 6.5

NPRM Relative Payment Weights for 153 Episode Groups

Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	Base Wgt	Normalized Wgt	Final Wgt
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	4 to 5	0-5 Therapy Visits	0.8649	0.8618	1.0291
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	4 to 5	6 Therapy Visits	1.0492	1.0454	1.2484
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	4 to 5	7-9 Therapy Visits	1.2096	1.2052	1.4393
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	4 to 5	10 Therapy Visits	1.3720	1.3669	1.6324
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	4 to 5	11 to 13 Therapy Visits	1.5122	1.5067	1.7993
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	6 to 8	0-5 Therapy Visits	0.9238	0.9204	1.0992
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	6 to 8	6 Therapy Visits	1.1081	1.1040	1.3184
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	6 to 8	7-9 Therapy Visits	1.2685	1.2638	1.5093
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	6 to 8	10 Therapy Visits	1.4308	1.4255	1.7024
1st and 2nd Episodes, 0 to 13 Therapy Visits (Step One)	10 or More	6 to 8	11 to 13 Therapy Visits	1.5711	1.5653	1.8693
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	0 to 5	14-15 Therapy Visits	1.2669	1.2622	1.5074
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	0 to 5	16-17 Therapy Visits	1.4237	1.4185	1.6940
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	0 to 5	18-19 Therapy Visits	1.5245	1.5189	1.8140
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	6 to 8	14-15 Therapy Visits	1.3658	1.3608	1.6251
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	6 to 8	16-17 Therapy Visits	1.5227	1.5171	1.8117
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	6 to 8	18 to 19 Therapy Visits	1.6235	1.6175	1.9317
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	9 or More	14-15 Therapy Visits	1.4238	1.4186	1.6941
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	9 or More	16-17 Therapy Visits	1.5807	1.5749	1.8807
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	0 to 4	9 or More	18-19 Therapy Visits	1.6815	1.6753	2.0007
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	0 to 5	14-15 Therapy Visits	1.4640	1.4586	1.7419
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	0 to 5	16-17 Therapy Visits	1.6208	1.6149	1.9285
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	0 to 5	18-19 Therapy Visits	1.7216	1.7153	2.0485
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	6 to 8	14-15 Therapy Visits	1.5629	1.5572	1.8596
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	6 to 8	16-17 Therapy Visits	1.7198	1.7135	2.0463
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	6 to 8	18-19 Therapy Visits	1.8206	1.8139	2.1662
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	9 or More	14-15 Therapy Visits	1.6209	1.6150	1.9286
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	9 or More	16-17 Therapy Visits	1.7778	1.7712	2.1153
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	9 or More	18-19 Therapy Visits	1.8786	1.8717	2.2352
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	0 to 5	14-15 Therapy Visits	1.7264	1.7200	2.0541
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	0 to 5	16-17 Therapy Visits	1.8832	1.8763	2.2407
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	0 to 5	18-19 Therapy Visits	1.9840	1.9767	2.3607
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	6 to 8	14-15 Therapy Visits	1.8253	1.8186	2.1718
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	6 to 8	16-17 Therapy Visits	1.9822	1.9749	2.3584
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	6 to 8	18 to 19 Therapy Visits	2.0829	2.0753	2.4784
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	9 or More	14-15 Therapy Visits	1.8833	1.8764	2.2408

Exhibit 6.5

NPRM Relative Payment Weights for 153 Episode Groups

Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	Base Wgt	Normalized Wgt	Final Wgt
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	9 or More	16-17 Therapy Visits	2.0401	2.0327	2.4274
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	9 or More	18-19 Therapy Visits	2.1409	2.1331	2.5474
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	0 to 8	14-15 Therapy Visits	1.2696	1.2649	1.5106
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	0 to 8	16-17 Therapy Visits	1.3773	1.3722	1.6387
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	0 to 8	18-19 Therapy Visits	1.5323	1.5267	1.8232
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	9 to 13	14-15 Therapy Visits	1.4136	1.4084	1.6820
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	9 to 13	16-17 Therapy Visits	1.5213	1.5157	1.8101
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	9 to 13	18-19 Therapy Visits	1.6763	1.6702	1.9946
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	14 or More	14-15 Therapy Visits	1.5229	1.5173	1.8120
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	14 or More	16-17 Therapy Visits	1.6305	1.6246	1.9401
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	14 or More	18-19 Therapy Visits	1.7856	1.7790	2.1246
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	0 to 5	14-15 Therapy Visits	1.4640	1.4586	1.7419
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	0 to 5	16-17 Therapy Visits	1.6208	1.6149	1.9285
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	0 to 5	18-19 Therapy Visits	1.7216	1.7153	2.0485
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	6 to 8	14-15 Therapy Visits	1.5629	1.5572	1.8596
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	6 to 8	16-17 Therapy Visits	1.7198	1.7135	2.0463
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	6 to 8	18-19 Therapy Visits	1.8206	1.8139	2.1662
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	9 or More	14-15 Therapy Visits	1.6209	1.6150	1.9286
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	9 or More	16-17 Therapy Visits	1.7778	1.7712	2.1153
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	5 to 12	9 or More	18-19 Therapy Visits	1.8786	1.8717	2.2352
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	0 to 5	14-15 Therapy Visits	1.7264	1.7200	2.0541
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	0 to 5	16-17 Therapy Visits	1.8832	1.8763	2.2407
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	0 to 5	18-19 Therapy Visits	1.9840	1.9767	2.3607
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	6 to 8	14-15 Therapy Visits	1.8253	1.8186	2.1718
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	6 to 8	16-17 Therapy Visits	1.9822	1.9749	2.3584
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	6 to 8	18 to 19 Therapy Visits	2.0829	2.0753	2.4784
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	9 or More	14-15 Therapy Visits	1.8833	1.8764	2.2408
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	9 or More	16-17 Therapy Visits	2.0401	2.0327	2.4274
1st and 2nd Episodes, 14 to 19 Therapy Visits (Step Two-1)	13 or More	9 or More	18-19 Therapy Visits	2.1409	2.1331	2.5474
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	0 to 8	14-15 Therapy Visits	1.2696	1.2649	1.5106
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	0 to 8	16-17 Therapy Visits	1.3773	1.3722	1.6387
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	0 to 8	18-19 Therapy Visits	1.5323	1.5267	1.8232
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	9 to 13	14-15 Therapy Visits	1.4136	1.4084	1.6820
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	9 to 13	16-17 Therapy Visits	1.5213	1.5157	1.8101
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	9 to 13	18-19 Therapy Visits	1.6763	1.6702	1.9946

Exhibit 6.5

NPRM Relative Payment Weights for 153 Episode Groups

Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	Base Wgt	Normalized Wgt	Final Wgt
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	14 or More	14-15 Therapy Visits	1.5229	1.5173	1.8120
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	14 or More	16-17 Therapy Visits	1.6305	1.6246	1.9401
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	0 to 4	14 or More	18-19 Therapy Visits	1.7856	1.7790	2.1246
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	0 to 8	14-15 Therapy Visits	1.5176	1.5120	1.8057
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	0 to 8	16-17 Therapy Visits	1.6252	1.6193	1.9338
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	0 to 8	18-19 Therapy Visits	1.7803	1.7737	2.1182
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	9 to 13	14-15 Therapy Visits	1.6616	1.6555	1.9770
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	9 to 13	16-17 Therapy Visits	1.7693	1.7628	2.1051
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	9 to 13	18-19 Therapy Visits	1.9243	1.9172	2.2896
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	14 or More	14-15 Therapy Visits	1.7708	1.7643	2.1070
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	14 or More	16-17 Therapy Visits	1.8785	1.8716	2.2351
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	5 to 12	14 or More	18-19 Therapy Visits	2.0335	2.0261	2.4196
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	0 to 8	14-15 Therapy Visits	1.7830	1.7764	2.1214
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	0 to 8	16-17 Therapy Visits	1.8906	1.8837	2.2495
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	0 to 8	18-19 Therapy Visits	2.0457	2.0381	2.4340
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	9 to 13	14-15 Therapy Visits	1.9270	1.9199	2.2928
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	9 to 13	16-17 Therapy Visits	2.0347	2.0272	2.4209
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	9 to 13	18-19 Therapy Visits	2.1897	2.1816	2.6054
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	14 or More	14-15 Therapy Visits	2.0362	2.0288	2.4228
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	14 or More	16-17 Therapy Visits	2.1439	2.1360	2.5509
3rd+ Episodes, 14 to 19 Therapy Visits (Step Two-2)	13 or More	14 or More	18-19 Therapy Visits	2.2989	2.2905	2.7354
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	0 to 8	0-5 Therapy Visits	0.5441	0.5421	0.6474
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	0 to 8	6 Therapy Visits	0.7822	0.7794	0.9307
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	0 to 8	7-9 Therapy Visits	0.9435	0.9400	1.1226
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	0 to 8	10 Therapy Visits	1.0999	1.0959	1.3087
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	0 to 8	11 to 13 Therapy Visits	1.2411	1.2366	1.4768
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	9 to 13	0-5 Therapy Visits	0.6970	0.6945	0.8294
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	9 to 13	6 Therapy Visits	0.9351	0.9317	1.1127
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	9 to 13	7-9 Therapy Visits	1.0964	1.0923	1.3045
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	9 to 13	10 Therapy Visits	1.2528	1.2482	1.4906
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	9 to 13	11 to 13 Therapy Visits	1.3940	1.3889	1.6587
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	14 or More	0-5 Therapy Visits	0.8458	0.8427	1.0063
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	14 or More	6 Therapy Visits	1.0839	1.0799	1.2896
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	14 or More	7-9 Therapy Visits	1.2451	1.2405	1.4815
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	14 or More	10 Therapy Visits	1.4015	1.3964	1.6676

Exhibit 6.5

NPRM Relative Payment Weights for 153 Episode Groups

Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	Base Wgt	Normalized Wgt	Final Wgt
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	0 to 2	14 or More	11 to 13 Therapy Visits	1.5428	1.5371	1.8357
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	0 to 8	0-5 Therapy Visits	0.5955	0.5933	0.7085
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	0 to 8	6 Therapy Visits	0.8336	0.8305	0.9918
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	0 to 8	7-9 Therapy Visits	0.9948	0.9912	1.1837
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	0 to 8	10 Therapy Visits	1.1512	1.1470	1.3698
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	0 to 8	11 to 13 Therapy Visits	1.2925	1.2877	1.5378
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	9 to 13	0-5 Therapy Visits	0.7484	0.7456	0.8904
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	9 to 13	6 Therapy Visits	0.9865	0.9828	1.1737
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	9 to 13	7-9 Therapy Visits	1.1477	1.1435	1.3656
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	9 to 13	10 Therapy Visits	1.3041	1.2993	1.5517
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	9 to 13	11 to 13 Therapy Visits	1.4454	1.4401	1.7198
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	14 or More	0-5 Therapy Visits	0.8971	0.8938	1.0674
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	14 or More	6 Therapy Visits	1.1352	1.1310	1.3507
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	14 or More	7-9 Therapy Visits	1.2965	1.2917	1.5426
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	14 or More	10 Therapy Visits	1.4529	1.4475	1.7287
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	3 to 4	14 or More	11 to 13 Therapy Visits	1.5941	1.5883	1.8967
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	0 to 8	0-5 Therapy Visits	0.7704	0.7676	0.9166
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	0 to 8	6 Therapy Visits	1.0085	1.0048	1.1999
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	0 to 8	7-9 Therapy Visits	1.1697	1.1654	1.3918
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	0 to 8	10 Therapy Visits	1.3261	1.3213	1.5779
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	0 to 8	11 to 13 Therapy Visits	1.4674	1.4620	1.7460
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	9 to 13	0-5 Therapy Visits	0.9233	0.9199	1.0986
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	9 to 13	6 Therapy Visits	1.1614	1.1571	1.3819
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	9 to 13	7-9 Therapy Visits	1.3226	1.3178	1.5737
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	9 to 13	10 Therapy Visits	1.4790	1.4736	1.7598
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	9 to 13	11 to 13 Therapy Visits	1.6203	1.6143	1.9279
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	14 or More	0-5 Therapy Visits	1.0720	1.0681	1.2755
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	14 or More	6 Therapy Visits	1.3101	1.3053	1.5588
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	14 or More	7-9 Therapy Visits	1.4714	1.4660	1.7507
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	14 or More	10 Therapy Visits	1.6278	1.6218	1.9368
3rd+ Episodes, 0 to 13 Therapy Visits (Step Three)	5 or More	14 or More	11 to 13 Therapy Visits	1.7690	1.7625	2.1049
All Episodes, 20+ Therapy Visits (Step Four)	0 to 4	0 to 5	20 or More Therapy Visits	1.9397	1.9326	2.3080
All Episodes, 20+ Therapy Visits (Step Four)	0 to 4	6 to 8	20 or More Therapy Visits	2.1188	2.1110	2.5210
All Episodes, 20+ Therapy Visits (Step Four)	0 to 4	9 or More	20 or More Therapy Visits	2.3243	2.3157	2.7655
All Episodes, 20+ Therapy Visits (Step Four)	5 to 12	0 to 5	20 or More Therapy Visits	2.1530	2.1451	2.5617

Exhibit 6.5

NPRM Relative Payment Weights for 153 Episode Groups

Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	Base Wgt	Normalized Wgt	Final Wgt
All Episodes, 20+ Therapy Visits (Step Four)	5 to 12	6 to 8	20 or More Therapy Visits	2.3320	2.3235	2.7748
All Episodes, 20+ Therapy Visits (Step Four)	5 to 12	9 or More	20 or More Therapy Visits	2.5375	2.5282	3.0192
All Episodes, 20+ Therapy Visits (Step Four)	13 or More	0 to 5	20 or More Therapy Visits	2.4498	2.4408	2.9149
All Episodes, 20+ Therapy Visits (Step Four)	13 or More	6 to 8	20 or More Therapy Visits	2.6289	2.6192	3.1279
All Episodes, 20+ Therapy Visits (Step Four)	13 or More	9 or More	20 or More Therapy Visits	2.8343	2.8239	3.3724
Sample: Episodes from August 2002 to September 2003 (817,550 Episodes): Normal, SCIC, PEP, LUPA, and Outlier Episodes.						

The final relative payment weights were then used to calculate base payment amounts for normal, SCIC (treated as normal), and PEP episodes for the 1st simulation (no outlier payments). The purpose of this simulation was to determine what standardized payment amount needed to be used so that total payments across all episodes for the 1st simulation equal the budget neutral target amount ($2,004.968 million). That conversion factor, rounded to the nearest penny, was $2,399.92.

The 2nd simulation went on to calculate outlier payments and final payment rates. Outlier payments were calculated using a fixed dollar loss percentage of 67%. For the impact analysis file, a fixed dollar loss percentage of 67% translated into outlier payments that were 4.14% of total payments, assuming that total payments were equal to the budget neutral target of $2,004.968 million. To "pay" for outliers, all payment parameters from the first simulation, including the NRS payment amounts, LUPA add-on, and LUPA per visit amounts, were reduced by 4.14%. This resulted in the following payment parameters used for the NPRM:

- Standardized payment amount: $2,300.60
- NRS payment conversion factor: $52.77
- LUPA Add-on Adjustment Payment: $92.63
- LUPA per visit payment amounts:
  - Aide visit payment: $47.91
  - MSS visit payment: $169.53
  - OT visit payment: $116.42
  - PT visit payment: $115.63
  - Skilled nursing visit payment: $105.76
  - Speech therapy visit payment: $125.55

6.2. Calculations for the Final Payment Rule – CY 2005 Validation

As noted in the discussion of the four-equation model, the initial goal of the home health payment system refinement project was to develop the analyses and payment parameters presented in the proposed regulation on HH PP refinements (CMS-1541-P, dated May 4, 2007), using the most recent data available. After the publication of the proposed rule, newer data became available and further analyses and refinements were pursued using data from calendar 2005. In this section, we describe the payment regression and impact analyses that developed the information that fed into the Final Rule (CMS-1541-FC, dated August 29, 2007).

6.2.1. Data Source

Home health episodes ending in calendar year 2005 (CY2005) for a 20% random sample of Medicare beneficiaries were selected for this analysis. The payment regressions used normal, non-outlier episodes (n=790,358 episodes). The impact analyses used all episodes, including normal episodes, SCIC, PEP, SCIC/PEP, LUPA, and outlier episodes (n=983,063 episodes.)

6.2.2. Validation of Payment Weight Calculations - Final Payment Rule

Using the final four-equation model validated with CY2005 data (Exhibit 5.1), the coefficients for each variable were converted to "points" by dividing the coefficients by 10 and rounding to the nearest whole number. Next, two total scores, one for all clinical/diagnostic variables and one for functional variables,

were then calculated for each normal episode in the CY 05 file. The clinical/diagnostic variables included all clinical and diagnostic variables along with all interactions, including those between clinical or diagnostic variables and functional variables. The functional variables included only pure functional variables – i.e., dressing, bathing, toileting, transferring, and locomotion variables (based on OASIS items M0650, M0660, M0670, M0680, M0690, M0700).

Next, the distribution of the total clinical and functional scores was inspected for the following subgroups of episodes, which we called "grouping steps":

- Step One – 1st and 2nd episodes, 0-13 therapy visits (equivalent to leg one);
- Step Two-1: 1st and 2nd episodes, 14 to 19 therapy visits;
- Step Three: 3rd+ episodes, 0-13 therapy visits (equivalent to leg three); and
- Step Two-2: 3rd+ episodes, 14-19 therapy visits;
- Step Four: All episodes, 20 or more therapy visits.

As previously discussed, these grouping steps appeared to make sense given the distribution of clinical and functional scores across episodes. One point worth mentioning again is that the clinical and functional scores for these five grouping steps depend on the four legs of the final four-equation model. For Step One and Step Three (the low therapy steps), the clinical and functional scores come exactly from the corresponding groups of episodes (legs one and three, respectively). Scores for Step Two-1 come from leg two of the final four-equation model, and those for Step Two-2 come from leg 4 of the model. Finally, scores for Step Four (20+ therapy visits) come from both legs 2 and 4, depending on whether the specific episode is an early (1-2) or later (3+) episode.

The goals of inspecting the distribution of clinical and functional scores in each step were to determine appropriate cut points to define clinical and functional severity levels for each step. As much as possible, the clinical and functional cut points, or breaks, were selected to come up with groups of episodes in each step that were similar in sample size. This was not always possible, particularly for functional scores. A large number of episodes in a given step had exactly the same score ("mass points"). In such circumstances, the functional score breaks used to define ranges were selected to be below the mass point, equal to the mass point, and above the mass point. Exhibit 6.6 provides the clinical and functional score ranges for each step.

The clinical and functional score ranges within each step were then converted into corresponding groups, but a similar set of groups needed to be created for therapy visits. There were several goals that ideally the therapy visit groups would meet, including:

- Consistency – the therapy visit breaks would be the same across all steps.

- Structure – higher therapy visits would be associated with higher relative payment weights (see below).

- Size – there was a desire to avoid sudden, large jumps in weights across adjacent therapy visit groups.

Exhibit 6.6

Clinical and Functional Score Ranges by Step for the Final Payment Rule

Step	Clinical Score Ranges	Functional Score Ranges
Step One (1st and 2nd episodes, 0-13 therapy visits)	0 to 4	0 to 5
	5 to 8	6
	9 or More	7 or More
Step Two-1 (1st and 2nd episodes, 14-19 therapy visits)	0 to 6	0 to 6
	7 to 14	7
	15 or More	8 or More
Step Two-2 (3rd+ episodes, 14-19 therapy visits)	0 to 8	0 to 7
	9 to 16	8
	17 or More	9 or More
Step Three (3rd+ episodes, 0-13 therapy visits)	0 to 2	0 to 8
	3 to 5	9
	6 or More	10 or More
Step Four (All episodes, 20 or more therapy visits)	0 to 7	0 to 6
	8 to 14	7
	15 or More	8 or More
Sample: Episodes ending in CY2005 for a 20% sample of beneficiaries		

The final therapy visit group breaks were determined empirically. Different versions of the payment regression model (see Exhibit 6.8 below) were estimated, and the resulting estimates were evaluated with attention to the size of jumps predicted in values across adjacent therapy groups. This information allowed us to minimize to the extent possible (consistent with the data) large jumps in weights across adjacent therapy groups. After evaluating several alternatives, the following breaks, which preserve the six and 20 therapy visit thresholds, were ultimately selected:

- Zero to five therapy visits
- Six therapy visits
- Seven to nine therapy visits
- 10 therapy visits
- 11 to 13 therapy visits
- 14 to 15 therapy visits
- 16 to 17 therapy visits
- 18 to 19 therapy visits
- 20 or more therapy visits

Next, we estimated a payment weight regression model. The purpose of the payment weight regression model was to ensure an increasing gradient of predicted costs as severity levels and therapy visit breaks increase. Simply defining groups based on classifying episodes based on the regression coefficients in Exhibit 6.7 and the therapy breaks, and then computing relative weights from the group averages, does not invariably lead to an increasing gradient of costs. In essence, the clinical and functional scores that define the episode's severity level, along with the therapy break range applicable to the episode, are used to classify each episode in the sample for purposes of the payment regression analysis. Indicator variables that represent the classifications are the independent variables in the payment regression.

Specifically, the independent variables in the payment weight regression model consisted of step indicator variables, and clinical severity, functional severity, and therapy visit indicator variables within each of the

five steps, while the dependent variable was resource use. Exhibit 6.7 presents the results. The adjusted R-squared statistic from the payment weight regression model, 0.4516, indicates that this model accounts for 45% of the variation in resource use, a loss of 1.2 percentage points compared to the final validated four-equation model developed in Chapter 5.

The coefficients from the payment weight regression model were used to construct raw relative payment weights for episode groups as follows. First, unique combinations of clinical, functional, and therapy visit ranges with each step needed to be formed. For example, one such combination for Step One is the lowest clinical (score zero to four), functional (score zero to five), and therapy visit (zero to five therapy visit) range. There are a total of 153 such combinations as follows:

- Step One – 3 clinical times 3 functional times 5 therapy visit – 45 combinations.
- Step Two-1 – 3 clinical times 3 functional times 3 therapy visit – 27 combinations.
- Step Three – 3 clinical times 3 functional times 5 therapy visit – 45 combinations.
- Step Two-2 – 3 clinical times 3 functional times 3 therapy visit –27 combinations.
- Step Four – 3 clinical times 3 functional times 1 therapy visit – 9 combinations.

These 153 combinations form the 153 new relative payment groups of the new home health payment system as published in the Final Payment Rule.

Next, each coefficient was divided by the mean total resource use across all episodes (here, 460.36) to yield raw relative payment weight components. For example, for the lowest clinical, functional, and therapy visit combination in Step One, this is equivalent to dividing the intercept from the payment weight regression equation (213.93) by the mean resource use (460.36), to yield the quotient, a raw relative payment weight of 0.4647.

A few examples might help to explain how the relative payment calculations are made. Suppose one wanted to calculate the raw relative payment weight for the Step One relative payment group with a clinical score of 5 to 8, a functional score of 6, and with 10 therapy visits. This raw relative payment weight = 0.4647 (base) + 0.1206 (quotient from contribution for higher clinical score) + 0.0702 (quotient from contribution for higher functional score) + 0.5904 (quotient from contribution for therapy visits) = 1.2459. Similarly, suppose one wanted to calculate the raw relative payment weight for an episode in Step Two-2 with a clinical score of 0 to 8, a functional score of 8, and 16-17 therapy visits. The raw relative payment weight for this group = 0.4647 + 0.9472 (quotient from contribution for being in Step Two-2) + 0.0000 (no additional contribution for being in the lowest clinical group) + 0.0987 (quotient from contribution for having a functional score of 8) + 0.0936 (quotient from contribution of having 16-17 therapy visits) = 1.6043 (with rounding).

Exhibit 6.7

Payment Weight Regression Estimates for the Final Payment Rule

		N	Coefficient	Std.Error	TStat	SigLevel
	Adjusted R Square Statistic		0.4516			
	Mean of the Dependent Variable		460.36			
Intercept		790,358	213.93	0.85	251.36	<.0001
step2_1	Step 2.1, 1st and 2nd Episodes, 14 to 19 Therapy Visits	62,048	382.84	2.97	129.01	<.0001
step2_2	Step 2.2, 3rd+ Episodes, 14 to 19 Therapy Visits	12,093	436.05	6.85	63.69	<.0001
step3	Step 3, 3rd+ Episodes, 0-13 Therapy Visits	207,525	26.28	1.46	17.95	<.0001
step4	Step 4, All Episodes, 20+ Therapy Visits	37,638	732.83	3.81	192.48	<.0001
ser_1_2	Step 1, 6 Therapy Visits	23,476	99.71	1.77	56.40	<.0001
ser_1_3	Step 1, 7 to 9 Therapy Visits	49,338	177.53	1.28	138.30	<.0001
ser_1_4	Step 1, 10 Therapy Visits	35,064	271.79	1.48	184.05	<.0001
ser_1_5	Step 1, 11 to 13 Therapy Visits	75,815	341.39	1.08	314.95	<.0001
ser_2_1_2	Step 2.1, 16 to 17 Therapy Visits	21,017	68.49	2.36	28.99	<.0001
ser_2_1_3	Step 2.1, 18 to 19 Therapy Visits	13,736	143.92	2.70	53.39	<.0001
ser_2_2_2	Step 2.2, 16 to 17 Therapy Visits	4,474	43.11	5.20	8.29	<.0001
ser_2_2_3	Step 2.2, 18 to 19 Therapy Visits	2,209	116.46	6.50	17.91	<.0001
ser_3_2	Step 3, 6 Therapy Visits	2,510	136.05	5.18	26.29	<.0001
ser_3_3	Step 3, 7 to 9 Therapy Visits	6,045	205.44	3.37	60.94	<.0001
ser_3_4	Step 3, 10 Therapy Visits	6,610	314.61	3.23	97.44	<.0001
ser_3_5	Step 3, 11 to 13 Therapy Visits	14,172	378.62	2.25	167.91	<.0001
clin_grp2_1	Step 1, Clinical Score 5 to 8	156,492	55.53	0.92	60.05	<.0001
clin_grp3_1	Step1, Clinical Score 9 or More	150,450	117.23	0.97	121.39	<.0001
func_grp2_1	Step 1, Functional Score = 6	217,532	32.31	0.83	39.01	<.0001
func_grp3_1	Step1, Functional Score 7 or More	67,459	62.83	1.18	53.25	<.0001
clin_grp2_21	Step 2.1, Clinical Score 7 to 14	24,050	92.18	2.51	36.70	<.0001
clin_grp3_21	Step 2.1, Clinical Score 15 or More	19,100	198.67	2.68	74.14	<.0001
func_grp2_21	Step 2.1, Functional Score = 7	32,914	42.56	2.65	16.05	<.0001
func_grp3_21	Step 2.1, Functional Score 8 or More	15,810	69.27	3.07	22.54	<.0001
clin_grp2_22	Step 2.2, Clinical Score 9 to 16	4,006	100.57	5.81	17.30	<.0001
clin_grp3_22	Step 2.2, Clinical Score 17+	4,229	226.63	5.85	38.74	<.0001
func_grp2_22	Step 2.2, Functional Score = 8	7,620	45.45	6.32	7.19	<.0001
func_grp3_22	Step 2.2, Functional Score 9 or More	2,336	104.21	7.87	13.24	<.0001
clin_grp2_3	Step 3, Clinical Score 3 to 5	55,363	22.97	1.42	16.22	<.0001
clin_grp3_3	Step 3, Clinical Score 6 or More	67,835	112.91	1.38	82.06	<.0001
func_grp2_3	Step 3, Functional Score = 9	82,791	46.07	1.37	33.52	<.0001
func_grp3_3	Step 3, Functional Score 10 or More	62,648	89.72	1.50	59.73	<.0001
clin_grp2_4	Step 4, Clinical Score 8 to 14	11,775	78.62	3.28	23.95	<.0001
clin_grp3_4	Step 4, Clinical Score 15 or More	12,799	196.45	3.29	59.77	<.0001
func_grp2_4	Step 4, Functional Score = 7	16,281	69.42	3.95	17.56	<.0001
func_grp3_4	Step 4, Functional Score 8 or More	15,596	147.90	4.04	36.57	<.0001

Sample: Episodes ending in CY2005 for a 20% sample of beneficiaries

Several additional adjustments were made to the relative payment weights before final relative payment weights were set.

- We imposed restrictions on the therapy visit variables that were included in the payment weight regressions, to enable us to implement the same gradually decelerating therapy cost patterns that we used in the four-equation model. These restrictions smoothed the increases of the therapy breaks.

- We calculated a set of therapy visit factors and applied these to the raw therapy visit relative weight components resulting from the payment weight regression, to smooth these components in a similar way.

- To offset these adjustments to the therapy visit components of the relative payment weights, all other relative payment weights were increased by a proportional factor to assure that the resulting average relative payment weights across all normal episodes in the CY05 Two Decile File would equal 1.0000.[18]

Another adjustment was made for injectable drug use. While injectable drugs are a significant predictor of increased relative resource use, this item is not collected on recertification/followup OASIS assessments) and thus was missing for a significant fraction of the CY05 episodes. In the absence of the adjustment for injectable drug use, when in CY2008 and later injectable drug use is known for all episodes, the average relative payment weight will be too high, reflecting the contribution of injectable drug use for episodes where such use had been unknown.

For each step, the number of episodes where injectable drug use is unknown is calculated. Next, it is assumed that injectable drug use has the same prevalence for episodes where injectable drug use is known and unknown for each step. For example, if the percentage of episodes where injectable drug use is positive for a step is equal to 40% where such use is known, it is assumed that 40% of the episodes where injectable drug use is unknown used injectable drugs. The increase in total clinical scores for the step attributed to this "missing" injectable drug use is calculated and compared to the total clinical score for the step, to calculate a reduction factor for the step. This reduction factor is applied to the clinical weight components for the step (after adjustment for therapy visits as described previously has been made), and a corresponding increase factor is applied to the functional weight components of the step, to assure that

[18] Another four-equation model was estimated, eliminating the restrictions on the therapy visit coefficients from six to 19 therapy visits (Relaxed Final Model). The restricted coefficients for the therapy visit variables for the final four-equation model were compared to those for the Relaxed Final Model, and adjustment factors were calculated for each therapy visit break (e.g., 0-5, 6, 7-9, 10, 11-13, 14-15, 16-17, 18-19, 20+) in each leg of the model, using the number of episodes with specific numbers of therapy visits as weights. Adjustment factors were constrained to be less than or equal to 1.0000. These factors were then applied to the corresponding relative payment weight components from the payment weight regression. The reason the adjustment factors were constrained to be less than or equal to 1.0000 was so that the relative payment weight components for the therapy visit groups would not increase. An adjustment factor was then calculated to inflate all the other relative payment weight components by an amount necessary so that the average relative payment weight across all normal episodes in the CY 2005 Two Decile File was equal to 1.0000. This adjustment factor was 1.32%.

overall relative payment weights still average to 1.0000 for all normal episodes in the CY05 Two Decile File.[19]

Later, as described in the discussion of the impact analysis, two further adjustments are made to the relative payment weights for the new 153 relative payment groups. First, to assure that relative payment weights still average 1.0000 once SCIC, PEP, SCIC/PEP, and outlier episodes are included, a normalization factor is applied. Second, to assure that the average relative payment weight for the new 153 groups is the same as it was for the old 80 HHRG system, a budget neutrality adjustment to the weights is applied, until the final relative payment weights for the new 153 group system are achieved.

Exhibit 6.8 presents the various relative payment weights for each of these 153 groups as defined in the Final Payment Rule. Raw weights are relative payment weights based directly on the results of the payment weight regression. Adjusted (Adj) weights are the relative payment weights after applying the adjustments for implementing gradual deceleration of costs for therapy visits and for injectable drug use. Normalized weights have had the normalization factor (moving from normal episodes only to all episodes) applied to them, while final weights have also been adjusted to account for the budget neutrality adjustment (1.2388).

[19] Incorporating both the therapy visit and injectable drug use adjustments to the relative payment weights reduced the adjusted R-squared of the payment weight regression model to 0.4511, from 0.4516 (its level for the raw relative payment weights).

Exhibit 6.8

Final Payment Rule: Relative Payment Weights for 153 New Relative Payment Groups Based on CY05 Validation Analysis

Group	Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	N	Raw Weight	Adj. Weight	Normalized Weight	Final Weight
10111	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	0 to 5	0-5 Therapy Visits	40,242	0.4647	0.4708	0.4703	0.5827
10112	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	0 to 5	6 Therapy Visits	4,918	0.6813	0.6874	0.6867	0.8507
10113	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	0 to 5	7 to 9 Therapy Visits	9,510	0.8503	0.8564	0.8556	1.0599
10114	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	0 to 5	10 Therapy Visits	5,651	1.0551	1.0297	1.0287	1.2744
10115	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	0 to 5	11 to 13 Therapy Visits	11,127	1.2063	1.1722	1.1709	1.4506
10121	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	6	0-5 Therapy Visits	27,923	0.5349	0.5424	0.5418	0.6713
10122	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	6	6 Therapy Visits	6,665	0.7515	0.7590	0.7582	0.9393
10123	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	6	7 to 9 Therapy Visits	14,165	0.9205	0.9280	0.9271	1.1485
10124	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	6	10 Therapy Visits	9,046	1.1253	1.1013	1.1002	1.3630
10125	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	6	11 to 13 Therapy Visits	20,364	1.2764	1.2437	1.2425	1.5392
10131	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	7 or More	0-5 Therapy Visits	5,678	0.6012	0.6100	0.6094	0.7550
10132	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	7 or More	6 Therapy Visits	931	0.8178	0.8266	0.8258	1.0230
10133	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	7 or More	7 to 9 Therapy Visits	2,240	0.9868	0.9957	0.9946	1.2322
10134	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	7 or More	10 Therapy Visits	1,607	1.1916	1.1690	1.1678	1.4467
10135	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	0 to 4	7 or More	11 to 13 Therapy Visits	4,045	1.3427	1.3114	1.3100	1.6229
10211	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	0 to 5	0-5 Therapy Visits	46,418	0.5853	0.5927	0.5920	0.7335
10212	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	0 to 5	6 Therapy Visits	2,155	0.8019	0.8093	0.8084	1.0015
10213	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	0 to 5	7 to 9 Therapy Visits	4,053	0.9710	0.9783	0.9773	1.2107
10214	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	0 to 5	10 Therapy Visits	2,961	1.1757	1.1516	1.1504	1.4252
10215	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	0 to 5	11 to 13 Therapy Visits	5,752	1.3269	1.2940	1.2927	1.6014
10221	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	6	0-5 Therapy Visits	41,587	0.6555	0.6643	0.6636	0.8221
10222	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	6	6 Therapy Visits	3,820	0.8721	0.8808	0.8799	1.0901
10223	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	6	7 to 9 Therapy Visits	8,131	1.0411	1.0499	1.0488	1.2993
10224	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	6	10 Therapy Visits	6,467	1.2459	1.2232	1.2219	1.5138
10225	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	6	11 to 13 Therapy Visits	14,460	1.3971	1.3656	1.3642	1.6900
10231	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	7 or More	0-5 Therapy Visits	11,415	0.7218	0.7319	0.7311	0.9058
10232	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	7 or More	6 Therapy Visits	841	0.9384	0.9485	0.9475	1.1738
10233	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	7 or More	7 to 9 Therapy Visits	2,147	1.1074	1.1175	1.1164	1.3830
10234	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	7 or More	10 Therapy Visits	1,879	1.3122	1.2908	1.2895	1.5975
10235	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	5 to 8	7 or More	11 to 13 Therapy Visits	4,406	1.4634	1.4332	1.4317	1.7737
10311	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	0 to 5	0-5 Therapy Visits	46,342	0.7194	0.7281	0.7273	0.9010
10312	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	0 to 5	6 Therapy Visits	983	0.9359	0.9447	0.9437	1.1691
10313	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	0 to 5	7 to 9 Therapy Visits	1,954	1.1050	1.1137	1.1125	1.3783
10314	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	0 to 5	10 Therapy Visits	1,372	1.3098	1.2870	1.2857	1.5927
10315	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	0 to 5	11 to 13 Therapy Visits	2,625	1.4609	1.4294	1.4279	1.7690
10321	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	6	0-5 Therapy Visits	45,430	0.7895	0.7997	0.7988	0.9896

Exhibit 6.8

Final Payment Rule: Relative Payment Weights for 153 New Relative Payment Groups Based on CY05 Validation Analysis

Group	Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	N	Raw Weight	Adj. Weight	Normalized Weight	Final Weight
10322	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	6	6 Therapy Visits	2,189	1.0061	1.0162	1.0152	1.2577
10323	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	6	7 to 9 Therapy Visits	4,664	1.1752	1.1853	1.1840	1.4669
10324	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	6	10 Therapy Visits	4,074	1.3799	1.3586	1.3572	1.6813
10325	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	6	11 to 13 Therapy Visits	8,547	1.5311	1.5010	1.4994	1.8576
10331	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	7 or More	0-5 Therapy Visits	22,326	0.8558	0.8673	0.8664	1.0733
10332	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	7 or More	6 Therapy Visits	974	1.0724	1.0839	1.0827	1.3414
10333	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	7 or More	7 to 9 Therapy Visits	2,474	1.2415	1.2529	1.2516	1.5506
10334	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	7 or More	10 Therapy Visits	2,007	1.4462	1.4262	1.4247	1.7650
10335	1st and 2nd Episodes, 0 to 13 Therapy Visits (Step 1)	9 or More	7 or More	11 to 13 Therapy Visits	4,489	1.5974	1.5686	1.5670	1.9413
21111	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	0 to 6	14 to 15 Therapy Visits	2,439	1.2963	1.3024	1.3011	1.6118
21112	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	0 to 6	16 to 17 Therapy Visits	1,842	1.4451	1.4282	1.4267	1.7675
21113	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	0 to 6	18 to 19 Therapy Visits	1,099	1.6089	1.5390	1.5374	1.9046
21121	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	7	14 to 15 Therapy Visits	4,395	1.3888	1.3963	1.3949	1.7281
21122	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	7	16 to 17 Therapy Visits	3,457	1.5375	1.5221	1.5205	1.8837
21123	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	7	18 to 19 Therapy Visits	2,262	1.7014	1.6329	1.6312	2.0208
21131	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	8 or More	14 to 15 Therapy Visits	1,359	1.4468	1.4553	1.4538	1.8010
21132	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	8 or More	16 to 17 Therapy Visits	1,225	1.5956	1.5811	1.5794	1.9566
21133	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	0 to 6	8 or More	18 to 19 Therapy Visits	820	1.7594	1.6918	1.6900	2.0937
21211	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	0 to 6	14 to 15 Therapy Visits	2,316	1.4966	1.5051	1.5035	1.8626
21212	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	0 to 6	16 to 17 Therapy Visits	1,603	1.6453	1.6309	1.6292	2.0183
21213	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	0 to 6	18 to 19 Therapy Visits	963	1.8092	1.7416	1.7398	2.1554
21221	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	7	14 to 15 Therapy Visits	5,941	1.5890	1.5990	1.5973	1.9789
21222	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	7	16 to 17 Therapy Visits	4,507	1.7378	1.7248	1.7230	2.1345
21223	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	7	18 to 19 Therapy Visits	2,983	1.9016	1.8355	1.8336	2.2716
21231	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	8 or More	14 to 15 Therapy Visits	2,353	1.6470	1.6579	1.6562	2.0518
21232	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	8 or More	16 to 17 Therapy Visits	1,973	1.7958	1.7837	1.7819	2.2074
21233	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	7 to 14	8 or More	18 to 19 Therapy Visits	1,411	1.9596	1.8944	1.8925	2.3445
21311	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	0 to 6	14 to 15 Therapy Visits	1,459	1.7279	1.7392	1.7374	2.1524
21312	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	0 to 6	16 to 17 Therapy Visits	1,035	1.8767	1.8650	1.8631	2.3081
21313	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	0 to 6	18 to 19 Therapy Visits	568	2.0405	1.9758	1.9737	2.4451
21321	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	7	14 to 15 Therapy Visits	4,264	1.8203	1.8331	1.8312	2.2686
21322	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	7	16 to 17 Therapy Visits	3,133	1.9691	1.9589	1.9569	2.4243
21323	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	7	18 to 19 Therapy Visits	1,972	2.1330	2.0697	2.0675	2.5613
21331	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	8 or More	14 to 15 Therapy Visits	2,769	1.8784	1.8921	1.8901	2.3415
21332	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	8 or More	16 to 17 Therapy Visits	2,242	2.0271	2.0178	2.0157	2.4972
21333	1st and 2nd Episodes, 14 to 19 Therapy Visits (Step 2_1)	15 or More	8 or More	18 to 19 Therapy Visits	1,658	2.1910	2.1286	2.1264	2.6342

Exhibit 6.8

Final Payment Rule: Relative Payment Weights for 153 New Relative Payment Groups Based on CY05 Validation Analysis

Group	Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	N	Raw Weight	Adj. Weight	Normalized Weight	Final Weight
22111	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	0 to 7	14 to 15 Therapy Visits	416	1.4119	1.4165	1.4150	1.7530
22112	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	0 to 7	16 to 17 Therapy Visits	334	1.5055	1.5101	1.5086	1.8689
22113	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	0 to 7	18 to 19 Therapy Visits	137	1.6649	1.6364	1.6347	2.0252
22121	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	8	14 to 15 Therapy Visits	1,126	1.5106	1.5223	1.5207	1.8839
22122	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	8	16 to 17 Therapy Visits	936	1.6043	1.6159	1.6142	1.9998
22123	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	8	18 to 19 Therapy Visits	439	1.7636	1.7422	1.7404	2.1560
22131	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	9 or More	14 to 15 Therapy Visits	202	1.6383	1.6590	1.6573	2.0531
22132	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	9 or More	16 to 17 Therapy Visits	161	1.7319	1.7526	1.7508	2.1690
22133	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	0 to 8	9 or More	18 to 19 Therapy Visits	107	1.8912	1.8789	1.8769	2.3252
22211	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	0 to 7	14 to 15 Therapy Visits	340	1.6304	1.6384	1.6367	2.0276
22212	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	0 to 7	16 to 17 Therapy Visits	272	1.7240	1.7320	1.7302	2.1435
22213	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	0 to 7	18 to 19 Therapy Visits	131	1.8833	1.8583	1.8564	2.2998
22221	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	8	14 to 15 Therapy Visits	1,199	1.7291	1.7442	1.7423	2.1585
22222	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	8	16 to 17 Therapy Visits	1,006	1.8227	1.8378	1.8359	2.2744
22223	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	8	18 to 19 Therapy Visits	466	1.9821	1.9641	1.9620	2.4306
22231	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	9 or More	14 to 15 Therapy Visits	267	1.8567	1.8809	1.8789	2.3277
22232	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	9 or More	16 to 17 Therapy Visits	210	1.9504	1.9745	1.9725	2.4436
22233	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	9 to 16	9 or More	18 to 19 Therapy Visits	115	2.1097	2.1008	2.0986	2.5998
22311	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	0 to 7	14 to 15 Therapy Visits	242	1.9042	1.8972	1.8952	2.3479
22312	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	0 to 7	16 to 17 Therapy Visits	182	1.9978	1.9908	1.9887	2.4637
22313	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	0 to 7	18 to 19 Therapy Visits	83	2.1572	2.1171	2.1149	2.6200
22321	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	8	14 to 15 Therapy Visits	1,075	2.0029	2.0029	2.0008	2.4787
22322	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	8	16 to 17 Therapy Visits	897	2.0966	2.0966	2.0944	2.5946
22323	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	8	18 to 19 Therapy Visits	476	2.2559	2.2228	2.2205	2.7509
22331	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	9 or More	14 to 15 Therapy Visits	543	2.1306	2.1396	2.1374	2.6479
22332	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	9 or More	16 to 17 Therapy Visits	476	2.2242	2.2333	2.2310	2.7638
22333	3rd+ Episodes, 14 to 19 Therapy Visits (Step 2_2)	17 or More	9 or More	18 to 19 Therapy Visits	255	2.3835	2.3596	2.3571	2.9201
30111	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	0 to 8	0-5 Therapy Visits	28,816	0.5218	0.5287	0.5281	0.6543
30112	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	0 to 8	6 Therapy Visits	250	0.8173	0.8114	0.8105	1.0041
30113	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	0 to 8	7 to 9 Therapy Visits	524	0.9681	0.9749	0.9739	1.2065
30114	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	0 to 8	10 Therapy Visits	594	1.2052	1.1537	1.1525	1.4277
30115	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	0 to 8	11 to 13 Therapy Visits	1,256	1.3443	1.2948	1.2935	1.6024
30121	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	9	0-5 Therapy Visits	31,771	0.6219	0.6369	0.6362	0.7882
30122	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	9	6 Therapy Visits	352	0.9174	0.9196	0.9186	1.1380
30123	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	9	7 to 9 Therapy Visits	869	1.0681	1.0832	1.0820	1.3405
30124	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	9	10 Therapy Visits	1,260	1.3053	1.2619	1.2606	1.5617

Exhibit 6.8

Final Payment Rule: Relative Payment Weights for 153 New Relative Payment Groups Based on CY05 Validation Analysis

Group	Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	N	Raw Weight	Adj. Weight	Normalized Weight	Final Weight
30125	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	9	11 to 13 Therapy Visits	2,589	1.4443	1.4030	1.4016	1.7364
30131	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	10 or More	0-5 Therapy Visits	13,922	0.7167	0.7394	0.7387	0.9151
30132	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	10 or More	6 Therapy Visits	142	1.0122	1.0221	1.0211	1.2649
30133	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	10 or More	7 to 9 Therapy Visits	402	1.1629	1.1857	1.1844	1.4674
30134	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	10 or More	10 Therapy Visits	547	1.4001	1.3644	1.3630	1.6886
30135	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	0 to 2	10 or More	11 to 13 Therapy Visits	1,033	1.5391	1.5056	1.5040	1.8632
30211	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	0 to 8	0-5 Therapy Visits	13,591	0.5717	0.5756	0.5750	0.7124
30212	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	0 to 8	6 Therapy Visits	204	0.8672	0.8583	0.8574	1.0622
30213	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	0 to 8	7 to 9 Therapy Visits	432	1.0179	1.0219	1.0208	1.2646
30214	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	0 to 8	10 Therapy Visits	454	1.2551	1.2006	1.1994	1.4858
30215	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	0 to 8	11 to 13 Therapy Visits	920	1.3941	1.3418	1.3404	1.6605
30221	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	9	0-5 Therapy Visits	19,910	0.6718	0.6839	0.6831	0.8463
30222	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	9	6 Therapy Visits	356	0.9673	0.9665	0.9655	1.1962
30223	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	9	7 to 9 Therapy Visits	985	1.1180	1.1301	1.1289	1.3986
30224	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	9	10 Therapy Visits	1,128	1.3552	1.3089	1.3075	1.6198
30225	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	9	11 to 13 Therapy Visits	2,550	1.4942	1.4500	1.4485	1.7945
30231	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	10 or More	0-5 Therapy Visits	12,217	0.7666	0.7864	0.7856	0.9732
30232	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	10 or More	6 Therapy Visits	193	1.0621	1.0691	1.0680	1.3230
30233	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	10 or More	7 to 9 Therapy Visits	490	1.2128	1.2326	1.2314	1.5255
30234	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	10 or More	10 Therapy Visits	612	1.4500	1.4114	1.4099	1.7467
30235	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	3 to 5	10 or More	11 to 13 Therapy Visits	1,321	1.5890	1.5525	1.5509	1.9213
30311	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	0 to 8	0-5 Therapy Visits	13,792	0.7671	0.7595	0.7587	0.9399
30312	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	0 to 8	6 Therapy Visits	167	1.0626	1.0422	1.0411	1.2897
30313	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	0 to 8	7 to 9 Therapy Visits	324	1.2133	1.2057	1.2045	1.4922
30314	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	0 to 8	10 Therapy Visits	250	1.4505	1.3845	1.3830	1.7134
30315	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	0 to 8	11 to 13 Therapy Visits	512	1.5895	1.5256	1.5240	1.8880
30321	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	9	0-5 Therapy Visits	16,645	0.8672	0.8677	0.8668	1.0738
30322	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	9	6 Therapy Visits	439	1.1627	1.1504	1.1492	1.4237
30323	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	9	7 to 9 Therapy Visits	1,049	1.3134	1.3140	1.3126	1.6261
30324	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	9	10 Therapy Visits	881	1.5506	1.4927	1.4912	1.8473
30325	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	9	11 to 13 Therapy Visits	2,007	1.6896	1.6338	1.6321	2.0220
30331	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	10 or More	0-5 Therapy Visits	27,524	0.9620	0.9702	0.9692	1.2007
30332	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	10 or More	6 Therapy Visits	407	1.2575	1.2529	1.2516	1.5506
30333	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	10 or More	7 to 9 Therapy Visits	970	1.4082	1.4165	1.4150	1.7530
30334	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	10 or More	10 Therapy Visits	884	1.6454	1.5952	1.5936	1.9742
30335	3rd+ Episodes, 0 to 13 Therapy Visits (Step 3)	6 or More	10 or More	11 to 13 Therapy Visits	1,984	1.7844	1.7364	1.7346	2.1489

Exhibit 6.8

Final Payment Rule: Relative Payment Weights for 153 New Relative Payment Groups Based on CY05 Validation Analysis

Group	Step (Episode and/or Therapy Visit Ranges)	Clinical Score	Functional Score	Therapy Visits	N	Raw Weight	Adj. Weight	Normalized Weight	Final Weight
40111	All Episodes, 20+ Therapy Visits (Step 4)	0 to 7	0 to 6	20 or More Therapy Visits	2,720	2.0566	2.0601	2.0580	2.5495
40121	All Episodes, 20+ Therapy Visits (Step 4)	0 to 7	7	20 or More Therapy Visits	6,479	2.2074	2.2132	2.2109	2.7390
40131	All Episodes, 20+ Therapy Visits (Step 4)	0 to 7	8 or More	20 or More Therapy Visits	3,865	2.3778	2.3863	2.3838	2.9532
40211	All Episodes, 20+ Therapy Visits (Step 4)	8 to 14	0 to 6	20 or More Therapy Visits	1,851	2.2274	2.2328	2.2305	2.7632
40221	All Episodes, 20+ Therapy Visits (Step 4)	8 to 14	7	20 or More Therapy Visits	5,319	2.3781	2.3859	2.3834	2.9527
40231	All Episodes, 20+ Therapy Visits (Step 4)	8 to 14	8 or More	20 or More Therapy Visits	4,605	2.5486	2.5590	2.5563	3.1669
40311	All Episodes, 20+ Therapy Visits (Step 4)	15 or More	0 to 6	20 or More Therapy Visits	1,190	2.4833	2.4916	2.4890	3.0835
40321	All Episodes, 20+ Therapy Visits (Step 4)	15 or More	7	20 or More Therapy Visits	4,483	2.6341	2.6447	2.6419	3.2730
40331	All Episodes, 20+ Therapy Visits (Step 4)	15 or More	8 or More	20 or More Therapy Visits	7,126	2.8046	2.8178	2.8148	3.4872

6.2.3. Calculation of Payment Rates Using CY05 Data – Final Payment Rule

For the calculation of final payment rates for the Final Payment Rule, using CY05 data, episode payments were calculated for all episodes in the CY05 Two Decile file under:

- The old 80 HHRG payment system, and
- The new 153 group payment system.

Payments under the 80 HHRG system were required to establish the budget-neutral target for payments under the new system. Payments under the 80 HHRG system were calculated as follows. First, for normal episodes:

Payments = Standardized Payment Amount * Wage Factor * Relative Payment Weight

Where the Wage Factor = (Labor Share * Wage Index + (1 – Labor Share)).

For SCIC, PEP, and SCIC/PEP episodes payments were as follows:

Payments = Standardized Payment Amount * Wage Factor * Prorated Relative Payment Weight

The prorated relative payment weight is equal to days of care times the relative payment weight (based on the 80 HHRG group) for each segment of care within the episode, summed across segments, and divided by 60. Pure PEP episodes have a single segment of care. SCIC and SCIC/PEP episodes may have multiple segments of care, each with their own HHRG and relative payment weight – these occur with each significant change in condition. These payments are called base payments.

LUPA episode payments were determined using the following equation:

Payments = Wage Factor * $\sum \text{Visit}_i$*Per Visit Amount_i

Where the number of visits for each type of home health visit (indexed by "i") is multiplied by the corresponding per visit amount.

Some of the 80 HHRG payment calculations included outlier payments, while others did not. If outlier payments were being calculated, first a calculation was made for the episode using the LUPA episode payment formula above, to derive an estimate of cost for the episode. This cost estimate was then compared to the following amount:

Outlier Threshold = Base Payment + Outlier Amount * Wage Factor

The outlier amount is a fixed amount (often referred to as the fixed dollar loss [FDL]), usually set as a percentage of the standardized payment amount. If the episode's estimate of cost was greater than the episode's outlier threshold, outlier payments were set equal to 80% of the difference.

A variety of different 80 HHRG payment calculations were conducted that varied by:

- Whether outlier payments were included.

- Payment year – whether 2007 or 2008 payment rates, labor shares, and wage indexes were used.

- The fixed dollar loss threshold being used – sometimes this was set at 67% of the standardized payment amount (as it was under the 80-group HHRG system in 2007), and sometimes it was allowed to vary so that outlier payments were equal to 5% of total payments (as they are meant to be under current law).

- Whether payments were adjusted for nominal case-mix change.

The latter bullet points are worth additional explanation. In theory, the FDL was supposed to be set to allow outlier payments to be equal to 5% of total home health payments. One set of calculations placed the FDL at 67% of the standardized payment amount. Simulations based on the CY 05 data indicated that outlier payments were actually less than 5% of total payments with an FDL equal to 67% of the standardized payment amount – i.e., they were 4.13% of total payments. Our simulation showed that if the FDL is reduced to 39.6% of the standardized payment amount, outlier payments would be equal to 5% of total payments.

Finally, the relationship between patient characteristics at the start of a home health episode and the assignment of patients to HHRGs may have changed over time – i.e., patients with the same acuity levels may be being assigned to HHRGs with higher relative payment weights. This causes the average case-mix to drift upward over time. One set of the 80 HHRG payment calculations adjusts for this phenomenon by reducing all payments subject to case-mix adjustment (all payments except payments for LUPA episodes) by 2.75%.

Payments are then calculated under the new 153 group system. Before calculating payments, two adjustments discussed above were applied to the 153 group relative payment weights (the adjusted weights in Exhibit 6.8):

- Normalization – weights were normalized so that they averaged 1.0000 across all episodes where weights are used (normal, SCIC, PEP, and SCIC/PEP); and

- Budget neutrality – relative payment weights were adjusted upward so that average relative payment weights were the same for the 80 HHRG and 153 group systems for the CY 05 Two Decile File.

A budget neutral target amount was then computed, so that total payments would be the same under the 80 HHRG and 153 group systems. That budget neutral target was based on 2008 payment amounts, with the 2008 labor share, with no outlier payments, and reduced by 2.75% to offset the upward growth in the case-mix index.

Two different sets of payments (two scenarios) were simulated for the system of 153 payment groups. Both scenarios shared the following characteristics:

- Separate payments were made for non-routine supplies (NRS) for all non-LUPA episodes.

- SCIC episodes are paid as normal episodes.

- A special additional payment was made for LUPA episodes that were also 1st episodes (the LUPA add-on).

- Both systems included outlier payments, calculated using the same outlier formulas that are used in the 80 HHRG system (paying 80% of the difference between the episode's cost and outlier threshold).

- Payment rates are adjusted for coding change (excluding LUPA per visit and LUPA add-on payments).

The two scenarios differ in the way they make outlier payments. In the first (FDL 67), the FDL was set at 67% of the standardized payment amount. To achieve budget neutrality, a payment reduction factor was applied to all non-outlier payments, reducing the other amounts by an amount sufficient to cover the costs of outlier episodes, thus ensuring budget neutrality.

In the second scenario (Out 5), outlier payments were fixed at 5% of the budget neutral target. All other payment amounts were reduced by 5% relative to what they would have been in the absence of outlier payments. To achieve overall budget neutrality and to assure that outlier payments are equal to 5% of total payments, the amount of the FDL as a percentage of the standardized payment amount was allowed to vary, ensuring that outlier payments were equal to 5% of total payments

The scenario calculations began by simulating the 153 group system with no outlier payments (but with SCICs treated as normal episodes, separate NRS payments, and LUPA add-on payments). The standardized payment amount was allowed to iterate until budget neutrality is achieved (where the LUPA per visit amounts are equal to 2008 target values). In effect, the standardized payment amount was reduced to pay for separate NRS payments, the SCIC episodes being treated as normal episodes, and for the LUPA add-on payments. The standardized payment amount with no outlier payments adjusted for coding change was $2,460.07. This amount was reduced to $2,389.81 (before reduction to cover the outlier payments, and after adjustment for coding change) under the 153 group system, to account for the following policies:

- The change in case-mix systems – even with the same average case-mix, payments for the 80 HHRG and 153 group systems could differ, depending on where episodes are located.[20]
- SCIC episodes being treated as normal episodes.
- Separate NRS payments.
- LUPA add-on payments for LUPA episodes that are also first episodes.

Under the FDL67 scenario, budget neutrality was achieved with a payment reduction factor of 95.52486957%. Under this scenario, outlier payments were equal to 4.48% (100% - 95.52% = 4.48%) of total payments.

[20] That is because payments are wage adjusted. Suppose the average case-mix in higher wage areas is higher under the new system of 153 groups compared to the 80-group system. And suppose that, at the same time, average case-mix in lower wage areas is lower under the new system, compared to the 80-group system. That would mean total expenditures would be higher, given a constant standardized payment amount, for the 153 group system than for the 80 HHRG system.

In contrast, for the Out 5 scenario, outlier payments were equal to 5% of total expenditures with a FDL equal to 47.6655407% of the standardized payment amount (that has been reduced by 5% from the $2,389.81 amount, to the final standardized episode amount of $2,270.32, in order to ensure a budget-neutral total). The Out 5 scenario was used to determine all the final rates in Final Payment Rule (CMS-1541-FC.)

7. Impact Analysis

We conducted a set of impact analyses to estimate how the new episode groups, relative payment weights, and payment rates (for episodes, episode adjustments, and other system features) would affect payments for different categories of home health agencies. In this chapter, we first describe the impact analysis that was conducted on the 2002-2003 20% claims sample described in Section 6.1 and used as the basis for the impact table presented in the NPRM (CMS-1541-P). This is followed by a discussion of the final impact analysis, conducted on the CY2005 20% claims sample described in Section 6.2 and used as the basis for the impact table reported in the Final Payment Rule (CMS-1541-FC).

7.1. Estimating the Impact of the Proposed Payment System Refinements in the NPRM

Exhibit 7.1 compares estimated payments for different types of agencies under various payment simulation scenarios. The classification for agencies (column 1) comes from the CMS Online Survey and Certification System (OSCAR), which includes information on whether agencies are "facility-based," "freestanding," or "other." The "other" category is generally thought to represent freestanding agencies. The underlying data are episodes for a 20% sample of beneficiaries; the number of episodes by agency type is shown in column 2. The average case-mix weight by agency type under each classification system – original PPS (80 groups) versus the new system (153 groups) is shown in columns 3 and 4.

The first payment estimate (column 5) projects payments for CY07 (for our episode sample) under the original HH PPS system. The second payment estimate (column 6) assumes that the original HH PPS remains in place for CY08 and the market basket increase is applied, the only "change" being the update in the labor share. (At the time of the NPRM, the 2008 wage index was not yet available.) The third payment estimate (column 7) incorporates all the case-mix refinements and other payment parameter changes of the proposed rule – 153 new groups, separate NRS payments, LUPA add-on payments, SCIC episodes treated as normal episodes, and outlier payments equal to 4.14% percent of total payments, as well as the 2.75% reduction for nominal case-mix change. The parameters of each estimate are identified in the first rows of the table, defined as follows:

- "Payment System" indicates whether or not the system rules used in the simulation are those of the payment system in effect prior to January 1, 2008 or the newer system. If the Payment System is "Original PPS*", the simulation included SCICs, no extra payments for initial LUPAs, and no separate NRS prospective payment. If the Payment System is "New PPS**" then the simulation did not provide for SCICs, but allowed for the added payment for initial LUPA episodes and separate NRS payments.
- "Prices" indicates whether the episode rates were updated by the statutory estimated 2.9% home health market basket update.
- "Wage Index" indicates whether the 2007 or 2008 wage index was used.
- "Labor share" indicates whether the updated labor share was used for payment calculations;
- "Nominal Case Mix Change" indicates whether payment rates in the simulation were adjusted to account for the 2.75% rate reduction for nominal case mix change.
- "Outlier fixed dollar loss ratio" indicates whether the FDL ratio was fixed at the .67 level of the 2007 system, or whether it was allowed to find its own level consistent with outlier payments representing 5% of total payments.

The remaining columns of the table show the percentage differences among the estimates. The first (column 8) shows the difference in payment between CY07 and CY08 assuming the original PPS remains essentially in place. The second (column 9) shows the difference in CY08 between remaining with the original PPS or moving to the new system, including the 2.75% adjustment for nominal case-mix change. The last column (column 9) shows the estimated difference between CY07 payments under the current system and CY08 payments under the new system.

Before discussing the specific results, two general observations are in order. First, the CY08 estimates (original PPS – column 6) overall are 2.89 percent more than those for CY07 (original PPS – column 5), due largely to the estimated annual home health market basket update(2.9%) to the payment rates. Second, the estimated CY08 payments under the new system (column 7) are 1.88 percent less than CY08 payments under the original PPS (column 6) because they assume the -2.75 percent adjustment to the PPS episode rate to offset nominal change in case mix. The impact shown in column 9 (-1.88 percent) reflects an adjustment to the HH PPS rates in the simulation of the proposed CY08 system (column 7) to account for the fact that the outlier expenditures in the CY2005 sample did not reach the full 5% allowance. Rather than equating outlier expenditures to 5% of total expenditures by reducing the FDL ratio below 67%, CMS requested that the simulation maintain the existing FDL ratio but portray a scenario where total expenditures would incorporate a full 5% outlier pool. For illustrative purposes, we did this by inflating the PPS rates slightly (by a factor of 0.008614805).[21]

When identifying "winners and losers" in CY08 under the payment simulations (column 9), we consider "winners" to be those groups of agencies whose payments declined by less than the overall average decline (1.88%) or even increased, while the losers are those groups of agencies whose losses exceeded the average payment reduction estimated under the new PPS (relative to the extension of the current system into 2008).

Winners and losers under the simulation included the following:

- Facility type and control:
  - Winners
    - Free-standing voluntary non-profits (0.58% gain)
    - Free-standing government (0.51% gain)
    - Facility-based voluntary non-profits (0.73 gain)
    - Facility-based proprietary (0.26% gain)
    - Facility-based government (0.23% loss)
  - Losers
    - Free-standing proprietary (4.85% loss)

In general:

- Facility-based agencies are winners (0.59% gain).
- Voluntary non-profit agencies are winners (0.65% gain).
- Freestanding agencies are losers (2.71% loss)
- Proprietary agencies are losers (4.65% loss)

[21] CMS-1451-FC, FR, 8/29/2007, p. 25454

- Facility type and control (rural location)
  - Winners:
    - Free-standing voluntary non-profits (1.36% loss)
    - Free-standing government (0.52% gain)
    - Facility-based voluntary non-profits (0.49% loss)
    - Facility-based proprietary (1.05% loss)
    - Facility-based government (0.71% loss)
  - Losers
    - Free-standing proprietary (7.49% loss)

- Facility type and control (urban)
  - Winners:
    - Free-standing voluntary non-profits (0.80% gain)
    - Free-standing government (0.50% gain)
    - Facility-based voluntary non-profits (1.04% gain)
    - Facility-based proprietary (0.89% gain)
    - Facility-based government (0.29% gain)
  - Losers
    - Free-standing proprietary (4.41% loss)

In general,

- Rural agencies are losers (3.25% loss).

- Urban agencies are slight winners (1.60% loss)

- Region of the country:
  - Winners
    - North (1.37% gain)
    - Midwest (0.57% gain)
    - Other (outside United States – e.g., Puerto Rico, Virgin Islands) (0.08% gain)
  - Losers
    - South (4.40% loss)
    - West (2.77% loss)

- Census division regions:
  - Winners:
    - New England (1.14% gain)
    - Mid Atlantic (1.49% gain)
    - East North Central (0.66% gain)
    - West North Central (0.26% gain)
    - Mountain (0.75% gain)
    - Other (0.08% gain)
  - Losers
    - South Atlantic (-2.59% loss)
    - East South Central (-4.28% loss)
    - West South Central (-6.47% loss)
    - Pacific (4.02% loss)

- Size (number of initial episodes):

- Winners
  - 200 or more episodes (0.72% loss)
- Losers
  - 1 to 5 episodes (5.26% loss)
  - 6 to 9 episodes (5.47% loss)
  - 10 to 14 episodes (4.62% loss)
  - 15 to 19 episodes (4.41% loss)
  - 20 to 29 episodes (3.40% loss)
  - 30 to 49 episodes (3.62% loss)
  - 50 to 99 episodes (2.23% loss)
  - 100 to 199 episodes (1.93% loss)

In general, facility-based, voluntary, and government agencies are winners, while proprietary agencies are losers. The largest (200 or more first episodes) and urban agencies are winners, as are agencies located in the North East and Midwest. In contrast, smaller agencies and agencies located in the South and West typically are losers under the new payment system.

Exhibit 7.1 also includes the average case-mix weight for episodes under the original PPS system's 80 HHRGs and the proposed 153 groups (columns 3 and 4). As would be expected, there is a high correlation between increasing average case-mix weight under the new system and "winning" in payments. A less obvious relationship that sometimes holds is that original 80-group case-mix indices and winning may be inversely related – that is, groups with the highest original 80-group case-mix indices tend to lose under the new payment system. Simple (unweighted) correlations between percentage gains/losses and 80-group case-mix indices for different sets of groups of agencies were as follows (the unknown groups were excluded from the simple correlation calculations):

- Facility type and control: -0.7924
- Facility type and control, rural: -0.6464
- Facility type and control, urban: -0.8248
- Urban and rural: 1.0000
- Census region: -0.4545
- Census division region: -0.4787
- Agency size: 0.0797

With the exception of agency size, and urban/rural location, all the correlations between 80-group case-mix and gains/losses were negative for these groups of episodes. Within the agency size groups, the one "winner" had a below average case-mix index (1.1769 versus the overall average of 1.1942).

Exhibit 7.1

NPRM Estimated Payments for Agency Groups: Payment Simulations for CY07 and CY08 *(Based on 20% Beneficiary Sample)*

		Case-Mix Index		Payment Simulations			Estimated Change in CY08		
	N	Current Model, 80 Groups	Proposed New 153 Groups	Estimated Payments CY07 under Orig. PPS*	Estimated Payments CY08 under Orig. PPS*	Estimated Payments CY08 under New PPS**	Percent Change from CY07 Orig. PPS* to CY08, Orig.PPS*	Percent Change from CY08,Orig. PPS* to CY08,New PPS**	Percent Change from CY07,Orig. PPS* to CY08,New PPS**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Payment system				Orig. PPS*,	Orig. PPS*,	New PPS**			
Prices				2007	2008[22]	2008			
Wage index[23]				2007	2007	2007			
Labor share				2007	2008	2008			
Nominal case-mix change				No	No	Yes			
Outlier fixed dollar loss ratio				67%	67%	67%			
Agency Group/Type									
Facility Type and Control									
Unknown	311	1.3464	1.2868	$841,080	$865,407	$807,422	2.89%	-6.70%	-4.00%
Free-Standing Vol/NP	223,200	1.1502	1.1815	$523,626,229	$538,820,255	$541,929,108	2.90%	0.58%	3.50%
Free-Standing Proprietary	336,329	1.2641	1.2234	$898,223,897	$924,115,099	$879,267,743	2.88%	-4.85%	-2.11%
Free-Standing Government	30,254	1.1565	1.1865	$64,227,761	$66,065,492	$66,403,337	2.86%	0.51%	3.39%
Facility-Based Vol/NP	184,815	1.1287	1.1596	$407,015,001	$418,777,642	$421,854,635	2.89%	0.73%	3.65%
Facility-Based Proprietary	16,833	1.1794	1.2092	$37,608,057	$38,685,902	$38,785,418	2.87%	0.26%	3.13%
Facility-Based Government	25,808	1.1244	1.1441	$54,489,469	$56,046,773	$55,920,205	2.86%	-0.23%	2.63%
Subtotal: Freestanding	589,783	1.2155	1.2057	$1,486,077,887	$1,529,000,846	$1,487,600,188	2.89%	-2.71%	0.10%
Subtotal: Facility-Based	227,456	1.1320	1.1615	$499,112,527	$513,510,317	$516,560,258	2.88%	0.59%	3.50%
Subtotal: Vol/NP	408,015	1.1404	1.1716	$930,641,230	$957,597,897	$963,783,743	2.90%	0.65%	3.56%
Subtotal: Proprietary	353,162	1.2601	1.2227	$935,831,954	$962,801,001	$918,053,161	2.88%	-4.65%	-1.90%
Subtotal: Government	56,062	1.1417	1.1670	$118,717,230	$122,112,265	$122,323,542	2.86%	0.17%	3.04%
GRAND TOTAL	817,550	1.1942	1.1942	$1,986,031,494	$2,043,376,570	$2,004,967,868	2.89%	-1.88%	0.95%

[22] The 2008 prices assumed a 2.9% update, but a 3% update was finally used in the Final Rule. Note also that the CBSA wage index was the 2007 wage index since the 2008 wage index was not yet available at that time.

[23] At the time of this analysis, the 2008 CBSA wage index was not yet available.

Exhibit 7.1

NPRM Estimated Payments for Agency Groups: Payment Simulations for CY07 and CY08 *(Based on 20% Beneficiary Sample)*

		Case-Mix Index		Payment Simulations			Estimated Change in CY08		
	N	Current Model, 80 Groups	Proposed New 153 Groups	Estimated Payments CY07 under Orig. PPS*	Estimated Payments CY08 under Orig. PPS*	Estimated Payments CY08 under New PPS**	Percent Change from CY07 Orig. PPS* to CY08, Orig.PPS*	Percent Change from CY08,Orig. PPS* to CY08,New PPS**	Percent Change from CY07,Orig. PPS* to CY08,New PPS**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Payment system				Orig. PPS*,	Orig. PPS*,	New PPS**			
Prices				2007	2008[22]	2008			
Wage index[23]				2007	2007	2007			
Labor share				2007	2008	2008			
Nominal case-mix change				No	No	Yes			
Outlier fixed dollar loss ratio				67%	67%	67%			
Agency Group/Type									
Facility Type and Control: Rural									
Unknown	557	1.2479	1.2209	$1,353,667	$1,392,788	$1,328,729	2.89%	-4.60%	-1.84%
Free-Standing Vol/NP	13898	1.1325	1.1386	$52,971,733	$54,483,463	$53,741,851	2.85%	-1.36%	1.45%
Free-Standing Proprietary	3772	1.2212	1.1528	$129,925,584	$133,601,680	$123,597,181	2.83%	-7.49%	-4.87%
Free-Standing Government	15108	1.1274	1.1563	$32,832,207	$33,763,871	$33,939,761	2.84%	0.52%	3.37%
Facility-Based Vol/NP	41089	1.1107	1.1242	$81,671,947	$83,993,675	$83,585,472	2.84%	-0.49%	2.34%
Facility-Based Proprietary	6008	1.1435	1.1552	$12,291,879	$12,639,711	$12,507,269	2.83%	-1.05%	1.75%
Facility-Based Government	14440	1.1133	1.1269	$29,168,819	$29,996,803	$29,784,901	2.84%	-0.71%	2.11%
Facility Type and Control: Urban									
Free-Standing Vol/NP	197760	1.1525	1.1872	$470,654,496	$484,336,792	$488,187,257	2.91%	0.80%	3.73%
Free-Standing Proprietary	279155	1.2732	1.2383	$768,298,313	$790,513,419	$755,670,562	2.89%	-4.41%	-1.64%
Free-Standing Government	13411	1.1931	1.2244	$31,395,554	$32,301,621	$32,463,576	2.89%	0.50%	3.40%
Facility-Based Vol/NP	143726	1.1340	1.1701	$325,343,054	$334,783,967	$338,269,163	2.90%	1.04%	3.97%
Facility-Based Proprietary	10825	1.2004	1.2407	$25,316,178	$26,046,191	$26,278,149	2.88%	0.89%	3.80%
Facility-Based Government	11368	1.1402	1.1672	$25,320,650	$26,049,970	$26,135,304	2.88%	0.29%	3.17%

Exhibit 7.1

NPRM Estimated Payments for Agency Groups: Payment Simulations for CY07 and CY08 *(Based on 20% Beneficiary Sample)*

		Case-Mix Index		Payment Simulations			Estimated Change in CY08		
	N	Current Model, 80 Groups	Proposed New 153 Groups	Estimated Payments CY07 under Orig. PPS*	Estimated Payments CY08 under Orig. PPS*	Estimated Payments CY08 under New PPS**	Percent Change from CY07 Orig. PPS* to CY08, Orig.PPS*	Percent Change from CY08,Orig. PPS* to CY08,New PPS**	Percent Change from CY07,Orig. PPS* to CY08,New PPS**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Payment system				Orig. PPS*,	Orig. PPS*,	New PPS**			
Prices				2007	2008[22]	2008			
Wage index[23]				2007	2007	2007			
Labor share				2007	2008	2008			
Nominal case-mix change				No	No	Yes			
Outlier fixed dollar loss ratio				67%	67%	67%			
Agency Group/Type									
Type of Facility: Urban or Rural									
Unknown		1.2479	1.2209	$1,353,667	$1,392,788	$1,328,729	2.89%	4.60%	1.84%
Rural	161551	1.1583	1.1417	$340,215,836	$349,871,991	$338,485,164	2.84%	3.25%	0.50%
Urban	656,245	1.2032	1.2074	$1,644,461,992	$1,692,111,792	$1,665,153,975	2.90%	1.60%	1.26%
TOTAL	817,550	1.1942	1.1942	1,986,031,495	2,043,376,571	2,004,967,868	2.89%	1.88%	0.95%
Type Facility: Region									
North	175,150	1.0978	1.1397	418,653,733	430,897,014	436,796,465	2.92%	1.37%	4.33%
South	341,958	1.2495	1.2158	840,759,623	864,824,711	826,781,446	2.86%	-4.40%	-1.66%
Midwest	161,690	1.1680	1.2016	367,449,030	378,045,485	380,205,438	2.88%	0.57%	3.47%
West	109,223	1.1797	1.1668	$297,665,521	$306,383,166	$297,908,903	2.93%	-2.77%	0.08%
Other	29,529	1.2882	1.3136	61,503,588	63,226,195	63,275,616	2.80%	0.08%	2.88%
TOTAL	817,550	1.1942	1.1942	1,986,031,495	2,043,376,571	2,004,967,868	2.89%	-1.88%	0.95%
Facility Location: Region of the Country									
New England	59,600	1.0600	1.1000	$140,392,346	$144,504,392	$146,147,811	2.93%	1.14%	4.10%
Mid Atlantic	115,550	1.1172	1.1601	$278,261,387	$286,392,622	$290,648,654	2.92%	1.49%	4.45%
South Atlantic	141,816	1.2456	1.2351	$350,456,520	$360,546,708	$351,206,051	2.88%	-2.59%	0.21%
East South Central	75,243	1.2659	1.2391	$175,059,398	$180,025,160	$172,315,442	2.84%	-4.28%	-1.57%

Exhibit 7.1

NPRM Estimated Payments for Agency Groups: Payment Simulations for CY07 and CY08 *(Based on 20% Beneficiary Sample)*

		Case-Mix Index		Payment Simulations			Estimated Change in CY08		
	N	Current Model, 80 Groups	Proposed New 153 Groups	Estimated Payments CY07 under Orig. PPS*	Estimated Payments CY08 under Orig. PPS*	Estimated Payments CY08 under New PPS**	Percent Change from CY07 Orig. PPS* to CY08, Orig.PPS*	Percent Change from CY08,Orig. PPS* to CY08,New PPS**	Percent Change from CY07,Orig. PPS* to CY08,New PPS**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Payment system				Orig. PPS*,	Orig. PPS*,	New PPS**			
Prices				2007	2008[22]	2008			
Wage index[23]				2007	2007	2007			
Labor share				2007	2008	2008			
Nominal case-mix change				No	No	Yes			
Outlier fixed dollar loss ratio				67%	67%	67%			
Agency Group/Type									
West South Central	124,899	1.2439	1.1817	$315,243,705	$324,252,843	$303,259,953	2.86%	-6.47%	-3.80%
East North Central	121,759	1.1858	1.2226	$284,667,857	$292,892,944	$294,833,819	2.89%	0.66%	3.57%
West North Central	39,931	1.1134	1.1370	$82,781,173	$85,152,541	$85,371,619	2.86%	0.26%	3.13%
Mountain	32,820	1.2295	1.2687	$78,449,253	$80,700,939	$81,304,510	2.87%	0.75%	3.64%
Pacific	76,403	1.1575	1.1213	$219,216,268	$225,682,227	$216,604,393	2.95%	-4.02%	-1.19%
Other	29,529	1.2882	1.3136	$61,503,588	$63,226,195	$63,275,616	2.80%	0.08%	2.88%
TOTAL	817,550	1.1942	1.1942	$1,986,031,495	$2,043,376,572	$2,004,967,869	2.89%	-1.88%	0.95%
Facility Size (Number of 1st Episodes)									
Unknown	147	1.0500	1.0387	$281,518	$289,589	$282,918	2.87%	2.30%	0.50%
1 to 5	5,524	1.1484	1.0993	$13,574,611	$13,965,312	$13,230,137	2.88%	5.26%	-2.54%
6 to 9	9,309	1.1608	1.1140	$22,721,961	$23,374,601	$22,095,716	2.87%	5.47%	-2.76%
10 to 14	13,935	1.1755	1.1438	$33,676,235	$34,644,356	$33,043,935	2.87%	4.62%	-1.88%
15 to 19	16,301	1.1602	1.1268	$38,944,617	$40,062,126	$38,294,880	2.87%	4.41%	-1.67%
20 to 29	35,677	1.1894	1.1678	$87,304,817	$89,809,631	$86,756,226	2.87%	3.40%	-0.63%
30 to 49	74,809	1.2062	1.1840	$181,772,417	$186,991,791	$180,213,395	2.87%	3.62%	-0.86%
50 to 99	150,256	1.2252	1.2221	$373,558,213	$384,307,576	$375,753,191	2.88%	2.23%	0.59%
100 to 199	182,388	1.2029	1.2024	$437,686,002	$450,295,340	$441,597,412	2.88%	1.93%	0.89%
200 or More	329,204	1.1769	1.1920	$796,511,105	$819,636,250	$813,700,060	2.90%	0.72%	2.16%
TOTAL	817,550	1.1942	1.1942	$1,986,031,496	$2,043,376,572	$2,004,967,870	2.89%	1.88%	0.95%

Exhibit 7.1

NPRM Estimated Payments for Agency Groups: Payment Simulations for CY07 and CY08 *(Based on 20% Beneficiary Sample)*

		Case-Mix Index		Payment Simulations			Estimated Change in CY08		
	N	Current Model, 80 Groups	Proposed New 153 Groups	Estimated Payments CY07 under Orig. PPS*	Estimated Payments CY08 under Orig. PPS*	Estimated Payments CY08 under New PPS**	Percent Change from CY07 Orig. PPS* to CY08, Orig.PPS*	Percent Change from CY08,Orig. PPS* to CY08,New PPS**	Percent Change from CY07,Orig. PPS* to CY08,New PPS**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Payment system				Orig. PPS*,	Orig. PPS*,	New PPS**			
Prices				2007	2008[22]	2008			
Wage index[23]				2007	2007	2007			
Labor share				2007	2008	2008			
Nominal case-mix change				No	No	Yes			
Outlier fixed dollar loss ratio				67%	67%	67%			
Agency Group/Type									

Notes:

- Sample: 20% beneficiary sample, episodes August 2002 - September 2003: normal, SCIC, PEP, LUPA, and outliers included.
- Facility type is based on the Online Survey and Certification System (OSCAR); the "other" category is a self-reported facility type but assumed to be freestanding.

Key:

Payment System: the system rules used in the simulation:

- *Orig. PPS = 80 HHRGs, SCIC adjustments, no LUPA add-on, no separate NRS payment
- **New PPS = 153 groups, no SCIC adjustments, LUPA add-on, separate NRS payment

Prices: "2007" = 2007 rates, "2008" = episode rates were updated by the estimated 2.9% home health market basket update.

Wage Index: indicates whether the 2007 or 2008 wage index was used.

Labor share: Labor share that was used for payment calculations; "2007" = 2007 labor share, "2008" = updated labor share

Nominal Case Mix Change: indicates whether payment rates in the simulation were adjusted to account for the 2.75% rate reduction for nominal case mix change.

Outlier fixed dollar loss ratio: indicates whether the FDL ratio was fixed at the .67 level of the 2007 system, or was it was allowed to find the level needed for outlier payments to represent 5% of total estimated payments.

7.2. Impact Analysis for the Final Payment Rule - CY05 Validation

In this section, we discuss the impact analysis that was the basis for the Table15, Impact by Agency Type, presented in the Final Payment Rule. Exhibit 7.2 presents average case-mix values and payment simulations based on data for CY2005 episodes for a 20% sample of beneficiaries (n= 983,063 episodes). Differences in estimated payments for various types of home health agencies under various payment scenarios are presented.

The first part of the exhibit (columns 3 and 4) presents average case-mix values (for the 80 HHRG and new 153 group systems), followed by total payment simulations for the 80 HHRG system under a variety of different assumptions (columns 5, 6, 7, 9, 10).[24] (Note that all but column 10 assume the rate update.) The next column (11) presents payment estimates for the new system with all features implemented, including the adjustment for nominal case mix change.

The columns that follow show the differences between these various scenarios, and how they differentially impact particular types of home health agencies. (The particular comparisons shown here are those published in the Final Payment Rule.) The first three comparisons (columns 12-14) show the modest impacts of updating individual parameters while retaining the original PPS payment rules. Comparison 1 (column 12) shows the impact of retaining the old payment rules but updating the wage index and labor share only. Comparison 2 (column 13) shows the impact of updating only the wage index, while Comparison 3 (column 14) shows the impact updating the labor share only.

Comparison 4 (column 15) shows the impact of the largest change – comparing estimated payments under the 2007 original PPS to full implementation of the new system – new groups and new rules, plus updates to rates, the wage index, the labor share, and implementation of the adjustment for nominal case-mix change. (Both of these scenarios set total outlier payments at 5% of total payments, allowing the FDL to "float" to the level needed to achieve that target, so the treatment of outliers is comparable, ensuring that outlier policy parameters are not contributing to this comparison.)

The rows of the table show how estimated impacts vary by agency type. As in the earlier analyses for the NPRM, voluntary/nonprofit agencies stand to benefit the most (a projected 3.60% increase in payments). While most agency types are projected to be "winners," freestanding proprietary agencies are projected to see a small decrease in payments (-2.49%). This projection holds across urban and rural agencies. Impacts on payment are also directly correlated with agency size, with only the largest agencies (200+ initial episodes) seeing a (small) positive impact on payment.

Other types of agencies projected to have higher payments under the new PPS (153 group) system included:

- Urban episodes
- Episodes in the North and West regions of the country
- Episodes in the New England, Mid Atlantic, Mountain, and Pacific census division regions

[24] We use the term "Simulation" in Exhibit 7.2 to label different sets of assumptions about payment rates, labor shares, inclusion/exclusion of outliers, and FDL percentages.

Exhibit 7.2

Final Payment Rule - Impact Analysis Results under Alternative Payment Simulations *(Based on CY05 20% Sample)*[25]

		Case-Mix Index		Payment Simulations		
Episodes	**N**	**Orig. PPS, 80 Groups**	**New PPS, 153 Groups**	Orig. PPS*, Simulation 1	Orig. PPS* Simulation 2	Orig. PPS* Simulation 3
1	*2*	*3*	*4*	*5*	*6*	*7*
Payment system				Orig. PPS*	Orig. PPS*	Orig. PPS*
Prices				2008	2008	2008
Wage index				2007	2008	2008
Labor share				2007	2008	2007
Nominal case-mix change				No	No	No
Outlier fixed dollar loss ratio:				67%	67%	67%
Agency Group/Type						
Facility Ownership and Type						
Unknown	589	1.5011	1.4848	$1,963,014	$1,964,930	$1,964,514
Free-Standing/Other Vol/NP	231,003	1.1982	1.2467	$581,543,531	$582,055,571	$582,069,656
Free-Standing/Other Proprietary	504,629	1.2841	1.2625	$1,414,769,616	$1,413,884,058	$1,414,228,052
Free-Standing/Other Government	29,039	1.2038	1.2576	$66,622,948	$66,652,077	$66,682,931
Facility-Based Vol/NP	178,576	1.1736	1.2162	$417,497,709	$417,650,049	$417,719,159
Facility-Based Proprietary	14,363	1.2145	1.2439	$33,073,944	$33,063,189	$33,078,742
Facility-Based Government	24,864	1.1513	1.1857	$53,829,656	$53,777,577	$53,805,961
Subtotal: Freestanding	764,671	1.2551	1.2576	$2,062,936,095	$2,062,591,706	$2,062,980,639
Subtotal: Facility-based	217,803	1.1737	1.2146	$504,401,308	$504,490,814	$504,603,861
Subtotal: Vol/PNP	409,579	1.1875	1.2334	$999,041,240	$999,705,620	$999,788,815
Subtotal: Proprietary	518,992	1.2821	1.2620	$1,447,843,560	$1,446,947,247	$1,447,306,794
Subtotal: Government	53,903	1.1796	1.2244	$120,452,604	$120,429,654	$120,488,892
TOTAL	983,063	1.2388	1.2388	$2,569,300,417	$2,569,047,450	$2,569,549,014

[25] Each "simulation" represents a different sets of assumptions about payment rates, labor shares, inclusion/exclusion of outliers, and FDL percentages.

Exhibit 7.2

Final Payment Rule - Impact Analysis Results under Alternative Payment Simulations *(Based on CY05 20% Sample)*[25]

		Case-Mix Index		Payment Simulations		
Episodes	**N**	**Orig. PPS, 80 Groups**	**New PPS, 153 Groups**	Orig. PPS*, Simulation 1	Orig. PPS* Simulation 2	Orig. PPS* Simulation 3
1	*2*	*3*	*4*	*5*	*6*	*7*
Payment system				Orig. PPS*	Orig. PPS*	Orig. PPS*
Prices				2008	2008	2008
Wage index				2007	2008	2008
Labor share				2007	2008	2007
Nominal case-mix change				No	No	No
Outlier fixed dollar loss ratio:				67%	67%	67%
Agency Group/Type						
Facility Ownership and Type: Rural						
Unknown	1	0.8205	0.8221	$2,284	$2,285	$2,284
Free-Standing/Other Vol/NP	42,633	1.1746	1.1895	$94,173,715	$94,262,842	$94,307,980
Free-Standing/Other Proprietary	127,559	1.2429	1.1936	$298,872,770	$298,467,566	$298,696,870
Free-Standing/Other Government	18,566	1.1883	1.2490	$39,605,298	$39,638,121	$39,664,401
Facility-Based Vol/NP	54,897	1.1588	1.1790	$115,346,860	$115,298,975	$115,369,740
Facility-Based Proprietary	7,363	1.2073	1.2242	$16,029,338	$16,015,439	$16,027,657
Facility-Based Government	18,582	1.1440	1.1701	$38,928,429	$38,889,840	$38,915,854
TOTAL	269,601	1.2047	1.1798	$602,958,693	$602,575,067	$602,984,785
Facility Ownership and Type: Urban						
Unknown	588	1.5025	1.4861	$1,960,730	$1,962,645	$1,962,230
Free-Standing/Other Vol/NP	188,370	1.2037	1.2598	$487,369,816	$487,792,730	$487,761,676
Free-Standing/Other Proprietary	377,070	1.2983	1.2836	$1,115,896,846	$1,115,416,491	$1,115,531,182
Free-Standing/Other Government	10,473	1.2312	1.2749	$27,017,651	$27,013,956	$27,018,530
Facility-Based Vol/NP	123,679	1.1803	1.2332	$302,150,849	$302,351,074	$302,349,419
Facility-Based Proprietary	7,000	1.2225	1.2655	$17,044,606	$17,047,750	$17,051,084
Facility-Based Government	6,282	1.1737	1.2336	$14,901,227	$14,887,737	$14,890,107
TOTAL	713,462	1.2520	1.2616	$1,966,341,724	$1,966,472,383	$1,966,564,230

Exhibit 7.2

Final Payment Rule - Impact Analysis Results under Alternative Payment Simulations *(Based on CY05 20% Sample)*[25]

		Case-Mix Index		Payment Simulations		
Episodes	**N**	**Orig. PPS, 80 Groups**	**New PPS, 153 Groups**	Orig. PPS*, Simulation 1	Orig. PPS* Simulation 2	Orig. PPS* Simulation 3
1	*2*	*3*	*4*	*5*	*6*	*7*
Payment system				Orig. PPS*	Orig. PPS*	Orig. PPS*
Prices				2008	2008	2008
Wage index				2007	2008	2008
Labor share				2007	2008	2007
Nominal case-mix change				No	No	No
Outlier fixed dollar loss ratio:				67%	67%	67%
Agency Group/Type						
Rural/Urban						
Rural	269,601	1.2047	1.1798	$602,958,693	$602,575,067	$602,984,785
Urban	713,462	1.2520	1.2616	$1,966,341,724	$1,966,472,383	$1,966,564,230
TOTAL	983,063	1.2388	1.2388	$2,569,300,417	$2,569,047,450	$2,569,549,015
Region						
North	187,084	1.1499	1.2090	$480,724,198	$481,324,981	$481,249,911
South	440,663	1.2761	1.2351	$1,159,574,764	$1,157,358,687	$1,157,862,903
Midwest	188,187	1.2249	1.2645	$465,345,716	$466,109,691	$466,201,282
West	119,563	1.2423	1.2382	$357,295,923	$357,940,801	$357,853,436
Other	47,566	1.2716	1.2933	$106,359,816	$106,313,291	$106,381,483
TOTAL	983,063	1.2388	1.2388	$2,569,300,417	$2,569,047,451	$2,569,549,015
Census Division Region						
New England	64,240	1.1106	1.1611	$163,316,595	$163,478,061	$163,440,366
Mid Atlantic	122,844	1.1706	1.2343	$317,407,604	$317,846,920	$317,809,545
South Atlantic	165,676	1.2862	1.2877	$451,116,194	$450,716,247	$450,839,688
East South Central	86,759	1.2897	1.2667	$207,802,725	$207,336,365	$207,482,699
West South Central	188,228	1.2618	1.1781	$500,655,845	$499,306,075	$499,540,516
East North Central	145,240	1.2409	1.2818	$368,262,936	$369,068,681	$369,122,234
West North Central	42,947	1.1705	1.2055	$97,082,780	$97,041,010	$97,079,048
Mountain	39,074	1.2660	1.3166	$100,438,049	$100,374,408	$100,413,615

Exhibit 7.2

Final Payment Rule - Impact Analysis Results under Alternative Payment Simulations *(Based on CY05 20% Sample)*[25]

		Case-Mix Index		Payment Simulations		
Episodes	**N**	**Orig. PPS, 80 Groups**	**New PPS, 153 Groups**	Orig. PPS*, Simulation 1	Orig. PPS* Simulation 2	Orig. PPS* Simulation 3
1	*2*	*3*	*4*	*5*	*6*	*7*
Payment system				Orig. PPS*	Orig. PPS*	Orig. PPS*
Prices				2008	2008	2008
Wage index				2007	2008	2008
Labor share				2007	2008	2007
Nominal case-mix change				No	No	No
Outlier fixed dollar loss ratio:				67%	67%	67%
Agency Group/Type						
Pacific	80,489	1.2305	1.1992	$256,857,874	$257,566,392	$257,439,821
Other	47,566	1.2716	1.2933	$106,359,816	$106,313,291	$106,381,483
TOTAL	983,063	1.2388	1.2388	$2,569,300,418	$2,569,047,450	$2,569,549,015
Agency Size (Number of 1st Episodes)						
Unknown	33	.10130	0.8895	$82,817	$82,594	$82,622
1 to 5	644	1.2056	1.1866	$1,649,481	$1,649,092	$1,649,435
6 to 9	716	1.2145	1.1806	$1,882,938	$1,882,885	$1,883,409
10 to 14	1,329	1.2297	1.2128	$3,413,443	$3,410,929	$3,411,710
15 to 19	1,689	1.2335	1.2186	$4,397,368	$4,395,181	$4,396,267
20 to 29	3,556	1.2412	1.2065	$9,305,977	$9,301,428	$9,303,604
30 to 49	8,917	1.2463	1.2335	$23,505,292	$23,494,261	$23,499,288
50 to 99	30,497	1.2505	1.2360	$81,098,337	$81,067,117	$81,085,765
100 to 199	72,309	1.2489	1.2344	$192,015,454	$191,961,619	$192,008,025
200 or More	863,373	1.2376	1.2398	$2,251,949,310	$2,251,802,342	$2,252,228,889
TOTAL	983,063	1.2388	1.2388	$2,569,300,418	$2,569,047,449	$2,569,549,015

Exhibit 7.2

Final Payment Rule - Impact Analysis Results for the CY05 20% Sample File under Alternative Payment Simulations[26]

	Payment Simulations (cont.)			Estimated Change in CY08			
Episodes	Orig. PPS* Simulation 4	Orig. PPS* Simulation 5	New PPS**	Comparison 1: Orig. PPS*, Sim. 1 vs. Orig. PPS*, Sim. 2	Comparison 2: Orig. PPS*, Sim. 3 vs. Orig. PPS*, Sim. 2	Comparison 3: Orig. PPS*, Sim. 2 vs. Orig. PPS*, Sim. 4	Comparison 4: Orig. PPS*, Sim. 5 vs. New PPS**
8	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Payment System	2007	2007	2008				
Prices	2008	2007	2008				
Wage Index	2007	2007	2008				
Labor Share	2008	2007	2008				
Nominal Case-Mix Change	No	No	Yes				
Outlier fixed dollar loss ratio:	FDL= 67%	FDL= 39.61% (Outlier $ = 5% of total)	FDL= 47.67% (Outlier $ = 5% of total)				
Agency Group/Type							
Facility Ownership and Type							
Unknown	$1,963,499	$1,906,085	$1,874,839	0.10%	0.02%	0.07%	-1.64%
Free-Standing/Other Vol/NP	$581,567,540	$568,195,488	$587,911,003	0.09%	0.00%	0.08%	3.47%
Free-Standing/Other Proprietary	$1,414,483,658	$1,383,914,898	$1,349,415,289	-0.06%	-0.02%	-0.04%	-2.49%
Free-Standing/Other Government	$66,595,362	$65,099,979	$66,950,361	0.04%	-0.05%	0.09%	2.84%
Facility-Based Vol/NP	$417,450,209	$407,110,561	$422,493,052	0.04%	-0.02%	0.05%	3.78%
Facility-Based Proprietary	$33,059,667	$32,250,584	$33,149,021	-0.03%	-0.05%	0.01%	2.79%
Facility-Based Government	$53,803,826	$52,497,323	$54,217,421	-0.10%	-0.05%	-0.05%	3.28%
Subtotal: Freestanding	$2,062,646,560	$2,017,210,365	$2,004,276,653	-0.02%	-0.02%	0.00%	-0.64%
Subtotal: Facility-based	$504,313,702	$491,858,468	$509,859,493	0.02%	-0.02%	0.04%	3.66%
Subtotal: Vol/PNP	$999,017,749	$975,306,049	$1,010,404,055	0.07%	-0.01%	0.07%	3.60%
Subtotal: Proprietary	$1,447,543,325	$1,416,165,482	$1,382,564,310	-0.06%	-0.02%	-0.04%	-2.37%
Subtotal: Government	$120,399,188	$117,597,303	$121,167,782	-0.02%	-0.05%	0.03%	3.04%
TOTAL	$2,568,923,761	$2,510,974,918	$2,516,010,985	-0.01%	-0.02%	0.00%	0.20%

[26] Each "simulation" represents a different sets of assumptions about payment rates, labor shares, inclusion/exclusion of outliers, and FDL percentages.

Exhibit 7.2

Final Payment Rule - Impact Analysis Results for the CY05 20% Sample File under Alternative Payment Simulations[26]

	Payment Simulations (cont.)			Estimated Change in CY08			
Episodes	Orig. PPS* Simulation 4	Orig. PPS* Simulation 5	New PPS**	Comparison 1: Orig. PPS*, Sim. 1 vs. Orig. PPS*, Sim. 2	Comparison 2: Orig. PPS*, Sim. 3 vs. Orig. PPS*, Sim. 2	Comparison 3: Orig. PPS*, Sim. 2 vs. Orig. PPS*, Sim. 4	Comparison 4: Orig. PPS*, Sim. 5 vs. New PPS**
8	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Payment System	2007	2007	2008				
Prices	2008	2007	2008				
Wage Index	2007	2007	2008				
Labor Share	2008	2007	2008				
Nominal Case-Mix Change	No	No	Yes				
Outlier fixed dollar loss ratio:	FDL= 67%	FDL= 39.61% (Outlier $ = 5% of total)	FDL= 47.67% (Outlier $ = 5% of total)				
Agency Group/Type							
Facility Ownership and Type: Rural							
Unknown	$2,285	$2,212	$2,208	0.05%	0.05%	0.00%	-0.15%
Free-Standing/Other Vol/NP	$94,132,508	$91,697,163	$92,744,341	0.09%	-0.05%	0.14%	1.14%
Free-Standing/Other Proprietary	$298,651,574	$290,939,162	$274,723,442	-0.14%	-0.08%	-0.06%	-5.57%
Free-Standing/Other Government	$39,580,865	$38,637,208	$39,695,240	0.08%	-0.07%	0.14%	2.74%
Facility-Based Vol/NP	$115,281,182	$112,290,522	$114,670,634	-0.04%	-0.06%	0.02%	2.12%
Facility-Based Proprietary	$16,017,647	$15,611,599	$15,920,597	-0.09%	-0.08%	-0.01%	1.98%
Facility-Based Government	$38,904,076	$37,931,341	$38,943,112	-0.10%	-0.07%	-0.04%	2.67%
TOTAL	$602,570,137	$587,109,208	$576,699,574	-0.06%	-0.07%	0.00%	-1.77%
Facility Ownership and Type: Urban							
Unknown	$1,961,214	$1,903,873	$1,872,630	0.10%	0.02%	0.07%	-1.64%
Free-Standing/Other Vol/NP	$487,435,032	$476,498,325	$495,166,663	0.09%	0.01%	0.07%	3.92%
Free-Standing/Other Proprietary	$1,115,832,084	$1,092,975,735	$1,074,691,847	-0.04%	-0.01%	-0.04%	-1.67%
Free-Standing/Other Government	$27,014,497	$26,462,771	$27,255,122	-0.01%	-0.02%	0.00%	2.99%
Facility-Based Vol/NP	$302,169,026	$294,820,039	$307,822,418	0.07%	0.00%	0.06%	4.41%
Facility-Based Proprietary	$17,042,020	$16,638,984	$17,228,423	0.02%	-0.02%	0.03%	3.54%
Facility-Based Government	$14,899,751	$14,565,982	$15,274,309	-0.09%	-0.02%	-0.08%	4.86%
TOTAL	$1,966,353,623	$1,923,865,711	$1,939,311,411	0.01%	0.00%	0.01%	0.80%

Exhibit 7.2

Final Payment Rule - Impact Analysis Results for the CY05 20% Sample File under Alternative Payment Simulations[26]

	Payment Simulations (cont.)			Estimated Change in CY08			
Episodes	Orig. PPS* Simulation 4	Orig. PPS* Simulation 5	New PPS**	Comparison 1: Orig. PPS*, Sim. 1 vs. Orig. PPS*, Sim. 2	Comparison 2: Orig. PPS*, Sim. 3 vs. Orig. PPS*, Sim. 2	Comparison 3: Orig. PPS*, Sim. 2 vs. Orig. PPS*, Sim. 4	Comparison 4: Orig. PPS*, Sim. 5 vs. New PPS**
8	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Payment System	2007	2007	2008				
Prices	2008	2007	2008				
Wage Index	2007	2007	2008				
Labor Share	2008	2007	2008				
Nominal Case-Mix Change	No	No	Yes				
Outlier fixed dollar loss ratio:	FDL= 67%	FDL= 39.61% (Outlier $ = 5% of total)	FDL= 47.67% (Outlier $ = 5% of total)				
Agency Group/Type							
Rural/Urban							
Rural	$602,570,137	$587,109,208	$576,699,574	-0.06%	-0.07%	0.00%	-1.77%
Urban	$1,966,353,623	$1,923,865,711	$1,939,311,411	0.01%	0.00%	0.01%	0.80%
TOTAL	$2,568,923,760	$2,510,974,919	$2,516,010,985	-0.01%	-0.02%	0.00%	0.20%
Region							
North	$480,834,817	$471,334,387	$492,894,515	0.12%	0.02%	0.10%	4.57%
South	$1,159,119,077	$1,133,156,426	$1,100,184,986	-0.19%	-0.04%	-0.15%	-2.91%
Midwest	$465,275,045	$452,978,852	$467,102,206	0.16%	-0.02%	0.18%	3.12%
West	$357,399,268	$349,968,120	$350,083,095	0.18%	0.02%	0.15%	0.03%
Other	$106,295,553	$103,537,133	$105,746,183	-0.04%	-0.06%	0.02%	2.13%
TOTAL	$2,568,923,760	$2,510,974,918	$2,516,010,985	-0.01%	-0.02%	0.00%	0.20%
Census Division Region							
New England	$163,366,308	$160,233,991	$166,364,622	0.10%	0.02%	0.07%	3.83%
Mid Atlantic	$317,468,510	$311,100,396	$326,529,893	0.14%	0.01%	0.12%	4.96%
South Atlantic	$451,012,189	$441,915,618	$443,878,030	-0.09%	-0.03%	-0.07%	0.44%
East South Central	$207,663,386	$201,951,666	$197,926,630	-0.22%	-0.07%	-0.16%	-1.99%
West South Central	$500,443,502	$489,289,142	$458,380,326	-0.27%	-0.05%	-0.23%	-6.32%
East North Central	$368,224,838	$358,341,031	$369,584,393	0.22%	-0.01%	0.23%	3.14%
West North Central	$97,050,207	$94,637,822	$97,517,813	-0.04%	-0.04%	-0.01%	3.04%
Mountain	$100,409,463	$98,152,847	$101,315,898	-0.06%	-0.04%	-0.03%	3.22%

Exhibit 7.2

Final Payment Rule - Impact Analysis Results for the CY05 20% Sample File under Alternative Payment Simulations[26]

	Payment Simulations (cont.)			Estimated Change in CY08			
Episodes	Orig. PPS* Simulation 4	Orig. PPS* Simulation 5	New PPS**	Comparison 1: Orig. PPS*, Sim. 1 vs. Orig. PPS*, Sim. 2	Comparison 2: Orig. PPS*, Sim. 3 vs. Orig. PPS*, Sim. 2	Comparison 3: Orig. PPS*, Sim. 2 vs. Orig. PPS*, Sim. 4	Comparison 4: Orig. PPS*, Sim. 5 vs. New PPS**
8	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Payment System	2007	2007	2008				
Prices	2008	2007	2008				
Wage Index	2007	2007	2008				
Labor Share	2008	2007	2008				
Nominal Case-Mix Change	No	No	Yes				
Outlier fixed dollar loss ratio:	FDL= 67%	FDL= 39.61% (Outlier $ = 5% of total)	FDL= 47.67% (Outlier $ = 5% of total)				
Agency Group/Type							
Pacific	$256,989,805	$251,815,274	$248,767,197	0.28%	0.05%	0.22%	-1.21%
Other	$106,295,553	$103,537,133	$105,746,183	-0.04%	-0.06%	0.02%	2.13%
TOTAL	$2,568,923,761	$2,510,974,919	$2,516,010,985	-0.01%	-0.02%	0.00%	0.20%
Agency Size (Number of 1st Episodes)							
Unknown	$82,796	$83,046	$76,530	-0.27%	-0.03%	-0.24%	-7.85%
1 to 5	$1,649,160	$1,617,806	$1,600,795	-0.02%	-0.02%	0.00%	-1.05%
6 to 9	$1,882,454	$1,840,067	$1,806,397	0.00%	-0.03%	0.02%	-1.83%
10 to 14	$3,412,794	$3,336,873	$3,310,866	-0.07%	-0.02%	-0.05%	-0.78%
15 to 19	$4,396,568	$4,298,078	$4,250,835	-0.05%	-0.02%	-0.03%	-1.10%
20 to 29	$9,304,157	$9,105,747	$8,929,888	-0.05%	-0.02%	-0.03%	-1.93%
30 to 49	$23,501,128	$22,958,083	$22,761,248	-0.05%	-0.02%	-0.03%	-0.86%
50 to 99	$81,083,503	$79,269,395	$78,601,489	-0.04%	-0.02%	-0.02%	-0.84%
100 to 199	$191,977,543	$187,687,098	$185,961,090	-0.03%	-0.02%	-0.01%	-0.92%
200 or More	$2,251,633,657	$2,200,778,725	$2,208,711,850	-0.01%	-0.02%	0.01%	0.36%
TOTAL	$2,568,923,760	$2,510,974,919	$2,516,010,986	-0.01%	-0.02%	0.00%	0.20%

Exhibit 7.2

Final Payment Rule - Impact Analysis Results for the CY05 20% Sample File under Alternative Payment Simulations[26]

	Payment Simulations (cont.)			Estimated Change in CY08			
Episodes	Orig. PPS* Simulation 4	Orig. PPS* Simulation 5	New PPS**	Comparison 1: Orig. PPS*, Sim. 1 vs. Orig. PPS*, Sim. 2	Comparison 2: Orig. PPS*, Sim. 3 vs. Orig. PPS*, Sim. 2	Comparison 3: Orig. PPS*, Sim. 2 vs. Orig. PPS*, Sim. 4	Comparison 4: Orig. PPS*, Sim. 5 vs. New PPS**
8	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Payment System	2007	2007	2008				
Prices	2008	2007	2008				
Wage Index	2007	2007	2008				
Labor Share	2008	2007	2008				
Nominal Case-Mix Change	No	No	Yes				
Outlier fixed dollar loss ratio:	FDL= 67%	FDL= 39.61% (Outlier $ = 5% of total)	FDL= 47.67% (Outlier $ = 5% of total)				
Agency Group/Type							

Notes:

- Facility type is based on the Online Survey and Certification System (OSCAR); the "other" category is a self-reported facility type but assumed to be freestanding.
- Episode sample (and estimated payments) are for a 20% sample of beneficiaries.

Key:

Payment System: the system rules used in the simulation:

- *Orig. PPS = 80 HHRGs, SCIC adjustments, no LUPA add-on, no separate NRS payment.
- **New PPS = 153 HHRGs, no SCIC adjustments, LUPA add-on, separate NRS payment.

Prices: "2007" = 2007 rates, "2008" = episode rates were updated by the statutory 3.0% home health market basket update.

Wage Index: indicates whether the 2007 or 2008 wage index was used.

Labor share: Labor share that was used for payment calculations; "2007" = 2007 labor share, "2008" = updated labor share.

Nominal Case Mix Change: indicates whether payment rates in the simulation were adjusted to account for the 2.75% rate reduction for nominal case mix change.

Outlier fixed dollar loss ratio: indicates whether the FDL ratio was fixed at the .67 level of the 2007 system, or was it was allowed to find the level needed for outlier payments to represent 5% of total estimated payments.

8. A Regression Analysis of Differences in Home Health Case-Mix Through Time

8.1. Overview

Under the home health prospective payment system (PPS) implemented in October 2000, Medicare payment for each 60-day episode of care is made based on the location of service and on the episode's classification into one of 80 case-mix groups, also called "home health resource groups" (HHRGs). This classification is based on the patient's characteristics at the start of the episode, as well as the patient's use of rehabilitation therapy services (physical therapy, occupational therapy, or speech language pathology) during the episode. Each HHRG has an associated case-mix weight, which determines how much the payment for the specific episode is adjusted from the standardized base payment established for the current payment year.

As noted in the Final HHA Payment Rule (CMS-1541-FC), between 2000 and 2005, the national average case-mix weight of Medicare home health episodes increased by 12.78%, with the average relative payment weight increasing from 1.0960 to 1.2361.[27] Because the case-mix assignment is based on home health agencies' classification of their own patients, there are questions about the extent to which the increase in case-mix weight reflects true changes in patient characteristics (i.e., real case-mix change) or changes in the coding practices used by agencies, for example, changes due to improvements in coding or to upcoding or case-mix "creep" (i.e., nominal case-mix change). The extent to which changes in case-mix assignments over time are due to changes in coding practice vs. real changes in patient acuity has important implications for the payment rates used in the prospective payment system. If the higher case-mix levels reflect the entry of more resource-intensive patients, then the case-mix change is real and no adjustment to the payment rates needs to be made, as the system will be achieving the policy objective of adequate provider reimbursement. However, if change in coding practices is the primary source of case-mix growth, then Medicare needs to consider how, and how much, to adjust payment rates to account for this growth, which is not due to true changes in patient characteristics. The Benefits Improvement and Protection Act (BIPA) of 2000 gives CMS the authority to make adjustments to payment rates to adjust for changes in the average case-mix that are due to changes in coding practices.

In this paper, we examine how consistently the home health case-mix system was applied in grouping patients into case-mix groups over time. The question of consistency in case-mix assignments over time has been important for Medicare in administering health care payments for more than two decades. Medicare first experienced nominal case-mix change following commencement of the first major prospective payment system, the inpatient hospital system based on Diagnoses-related Groups (DRGs) of 1983. One study found that between 1987 and 1988 about half of the 3.3% increase in the national inpatient case-mix index was due to coding changes that were unrelated to patient characteristics.[28] More recently, coding change was found to have affected Medicare prospective payment systems implemented

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[27] *Medicare Program; Home Health Prospective Payment System Refinement and Rate Update for Calendar Year 2008; Final Rule (42 CFR Part 484)* Federal Register, Vol. 72, No. 167, August 29, 2007, p.49833 Note that this estimate is based on a data sample different from the one used for the analyses in this paper.

[28] Carter, Grace M., J. P. Newhouse, and D. A. Relles (1991). Has DRG Creep Crept Up? Santa Monica, CA: RAND, R-4098-HCFA/ProPAC.

for inpatient rehabilitation facilities and long-term-care hospitals**.** Several possibilities could account for the coding changes, including improvements in the training of provider personnel, evolution in coding systems and instructions issued by myriad sources, and financial incentives to maximize reimbursement.

In the remainder of this paper we describe our analytical effort to distinguish sources of change in Medicare home health case-mix. We classify the sources of change into two major types. The predicted change in case-mix is considered real case-mix change that is based on (1) the relationship between patient characteristics and case-mix, and (2) changes in the characteristics of patients over time. The unpredicted change in case-mix cannot be explained by changes in patient characteristics, and is assumed to reflect differences in agency coding practices over time.

Our basic approach is to develop regression-based, predictive models of individual case-mix scores (relative weights) based on home health patients' demographic characteristics and clinical status in the time period leading up to their home health episodes. These models were estimated using data from a baseline period prior to the implementation of the prospective payment system. The regression coefficients from these models were applied to episodes from 2005, allowing one to measure how much of the observed case-mix change is attributable to variations in patients' demographic characteristics and clinical status. The degree to which observed change in case-mix exceeds the amount of change that is predicted by the models is thought to be due to differences in how patients are assigned to case-mix groups after controlling for their personal and health characteristics (i.e., nominal case-mix change).

Our goal in estimating these regressions is to predict the case-mix weights with variables readily available in our administrative data. We are not interested so much in the individual values of estimated coefficients, nor are we particularly concerned about redundancy among variables, as long as groups of variables make sense broadly as correlates of case-mix. Our interest is in achieving a reasonable amount of predictive power from the variables taken together. Nevertheless, in discussing the results below, we will comment on the some of the more significant coefficients estimated with the model.

8.2. Data

8.2.1. Baseline Period Data

The baseline period data are from Federal Fiscal Year (FY) 2000 (October 1, 1999 to September 30, 2000) – when the Home Health Interim Payment System (IPS) was in effect. Since home health services were not yet paid on the per-episode basis used under PPS, we used Medicare home health claims to construct an analysis file of simulated 60-day episodes, applying rules based on the anticipated design of the impending prospective payment system.

To assign case-mix weights to the simulated episodes, we needed the appropriate patient characteristics variables. While the collection of the Outcomes and Assessment Information Set (OASIS) variables on all Medicare and Medicaid home health patients began in July 1999, the data collection time points for each patient did not always match the starting points of our simulated payment episodes. This is because, at that time, OASIS assessments were conducted solely for outcomes monitoring purposes. When matching OASIS assessments to simulated payment episodes, we accepted any assessment within 14 days of the episode start date. If there were multiple qualifying assessments, we chose the closest start/resumption of care assessment for initial episodes, and the closest start/resumption or followup/recertification assessments for subsequent episodes. In approximately 18% of cases, no suitable OASIS assessment

(close enough to a simulated payment episode start date) was available, and those episodes had to be excluded from the analysis.

Episodes with fewer than five visits were also excluded from the analysis because they would be considered LUPA episodes under PPS, and would not be paid using home health resource groups (HHRGs) in any case. The analysis file for the base period included episodes for a 10% sample of beneficiaries and included 358,694 episodes. For episodes with OASIS assessments, an HHRG was assigned using the OASIS information, even though the actual claims for the services in the episodes were not paid (in 1999) using HHRGs. The mean relative payment weight (case-mix index) of these claims was 1.09976.[29]

8.2.2. PPS Period Data

The PPS period data consisted of an analogous file from Calendar Year 2005. These data were drawn from the Home Health Datalink file, which was created for CMS by Fu Associates of Arlington, VA. This database includes 100% of home health episode claims from the start of PPS, plus matched OASIS assessments, data on other Medicare service use by the beneficiary, and additional data on provider, beneficiary, and area characteristics. We used data for a 20% sample of Medicare home health users, selected based on beneficiary Medicare (HIC) number digits. This analysis file contained 876,119 episodes. Since these were records from the PPS period, the actual paid HHRGs were available. However, in preparing the file, we corrected the HHRG in situations where claims-based information on therapy visits during the episode was inconsistent with the HHRG on the claim.[30] The mean case-mix weight for this sample was 1.2293.

8.3. Methodology

We used a two-step process to examine whether changes in case-mix are due to changes in patient characteristics relative to the baseline (i.e., real case-mix change) or other factors that are not related to changes in baseline characteristics (i.e., nominal case-mix change).

- ***Examine the relationship between patient characteristics and case-mix in baseline period:*** We began by estimating a series of multivariate regression models to examine the relationship between patient characteristics and relative payment weight, our measure of case-mix. This model was estimated using patient characteristic measures that were

[29] The IPS file used for the official estimate of baseline case-mix in the Final Rule was a 100% file of (simulated) nonLUPA episodes ending from October 1999 through September 2000, n=3,138,743, with an estimated average case-mix weight of 1.0960.

[30] The CY2005 modeling file inadvertently included 7,212 RAP records, as well as some records with apparent date inconsistencies that were not included in the file used to calculate the official estimates of case-mix increase. This would have had some lowering effect on the average case-mix weight for the modeling file, since the average case-mix weight for these cases was lower than that of other cases. In addition, in the CY05 modeling file SCICs were assigned the case-mix weight at episode start, while in the official estimate file, they were assigned an average of all case-mix weights that were submitted on the claim (weighted by the proportion of paid days for each one.) This would also have had a slight lowering effect on the overall average case-mix weight in the CY05 modeling file. However, we believe these differences are unlikely to have had any systematic impact on the findings of the modeling and prediction analysis, which are based on the regression using the IPS data and the characteristics of patients in the 2005 data.

constructed using data from the time period preceding the start of each home health episode, thus ensuring that our covariates were not affected by home health agency coding practices.[31]

- ***Calculate predicted case-mix for PPS period***: We applied the coefficients from these models (i.e., the relationship between baseline patient characteristics and case-mix) to episodes from a later period to measure the change in case-mix that can be attributed to changes over time in patient characteristics. We compared the actual and predicted case-mix to measure how much of the change was due to changes in patient characteristics. Procedurally, this amounts to multiplying the average value for a covariate in the 2005 episodes by the relevant coefficient, and summing all the products. The sum is the predicted average case-mix weight in the sample of episodes.

8.3.1. Models to Examine Relationship Between Patient Characteristics and Case-Mix

Using data from an initial base period (defined using the 12-48 months immediately before the commencement of the payment episode), we estimated a series of regression models of the following basic functional form:

$$\text{Relative Payment Weight}_i = \alpha + \beta * \text{Personal Characteristics}_i + \varepsilon_i$$

where:

Relative Payment Weight for individual i is the relative payment weight for that individual's 60-day home health episode (based on the current 80 HHRGs);

α is a constant term (to be estimated);

β is a vector of coefficients (to be estimated);

Personal Characteristics is the vector of demographic and clinical variables for each individual; and

ε is an error term.

We estimated a series of nine different regression models,[32] which varied with respect to the independent variables that were included:

- **Model 1 – Demographic variables only.** The demographic variables were included to control for any differences in case-mix determination associated with age, gender, and race/ethnicity. It is possible that age may also be proxying for the reason for Medicare eligibility (i.e., individuals less than 65 who are Medicare-eligible are those with disabilities or end stage renal disease [ESRD]). The following demographic variables were included:

[31] Note that patient living arrangement was the only covariate in any of the models that used information from the OASIS assessment.

[32] In the Final Rule, this modeling is described as taking place in six phases. The difference is that, in this document, Models 6 though 9 are discussed separately, while in the Final Rule they are all grouped into the sixth phase.

- Age (age groups 65 to 74, 75 to 84, 85 to 84, and 95 and above; age under 65 is the reference category);
- Gender (male);
- Race (White and African American; other, including Asian, Hawaiian/Pacific Islander, and Native American/Alaskan Native, is the reference category).

In addition, the age variables were interacted with the gender and race dummy variables to fully exploit the potential differences in effect on case-mix from the various demographic subgroups. There were a total of 19 demographic variables in Model 1, and these variables were included in all other models.

- **Model 2 – Add measures of prior utilization.** Prior hospital, inpatient rehabilitation, and SNF stays and days of care are likely to be associated with home health case-mix for a variety of reasons. For example, individuals with a recent rehabilitation facility stay may be recovering from an injury or fall and may require substantial amounts of care and further rehabilitation services as they continue to recover during their home health episodes. Conversely, individuals with a recent hospital or SNF stay may have more chronic health conditions that require longer periods of home health care (i.e., multiple episodes) at lesser intensity (lower case-mix in each episode). Model 2 included additional variables related to utilization of Part A services, including whether the patient had any acute or long-term care hospital stay in the prior 14 days (relative to the start of the home health episode), any rehabilitation facility stay in the prior 14 days, any Medicare skilled nursing facility (SNF) stay in the prior 14 days, and no stays (hospital, rehabilitation facility, or SNF) in the prior 14 days, and then the number of days of care in these facilities preceding the home health episode. Specifically, the additional stay and days variables were:
  - Acute care hospital, long-term care hospital, rehabilitation facility, and SNF stay (any); and
  - For each of these four care settings, the total number of days in the preceding 14 days and the total number of days in the period 15 to 120 days prior to the home health episode. The stay and days of care variables represented an additional 12 independent variables. All the variables in Model 2 are included in the next seven models.

- **Model 3 – Add measures of patient living arrangements.** Individuals who live with other people, especially spouses and close family members, may have lower home health care needs from third parties (home health agencies), resulting in lower home health resource use and lower case-mix, all else equal. This set of variables was collected from the OASIS assessment matched to the claim in our analysis files. Living situation variables were selected for this analysis over caregiver variables because it may be easier to determine living situation accurately than to assess the level of caregiver support. Model 3 included dummy variables indicating the patient's living status at home – i.e., lives alone, lives with spouse, lives with another family member, lives with paid help, or lives with someone else (the reference category is living with a friend) – a total of five additional variables. These living status variables were the only variables in the model that came from agency-reported OASIS data. The next six models include all the variables in Model 3.

- **Model 4 – Add measures of patient's acute care hospital inpatient history.** We examined the patient's acute care hospital inpatient history for the entire reference period (beginning in 1996), considering the All Patient Refined Diagnosis Related Group (APR DRG) for the

patient for his or her most recent inpatient **stay**[33]. Our use of the APR DRG system represents an effort to broaden the classification of acute hospital inpatient stays in several ways. First, APR DRG classifications were developed across a population including all individuals (all patients) as opposed to being limited to only Medicare patients (as was the earlier DRG system). In addition, the risk of mortality and severity levels in the APR DRG were included to account for how comorbidities could affect the post-acute care needs of acute hospital patients.[34] As with the other independent variables in the model, APR DRGs reflect patient characteristics prior to the home health episode. As such, these patient characteristics are not affected or determined by the home health agency in any way. Second and more importantly, APR DRGs are designed to predict patient acuity and care needs in acute care hospital settings. To the extent that such acute care acuity and needs reflect the patient's need for more-intensive care in other settings (in this case, in home health settings), APR DRGs are reasonable proxy variables for home health care need (i.e., home health case-mix).

Model 4 included dummy variables for the following:

- The All Patient Refined Diagnosis Related Group (APR DRG) for the patient for his or her most recent inpatient stay.
- Whether that APR DRG was procedure-based or medically-based.
- The patient's expected risk of mortality at the time of the hospitalization (four levels – the reference group is patients with no APR DRGs – their relative mortality risk cannot be coded).
- Interactions between the APR DRG and APR DRG severity level. Based on a patient's personal characteristics and comorbidities at the time of the hospital stay, each patient within each APR DRG is assigned to one of four severity levels in the APR DRG algorithm. The severity levels are specified in the model as interactions, because the APR DRG severity levels are developed individually for each APR DRG classification. Interactions for the first three severity levels are included (the fourth and highest severity level is the reference category). This specification is equivalent to having a separate group indicator variable for each combination of APR DRG and severity level.
- APR DRG variables and interactions with severity levels are included only if at least 25 episodes have that combination of APR DRG and severity in the base-year file (see below). A total of 291 APR DRG variables and interactions were included.

An assumption of this approach is that the hospitals' coding of diagnoses, used for assigning the APR-DRG, is stable between the two periods of the analysis (baseline period and PPS period). We are not aware of any important general sources of diagnosis coding change in Medicare hospital diagnosis data. As described below in Section 5, we did ask clinicians and coding experts to review the specific APR DRGs where we observed significant changes

[33] Approximately 90% of beneficiaries with home health care episodes in the sample had a hospital stay during the lookback period.

[34] Abt Associates devised a dummy variable indicating whether an APR DRG was procedural or medical, using the APR DRG system designations – i.e., each APR DRG is classified as either a procedural or medical inpatient stay.

between the base period and the PPS period, and to identify any situations where changes in coding guidance or other external factors might be at work.

To adjust for changes in ICD-9-CM code sets and the derivation of the DRGs, the APR DRG software incorporates an ICD-9-CM code "mapper" to map hospital diagnosis codes back to their predecessor codes in case of changes to the code set across the study years. The code mapper, which we used in defining our analysis variables, is intended to permit valid comparisons of acute stay APR DRG assignments across years, even though the ICD-9-CM code set may incorporate a few changes from year to year.

All the variables in Model 4 were included in the next five models.

- **Model 5 – Add measures of home health agency ownership type.** Model 5 included dummy variables based on the home **health** agency's ownership type/type of control:
  - Free-standing, voluntary or non-profit
  - Free-standing, proprietary
  - Free-standing, government-owned
  - Facility-Based, voluntary or non-profit
  - Facility-Based, proprietary
  - Facility-Based, government-owned
  - Other, voluntary or non-profit
  - Other, proprietary
  - Other, government-owned
  - The reference category is unknown facility ownership/control

  All of the facility ownership/type variables in Model 5 are included in the next four models.

- **Models 6-9 – Add measures of Medicare Part A payments**. These models included measures of Medicare Part A payments in the 120 days preceding the home health episode.
  - Models 6 and 7 include separate payments variables for acute care hospital, long-term care hospital, rehabilitation facility, and SNFs. Model 6 uses this measure in actual dollars (levels), while Model 7 is the logarithm ("log") of the payment amount (1 is added to payments before taking logs because the log function is not defined for zero payments).
  - Models 8 and 9 sum Medicare payments across the four care settings, before including the total in levels (Model 8) or logs (Model 9).

Given that Models 6-9 also include variables that may be related to Medicare payments (e.g., variables for stays and days of care in each setting as well as the APR DRG variables), the Medicare payment variables may serve as measures of the intensity of services in the period preceding the home health episode.

8.3.2. Calculating Real Case-Mix Change

After estimating each of the nine models, the results (coefficient estimates) were applied to data for a later period. That is, a predicted relative payment weight for each episode in the later period was estimated

under each model. The resulting predicted values were then averaged for each model, and compared to the actual average case-mix for the later period.[35]

The following calculations were made.

- ***Total change in case-mix:*** We calculate the total difference in case-mix between the initial and final periods. This was based on the change in average relative payment weight between the two periods.

- Predicted change in case-mix and percentage of total change in case-mix that is predicted: Changes in patient characteristics over time lead to expected changes in case-mix. We used the regression coefficients from the models and patient characteristics from the later period to calculate the expected case-mix for the later period. The differences between the case-mix in the baseline period and the expected case-mix in the later period indicate how much of the case-mix change across the two periods is accounted for by observable differences (changes in the independent variables) in each model. We divided the predicted change in case-mix by the total change in case-mix to calculate the percentage of the total change in case-mix that was predicted by each of the nine models.

- ***Unpredicted change in case-mix and percentage of total change in case-mix that is unpredicted:*** The unpredicted change in case-mix is calculated as the difference between the total and predicted change in case-mix. It is a measure of the change in case-mix that is not due to observable changes in patient characteristics. The estimates of the unpredicted change in case-mix are attributed to changes in agency coding practices. Admittedly, there may be some other factor or factors associated with home health case-mix that are not included in any of the nine models that we estimated, but our estimates of the amount of unpredicted case-mix change were quite similar across the nine models, especially for Models 2-9. The robustness of our results suggests that patients with the same characteristics at intake (i.e., the start of the home health episode) were being coded into case-mix groups with higher relative payment weights in the later period.

While there may be observable or unobservable factors related to patient case-mix that were not included in our models, it is important to note that the omission of these variables is not enough to change estimates of unpredicted case-mix change. Such a variable or variables must have different prevalence rates in the initial and later periods. If prevalence rates for such variables were the same in both periods, the effects would net out – in other words, there would be no systematic difference in the predicted change in case-mix over time.

8.3.3. Accounting for Changes in Medicare Payment Rates

Medicare payments between the two periods vary due to the increases in Medicare payments made between 1999 and 2005. To adjust for this, we deflated the 2005 Medicare payment amounts using a

[35] In actuality, because all the models are completely linear, calculating each predicted value and then averaging is equivalent to predicting the average case-mix for all episodes by multiplying the mean value of each independent variable in the later period by the model coefficient for that variable, and then summing these products. The latter calculations were performed and will be displayed below.

deflation factor that was based on the aggregate change in payments during this time period.[36] The factors used were as follows:

- Acute care hospital: 1.179805
- Long-term care hospital: 1.195404
- Rehabilitation facility: 1.179823
- SNF: 1.165763

8.4. Results

8.4.1. Changes in Patient Characteristics

We analyzed the means of all of the variables included in the regression models for the two periods (Exhibit 8.1). These changes may indicate increasing patient acuity and real case-mix change. Some notable differences in patient characteristics occurred between the two periods.

- The prevalence of long-term care hospital days in the 14 days prior to the home health episode and in the period 15 to 120 days prior to the home health episode increased by 38%, from 5.40% in the baseline period to 7.45%.

- The proportion of patients at the highest risk of mortality (i.e., risk level four) was higher in 2005 (2.36%) than in the baseline period (1.62%).

- The proportion of patients who had cardiac defibrillator and heart assist implant was more than twice as high in 2005 (5.96%) than in the baseline period (2.38%).

- Coronary artery bypass without cardiac catheterization or percutaneous cardiac procedure was less prevalent in 2005 (1.59%) than in the baseline period (2.17%).

- Knee joint replacement was more 47.2% more prevalent in 2005 (8.22%) than in the baseline period (5.59%).

- Laparoscopic cholecystectomy was more prevalent in 2005 (0.96%) than in the baseline period (0.76%).

- Major thoracic and abdominal vascular procedures were less prevalent in 2005 (0.47%) than in the baseline period (0.64%).

- Multiple significant trauma was more prevalent in 2005 (0.04%) than in the baseline period (0.03%).

- Nonspecific CVA and precerebral occlusion without infarction was 66.6% less prevalent in 2005 (0.77%) than in the baseline period (2.29%).

[36] The Medicare payment increases in each setting in each year were multiplied together, and then an annual average increase was calculated. The resulting average annual increases were then raised to the power of the average difference in years for episodes in the IPS and 2005 files.

- Other aftercare and convalescence was more prevalent in 2005 (0.02%) than in the baseline period (0.01%).

- Other anemia and disorders of the blood and blood-forming organs were more prevalent in 2005 (1.23%) than in the baseline period (0.94%).

- Percutaneous cardiovascular procedures with AMI were more prevalent in 2005 (0.78%) than in the baseline period (0.53%).

- Percutaneous cardiovascular procedures without AMI were more prevalent in 2005 (1.42%) than in the baseline period (1.01%).

- Pulmonary edema and respiratory failure were more prevalent in 2005 (1.29%) than in the baseline period (1.03%).

- Renal failure was more prevalent in 2005 (2.44%) than in the baseline period (1.31%).

- Other proprietary home health agencies incurred 29.4% of episodes in the baseline period but 46.4% of episodes in 2005.

- There were increases in long-term care hospital and SNF payments from the IPS to 2005, after adjusting for inflation. Mean long-term care payments increased from $215 to $355, an increase of more than 60%, and mean SNF payments increased by 30%, from $1,178 to $1,537. Mean acute care hospital expenditures declined from $7,615 to $6,777, a decrease of 11%.

Exhibit 8.1 shows the frequency for individual APR DRGs. This is computed for each data set by adding up the prevalence of each APR DRG at each severity level.[37] While there were 14 APR DRGs with prevalence changes of at least 25% between the IPS and 2005, there were another 66 APR DRGs for which the prevalence changed by less than 25%.

Note that we did not include t-tests to evaluate whether differences were statistically significant. Given the very large sample size, even very small differences would likely be significant. Also note that our regression models included a number of interaction terms. In Exhibits 8.1 and 8.3, "Sev" indicates interactions between severity levels and APR DRGs (e.g., "One" indicates an interaction between an APR DRG and the first severity level).

[37] The proportion for each APR DRG represents the proportion of patients with an identified inpatient stay in the lookback period preceding home care (potentially a number of years). This included 89% of the observations in the IPS file and 91% in the PPS file. See section 8.5.3 below for description of analyses using alternative lookback periods.

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
	Relative Payment Weight (Dependent Variable)	1.09976	1.22926	11.8%
	Age 65 to 74	0.24487	0.24093	-1.6%
	Age 75 to 84	0.40201	0.38603	-4.0%
	Age 85 to 94	0.23642	0.23273	-1.6%
	Age 95+	0.02446	0.02421	-1.0%
	Age 65 to 74 * Male	0.09202	0.09084	-1.3%
	Age 75 to 84 * Male	0.13413	0.12948	-3.5%
	Age 85 to 94 * Male	0.06416	0.06704	4.5%
	Age 95+ * Male	0.00479	0.00479	0.0%
	Male	0.33895	0.34510	1.8%
	Age 65 to 74 * White	0.19328	0.18343	-5.1%
	Age 75 to 84 * White	0.34115	0.31097	-8.8%
	Age 85 to 94 * White	0.20385	0.19735	-3.2%
	Age 95+ * White	0.01994	0.01959	-1.7%
	White	0.82323	0.78902	-4.2%
	Age 65 to 74 * African American	0.03844	0.04324	12.5%
	Age 75 to 84 * African American	0.04459	0.04911	10.1%
	Age 85 to 94 * African American	0.02380	0.02391	0.5%
	Age 95+ * African American	0.00349	0.00339	-2.9%
	African American	0.13232	0.15044	13.7%
	Any Hospital in Prior 14 Days IP Claims	0.38548	0.33375	-13.4%
	Any Rehab in 14 Days Prior from IP Claims	0.04488	0.04215	-6.1%
	Any MCR SNF in 14 Days Prior From IP Claims	0.12012	0.12348	2.8%
	No Hosp/Rehab/SNF in 14 Days From Prior IP Claims	0.51543	0.55600	7.9%
	Acute Care Hospital Days in Period 14 Days Preceding Home Health Episode	2.25772	1.82436	-19.2%
	Acute Care Hospital Days in Period 15 to 120 Days Preceding Home Health Episode	4.08395	3.63742	-10.9%
	Long Term Care Hospital Days in Period 14 Days Preceding Home Health Episode	0.05398	0.07452	38.0%
	Long Term Care Hospital Days in Period 15 to 120 Days Preceding Home Health Episode	0.19601	0.28939	47.6%
	Rehabilitation Facility Days in Period 14 Days Preceding Home Health Episode	0.44888	0.41979	-6.5%
	Rehabilitation Facility Days in Period 15 to 120 Days Preceding Home Health Episode	0.68442	0.52362	-23.5%
	Medicare Skilled Nursing Facility (SNF) Days in Period 14 Days Preceding Home Health Episode	1.17840	1.27846	8.5%
	Medicare Skilled Nursing Facility (SNF) Days in Period 15 to 120 Days Preceding Home Health Episode	2.80072	3.58891	28.1%
	Patient Lives Alone	0.30457	0.19831	-34.9%
	Patient Lives with Other (Not Family, Friends, Paid Help or Spouse)	0.01426	0.00685	-51.9%
	Patient Lives with Other Family	0.28275	0.19323	-31.7%
	Patient Lives with Paid Help	0.07705	0.05850	-24.1%
	Patient Lives with Spouse	0.34982	0.24815	-29.1%
	Medical APR DRG	0.69815	0.70393	0.8%
	Procedure APR DRG	0.19004	0.20201	6.3%
	Mortality Risk Level 1	0.14219	0.14513	2.1%
	Mortality Risk Level 2	0.26581	0.25322	-4.7%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
	Mortality Risk Level 3	0.08848	0.09325	5.4%
	Mortality Risk Level 4	0.01615	0.02361	46.1%
	Acute Myocardial Infarction	0.01323	0.01065	-19.5%
One	Acute Myocardial Infarction	0.00132	0.00090	-31.8%
Two	Acute Myocardial Infarction	0.00576	0.00390	-32.3%
Three	Acute Myocardial Infarction	0.00484	0.00427	-11.8%
	TOTAL	0.02515	0.01971	-21.6%
	Cardiac Catheterization for Ischemic Heart Disease	0.00383	0.00467	21.9%
One	Cardiac Catheterization for Ischemic Heart Disease	0.00100	0.00135	35.0%
Two	Cardiac Catheterization for Ischemic Heart Disease	0.00200	0.00236	18.0%
Three	Cardiac Catheterization for Ischemic Heart Disease	0.00077	0.00090	16.9%
	TOTAL	0.00759	0.00928	22.3%
	Cardiac Catheterization W Circ Disorders Except Ischemic Heart Disease	0.00344	0.00373	8.4%
One	Cardiac Catheterization W Circ Disorders Except Ischemic Heart Disease	0.00025	0.00031	24.0%
Two	Cardiac Catheterization W Circ Disorders Except Ischemic Heart Disease	0.00065	0.00071	9.2%
Three	Cardiac Catheterization W Circ Disorders Except Ischemic Heart Disease	0.00233	0.00235	0.9%
	TOTAL	0.00666	0.00710	6.6%
	Cardiac Defibrillator and Heart Assist Implant	0.00126	0.00314	149.2%
One	Cardiac Defibrillator and Heart Assist Implant	0.00008	0.00012	50.0%
Two	Cardiac Defibrillator and Heart Assist Implant	0.00043	0.00087	102.3%
Three	Cardiac Defibrillator and Heart Assist Implant	0.00061	0.00183	200.0%
	TOTAL	0.00238	0.00596	150.4%
	Cardiac Pacemaker and Defibrillator Device Replacement	0.00055	0.00070	27.3%
One	Cardiac Pacemaker and Defibrillator Device Replacement	0.00039	0.00042	7.7%
Three	Cardiac Pacemaker and Defibrillator Device Replacement	0.00012	0.00018	50.0%
	TOTAL	0.00106	0.00130	22.6%
	Cardiac Pacemaker and Defibrillator Device Revision Except Device Replacement	0.00029	0.00045	55.2%
One	Cardiac Pacemaker and Defibrillator Device Revision Except Device Replacement	0.00012	0.00017	41.7%
Two	Cardiac Pacemaker and Defibrillator Device Revision Except Device Replacement	0.00013	0.00014	7.7%
	TOTAL	0.00054	0.00077	42.6%
	Cardiac Valve Procedures W Cardiac Catheterization	0.00234	0.00215	-8.1%
One	Cardiac Valve Procedures W Cardiac Catheterization	0.00011	0.00011	0.0%
Two	Cardiac Valve Procedures W Cardiac Catheterization	0.00062	0.00049	-21.0%
Three	Cardiac Valve Procedures W Cardiac Catheterization	0.00135	0.00112	-17.0%
	TOTAL	0.00443	0.00388	-12.4%
	Cholecystectomy Except Laparoscopic	0.00216	0.00177	-18.1%
One	Cholecystectomy Except Laparoscopic	0.00024	0.00025	4.2%
Two	Cholecystectomy Except Laparoscopic	0.00103	0.00070	-32.0%
Three	Cholecystectomy Except Laparoscopic	0.00071	0.00060	-15.5%
	TOTAL	0.00413	0.00333	-19.4%
	Chronic Obstructive Pulmonary Disease	0.02877	0.02808	-2.4%
One	Chronic Obstructive Pulmonary Disease	0.00608	0.00477	-21.5%
Two	Chronic Obstructive Pulmonary Disease	0.01464	0.01391	-5.0%
Three	Chronic Obstructive Pulmonary Disease	0.00708	0.00829	17.1%
	TOTAL	0.05658	0.05505	-2.7%
	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	0.01128	0.00840	-25.5%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
One	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	0.00067	0.00050	-25.4%
Two	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	0.00582	0.00383	-34.2%
Three	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	0.00395	0.00317	-19.7%
	TOTAL	0.02172	0.01589	-26.8%
	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	0.00694	0.00580	-16.4%
One	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	0.00076	0.00048	-36.8%
Two	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	0.00399	0.00303	-24.1%
Three	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	0.00188	0.00182	-3.2%
	TOTAL	0.01356	0.01113	-17.9%
	Craniotomy except for Trauma	0.00235	0.00222	-5.5%
One	Craniotomy except for Trauma	0.00093	0.00078	-16.1%
Two	Craniotomy except for Trauma	0.00083	0.00084	1.2%
Three	Craniotomy except for Trauma	0.00041	0.00038	-7.3%
	TOTAL	0.00451	0.00422	-6.4%
	CVA and Precerebral Occlusion W Infarction	0.02358	0.02383	1.1%
One	CVA and Precerebral Occlusion W Infarction	0.00210	0.00213	1.4%
Two	CVA and Precerebral Occlusion W Infarction	0.01512	0.01487	-1.7%
Three	CVA and Precerebral Occlusion W Infarction	0.00597	0.00633	6.0%
	TOTAL	0.04677	0.04717	0.9%
	Diabetes	0.00866	0.00893	3.1%
One	Diabetes	0.00333	0.00293	-12.0%
Two	Diabetes	0.00318	0.00358	12.6%
Three	Diabetes	0.00199	0.00218	9.5%
	TOTAL	0.01715	0.01761	2.7%
	Diverticulitis and Diverticulosis	0.00611	0.00699	14.4%
One	Diverticulitis and Diverticulosis	0.00078	0.00115	47.4%
Two	Diverticulitis and Diverticulosis	0.00388	0.00399	2.8%
Three	Diverticulitis and Diverticulosis	0.00138	0.00173	25.4%
	TOTAL	0.01216	0.01387	14.1%
	Electrolyte Disorders Except Hypovolemia Related	0.00547	0.00662	21.0%
One	Electrolyte Disorders Except Hypovolemia Related	0.00059	0.00077	30.5%
Two	Electrolyte Disorders Except Hypovolemia Related	0.00330	0.00366	10.9%
Three	Electrolyte Disorders Except Hypovolemia Related	0.00147	0.00203	38.1%
	TOTAL	0.01083	0.01308	20.8%
	Extracranial Vascular Procedures	0.00367	0.00388	5.7%
One	Extracranial Vascular Procedures	0.00120	0.00148	23.3%
Two	Extracranial Vascular Procedures	0.00171	0.00174	1.8%
Three	Extracranial Vascular Procedures	0.00068	0.00057	-16.2%
	TOTAL	0.00725	0.00767	5.8%
	Fracture of Femur	0.00215	0.00174	-19.1%
One	Fracture of Femur	0.00055	0.00037	-32.7%
Two	Fracture of Femur	0.00112	0.00102	-8.9%
Three	Fracture of Femur	0.00047	0.00033	-29.8%
	TOTAL	0.00428	0.00346	-19.2%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
	Heart and/or Lung transplant	0.00007	0.00007	0.0%
	Heart Failure	0.06056	0.05276	-12.9%
One	Heart Failure	0.00846	0.00550	-35.0%
Two	Heart Failure	0.03757	0.03155	-16.0%
Three	Heart Failure	0.01312	0.01385	5.6%
	TOTAL	0.11971	0.10365	-13.4%
	Hernia Procedures Except Inguinal, Femoral & Umbilical	0.00170	0.00188	10.6%
One	Hernia Procedures Except Inguinal, Femoral & Umbilical	0.00055	0.00066	20.0%
Two	Hernia Procedures Except Inguinal, Femoral & Umbilical	0.00089	0.00081	-9.0%
Three	Hernia Procedures Except Inguinal, Femoral & Umbilical	0.00021	0.00034	61.9%
	TOTAL	0.00335	0.00369	10.1%
	Hip and Femur Procedures For Trauma Except Joint Replacement	0.02409	0.02168	-10.0%
One	Hip and Femur Procedures For Trauma Except Joint Replacement	0.00560	0.00386	-31.1%
Two	Hip and Femur Procedures For Trauma Except Joint Replacement	0.01355	0.01208	-10.8%
Three	Hip and Femur Procedures For Trauma Except Joint Replacement	0.00459	0.00532	15.9%
	TOTAL	0.04783	0.04295	-10.2%
	Hip Joint Replacement	0.03163	0.03301	4.4%
One	Hip Joint Replacement	0.00352	0.00250	-29.0%
Two	Hip Joint Replacement	0.01610	0.01483	-7.9%
Three	Hip Joint Replacement	0.01178	0.01526	29.5%
	TOTAL	0.06303	0.06561	4.1%
	HIV W Major HIV Related Condition	0.00025	0.00023	-8.0%
Three	HIV W Major HIV Related Condition	0.00014	0.00014	0.0%
	TOTAL	0.00039	0.00037	-5.1%
	HIV W Multiple Major HIV Related Conditions	0.00013	0.00012	-7.7%
	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	0.00166	0.00211	27.1%
Two	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	0.00043	0.00028	-34.9%
Three	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	0.00085	0.00097	14.1%
	TOTAL	0.00295	0.00336	13.9%
	Interstitial Lung Disease	0.00128	0.00132	3.1%
One	Interstitial Lung Disease	0.00007	0.00007	0.0%
Two	Interstitial Lung Disease	0.00057	0.00053	-7.0%
Three	Interstitial Lung Disease	0.00057	0.00064	12.3%
	TOTAL	0.00250	0.00257	2.8%
	Intracranial Hemorrhage	0.00282	0.00260	-7.8%
One	Intracranial Hemorrhage	0.00057	0.00047	-17.5%
Two	Intracranial Hemorrhage	0.00130	0.00121	-6.9%
Three	Intracranial Hemorrhage	0.00083	0.00080	-3.6%
	TOTAL	0.00551	0.00507	-8.0%
	Knee Joint Replacement	0.02797	0.04121	47.3%
One	Knee Joint Replacement	0.01405	0.01880	33.8%
Two	Knee Joint Replacement	0.01246	0.01989	59.6%
Three	Knee Joint Replacement	0.00139	0.00234	68.3%
	TOTAL	0.05587	0.08224	47.2%
	Laparoscopic Cholecystectomy	0.00393	0.00493	25.4%
One	Laparoscopic Cholecystectomy	0.00057	0.00083	45.6%
Two	Laparoscopic Cholecystectomy	0.00179	0.00216	20.7%
Three	Laparoscopic Cholecystectomy	0.00134	0.00171	27.6%
	TOTAL	0.00763	0.00963	26.2%
	Major Esophageal Disorders	0.00055	0.00059	7.3%
Two	Major Esophageal Disorders	0.00026	0.00025	-3.8%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
Three	Major Esophageal Disorders	0.00024	0.00027	12.5%
	TOTAL	0.00106	0.00111	4.7%
	Major Pancreas, Liver and Shunt Procedures	0.00083	0.00090	8.4%
Two	Major Pancreas, Liver and Shunt Procedures	0.00022	0.00023	4.5%
Three	Major Pancreas, Liver and Shunt Procedures	0.00046	0.00045	-2.2%
	TOTAL	0.00151	0.00158	4.6%
	Major Respiratory and Chest Procedures	0.00199	0.00232	16.6%
One	Major Respiratory and Chest Procedures	0.00030	0.00031	3.3%
Two	Major Respiratory and Chest Procedures	0.00101	0.00108	6.9%
Three	Major Respiratory and Chest Procedures	0.00054	0.00068	25.9%
	TOTAL	0.00384	0.00439	14.3%
	Major Respiratory Infections and Inflammations	0.01395	0.01087	-22.1%
One	Major Respiratory Infections and Inflammations	0.00056	0.00040	-28.6%
Two	Major Respiratory Infections and Inflammations	0.00555	0.00401	-27.7%
Three	Major Respiratory Infections and Inflammations	0.00650	0.00520	-20.0%
	TOTAL	0.02657	0.02048	-22.9%
	Major Small and Large Bowel Procedures	0.01638	0.01495	-8.7%
One	Major Small and Large Bowel Procedures	0.00168	0.00168	0.0%
Two	Major Small and Large Bowel Procedures	0.00742	0.00617	-16.8%
Three	Major Small and Large Bowel Procedures	0.00578	0.00508	-12.1%
	TOTAL	0.03126	0.02789	-10.8%
	Major Stomach, Esophageal and Duodenal Procedures	0.00256	0.00225	-12.1%
One	Major Stomach, Esophageal and Duodenal Procedures	0.00037	0.00034	-8.1%
Two	Major Stomach, Esophageal and Duodenal Procedures	0.00083	0.00068	-18.1%
Three	Major Stomach, Esophageal and Duodenal Procedures	0.00104	0.00080	-23.1%
	TOTAL	0.00480	0.00406	-15.4%
	Major Thoracic and Abdominal Vascular Procedures	0.00347	0.00255	-26.5%
One	Major Thoracic and Abdominal Vascular Procedures	0.00023	0.00019	-17.4%
Two	Major Thoracic and Abdominal Vascular Procedures	0.00148	0.00094	-36.5%
Three	Major Thoracic and Abdominal Vascular Procedures	0.00125	0.00098	-21.6%
	TOTAL	0.00643	0.00466	-27.5%
Two	Multiple Significant Trauma W/O O.R. Procedure	0.00016	0.00020	25.0%
Three	Multiple Significant Trauma W/O O.R. Procedure	0.00012	0.00020	66.7%
	TOTAL	0.00028	0.00039	39.3%
Two	Musculoskeletal & Other Procedures for Multiple Significant Trauma	0.00024	0.00022	-8.3%
Three	Musculoskeletal & Other Procedures for Multiple Significant Trauma	0.00021	0.00032	52.4%
	TOTAL	0.00045	0.00054	20.0%
	Nonspecific CVA and Precerebral Occlusion W/O Infarction	0.01153	0.00385	-66.6%
One	Nonspecific CVA and Precerebral Occlusion W/O Infarction	0.00146	0.00047	-67.8%
Two	Nonspecific CVA and Precerebral Occlusion W/O Infarction	0.00753	0.00251	-66.7%
Three	Nonspecific CVA and Precerebral Occlusion W/O Infarction	0.00241	0.00083	-65.6%
	TOTAL	0.02293	0.00766	-66.6%
	Other Aftercare and Convalescence	0.00011	0.00020	81.8%
	Other and Unspecified Gastrointestinal Hemorrhage	0.00635	0.00606	-4.6%
One	Other and Unspecified Gastrointestinal Hemorrhage	0.00069	0.00064	-7.2%
Two	Other and Unspecified Gastrointestinal Hemorrhage	0.00345	0.00304	-11.9%
Three	Other and Unspecified Gastrointestinal Hemorrhage	0.00206	0.00210	1.9%
	TOTAL	0.01256	0.01185	-5.7%
	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.00474	0.00624	31.6%
One	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.00192	0.00193	0.5%
Two	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.00190	0.00277	45.8%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
Three	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.00087	0.00138	58.6%
	TOTAL	0.00943	0.01232	30.6%
	Other Cardiothoracic Procedures	0.00035	0.00034	-2.9%
Two	Other Cardiothoracic Procedures	0.00008	0.00005	-37.5%
Three	Other Cardiothoracic Procedures	0.00016	0.00019	18.8%
	TOTAL	0.00059	0.00058	-1.7%
	Other Circulatory System Procedures	0.00193	0.00152	-21.2%
One	Other Circulatory System Procedures	0.00038	0.00017	-55.3%
Two	Other Circulatory System Procedures	0.00057	0.00050	-12.3%
Three	Other Circulatory System Procedures	0.00081	0.00064	-21.0%
	TOTAL	0.00368	0.00283	-23.1%
	Other Complications of Treatment	0.00196	0.00204	4.1%
One	Other Complications of Treatment	0.00043	0.00036	-16.3%
Two	Other Complications of Treatment	0.00099	0.00103	4.0%
Three	Other Complications of Treatment	0.00050	0.00056	12.0%
	TOTAL	0.00388	0.00399	2.8%
	Other Digestive System and Abdominal Procedures	0.00067	0.00060	-10.4%
Two	Other Digestive System and Abdominal Procedures	0.00025	0.00024	-4.0%
Three	Other Digestive System and Abdominal Procedures	0.00029	0.00026	-10.3%
	TOTAL	0.00121	0.00109	-9.9%
	Other Digestive System Diagnoses	0.00677	0.00755	11.5%
One	Other Digestive System Diagnoses	0.00207	0.00244	17.9%
Two	Other Digestive System Diagnoses	0.00290	0.00289	-0.3%
Three	Other Digestive System Diagnoses	0.00166	0.00206	24.1%
	TOTAL	0.01340	0.01494	11.5%
	Other Esophageal Disorders	0.00287	0.00300	4.5%
One	Other Esophageal Disorders	0.00042	0.00039	-7.1%
Two	Other Esophageal Disorders	0.00166	0.00162	-2.4%
Three	Other Esophageal Disorders	0.00072	0.00093	29.2%
	TOTAL	0.00568	0.00593	4.4%
	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.00343	0.00346	0.9%
One	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.00082	0.00088	7.3%
Two	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.00157	0.00151	-3.8%
Three	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.00099	0.00099	0.0%
	TOTAL	0.00681	0.00684	0.4%
	Other Kidney, Urinary Tract and Related Procedures	0.00120	0.00123	2.5%
One	Other Kidney, Urinary Tract and Related Procedures	0.00016	0.00018	12.5%
Two	Other Kidney, Urinary Tract and Related Procedures	0.00057	0.00051	-10.5%
Three	Other Kidney, Urinary Tract and Related Procedures	0.00038	0.00045	18.4%
	TOTAL	0.00232	0.00236	1.7%
	Other Nervous System and Related Procedures	0.00094	0.00101	7.4%
One	Other Nervous System and Related Procedures	0.00012	0.00017	41.7%
Two	Other Nervous System and Related Procedures	0.00045	0.00042	-6.7%
Three	Other Nervous System and Related Procedures	0.00034	0.00036	5.9%
	TOTAL	0.00186	0.00196	5.4%
	Other Pneumonia	0.04307	0.04326	0.4%
One	Other Pneumonia	0.00223	0.00189	-15.2%
Two	Other Pneumonia	0.02261	0.02123	-6.1%
Three	Other Pneumonia	0.01682	0.01832	8.9%
	TOTAL	0.08473	0.08470	0.0%
	Other Respiratory and Chest Procedures	0.00183	0.00169	-7.7%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
One	Other Respiratory and Chest Procedures	0.00031	0.00021	-32.3%
Two	Other Respiratory and Chest Procedures	0.00083	0.00075	-9.6%
Three	Other Respiratory and Chest Procedures	0.00052	0.00057	9.6%
	TOTAL	0.00348	0.00322	-7.5%
	Other Respiratory Diagnoses Except Signs, Symptoms and Minor Diagnoses	0.00287	0.00261	-9.1%
One	Other Respiratory Diagnoses Except Signs, Symptoms and Minor Diagnoses	0.00022	0.00017	-22.7%
Two	Other Respiratory Diagnoses Except Signs, Symptoms and Minor Diagnoses	0.00147	0.00134	-8.8%
Three	Other Respiratory Diagnoses Except Signs, Symptoms and Minor Diagnoses	0.00100	0.00094	-6.0%
	TOTAL	0.00556	0.00506	-9.0%
	Other Small and Large Bowel Procedures	0.00141	0.00132	-6.4%
One	Other Small and Large Bowel Procedures	0.00043	0.00037	-14.0%
Two	Other Small and Large Bowel Procedures	0.00052	0.00047	-9.6%
Three	Other Small and Large Bowel Procedures	0.00031	0.00033	6.5%
	TOTAL	0.00267	0.00250	-6.4%
	Other Stomach, Esophageal and Duodenal Procedures	0.00018	0.00020	11.1%
Two	Other Stomach, Esophageal and Duodenal Procedures	0.00009	0.00008	-11.1%
Three	Other Stomach, Esophageal and Duodenal Procedures	0.00038	0.00037	-2.6%
	TOTAL	0.00065	0.00065	0.0%
	Other Vascular Procedures	0.01159	0.01032	-11.0%
One	Other Vascular Procedures	0.00226	0.00201	-11.1%
Two	Other Vascular Procedures	0.00445	0.00414	-7.0%
Three	Other Vascular Procedures	0.00406	0.00339	-16.5%
	TOTAL	0.02236	0.01986	-11.2%
	Peptic Ulcer and Gastritis	0.00899	0.00876	-2.6%
One	Peptic Ulcer and Gastritis	0.00106	0.00105	-0.9%
Two	Peptic Ulcer and Gastritis	0.00479	0.00433	-9.6%
Three	Peptic Ulcer and Gastritis	0.00293	0.00300	2.4%
	TOTAL	0.01778	0.01715	-3.5%
	Percutaneous Cardiovascular Procedures W AMI	0.00291	0.00426	46.4%
One	Percutaneous Cardiovascular Procedures W AMI	0.00028	0.00039	39.3%
Two	Percutaneous Cardiovascular Procedures W AMI	0.00143	0.00202	41.3%
Three	Percutaneous Cardiovascular Procedures W AMI	0.00070	0.00115	64.3%
	TOTAL	0.00532	0.00783	47.2%
	Percutaneous Cardiovascular Procedures W/o AMI	0.00521	0.00726	39.3%
One	Percutaneous Cardiovascular Procedures W/o AMI	0.00118	0.00182	54.2%
Two	Percutaneous Cardiovascular Procedures W/o AMI	0.00246	0.00338	37.4%
Three	Percutaneous Cardiovascular Procedures W/o AMI	0.00124	0.00170	37.1%
	TOTAL	0.01010	0.01416	40.2%
	Peripheral, Cranial and Autonomic Nerve Disorders	0.00394	0.00461	17.0%
One	Peripheral, Cranial and Autonomic Nerve Disorders	0.00169	0.00218	29.0%
Two	Peripheral, Cranial and Autonomic Nerve Disorders	0.00162	0.00183	13.0%
Three	Peripheral, Cranial and Autonomic Nerve Disorders	0.00061	0.00055	-9.8%
	TOTAL	0.00786	0.00917	16.7%
	Peritoneal Adhesiolysis	0.00097	0.00095	-2.1%
One	Peritoneal Adhesiolysis	0.00013	0.00009	-30.8%
Two	Peritoneal Adhesiolysis	0.00045	0.00041	-8.9%
	TOTAL	0.00155	0.00145	-6.5%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	0.00723	0.00808	11.8%
One	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	0.00193	0.00202	4.7%
Two	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	0.00387	0.00446	15.2%
Three	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	0.00127	0.00142	11.8%
	TOTAL	0.01430	0.01599	11.8%
	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	0.00113	0.00115	1.8%
One	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	0.00013	0.00008	-38.5%
Two	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	0.00056	0.00059	5.4%
Three	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	0.00040	0.00040	0.0%
	TOTAL	0.00222	0.00222	0.0%
	Pulmonary Edema and Respiratory Failure	0.00612	0.00786	28.4%
One	Pulmonary Edema and Respiratory Failure	0.00012	0.00005	-58.3%
Two	Pulmonary Edema and Respiratory Failure	0.00143	0.00132	-7.7%
Three	Pulmonary Edema and Respiratory Failure	0.00265	0.00369	39.2%
	TOTAL	0.01032	0.01292	25.2%
	Renal Failure	0.00675	0.01259	86.5%
One	Renal Failure	0.00013	0.00011	-15.4%
Two	Renal Failure	0.00109	0.00114	4.6%
Three	Renal Failure	0.00510	0.01059	107.6%
	TOTAL	0.01306	0.02443	87.1%
	Respiratory Malignancy	0.00314	0.00238	-24.2%
One	Respiratory Malignancy	0.00013	0.00011	-15.4%
Two	Respiratory Malignancy	0.00135	0.00091	-32.6%
Three	Respiratory Malignancy	0.00154	0.00124	-19.5%
	TOTAL	0.00616	0.00464	-24.7%
	Respiratory Signs, Symptoms, and Diagnoses	0.00649	0.00630	-2.9%
One	Respiratory Signs, Symptoms, and Diagnoses	0.00137	0.00138	0.7%
Two	Respiratory Signs, Symptoms, and Diagnoses	0.00357	0.00332	-7.0%
Three	Respiratory Signs, Symptoms, and Diagnoses	0.00151	0.00152	0.7%
	TOTAL	0.01293	0.01252	-3.2%
	Respiratory System Diagnosis W Ventilation Support 96+ Hours	0.00280	0.00243	-13.2%
Two	Respiratory System Diagnosis W Ventilation Support 96+ Hours	0.00049	0.00028	-42.9%
Three	Respiratory System Diagnosis W Ventilation Support 96+ Hours	0.00136	0.00095	-30.1%
	TOTAL	0.00465	0.00366	-21.3%
	Septicemia and Disseminated Infections	0.01449	0.01590	9.7%
One	Septicemia and Disseminated Infections	0.00020	0.00017	-15.0%
Two	Septicemia and Disseminated Infections	0.00618	0.00522	-15.5%
Three	Septicemia and Disseminated Infections	0.00677	0.00735	8.6%
	TOTAL	0.02764	0.02864	3.6%
	Tracheostomy W Long Term Mechanical Ventilation W Extensive Procedure	0.00055	0.00057	3.6%
Three	Tracheostomy W Long Term Mechanical Ventilation W Extensive Procedure	0.00019	0.00019	0.0%
	TOTAL	0.00074	0.00076	2.7%
	Tracheostomy W Long Term Mechanical Ventilation W/O Extensive Procedure	0.00094	0.00103	9.6%
Two	Tracheostomy W Long Term Mechanical Ventilation W/O Extensive Procedure	0.00010	0.00007	-30.0%
Three	Tracheostomy W Long Term Mechanical Ventilation W/O Extensive Procedure	0.00036	0.00040	11.1%
	TOTAL	0.00139	0.00150	7.9%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
	Transient Ischemia	0.01104	0.00985	-10.8%
One	Transient Ischemia	0.00197	0.00164	-16.8%
Two	Transient Ischemia	0.00730	0.00638	-12.6%
Three	Transient Ischemia	0.00175	0.00177	1.1%
	TOTAL	0.02207	0.01964	-11.0%
	Unknown	0.37555	0.39064	4.0%
	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.00076	0.00079	3.9%
One	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.00022	0.00019	-13.6%
Two	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.00041	0.00043	4.9%
Three	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.00013	0.00015	15.4%
	TOTAL	0.00151	0.00157	4.0%
	Uterine and Adnexa Procedures for Leiomyoma	0.00009	0.00012	33.3%
	Uterine and Adnexa Procedures for Non-Malignancy Except Leiomyoma	0.00141	0.00140	-0.7%
One	Uterine and Adnexa Procedures for Non-Malignancy Except Leiomyoma	0.00056	0.00057	1.8%
Two	Uterine and Adnexa Procedures for Non-Malignancy Except Leiomyoma	0.00066	0.00065	-1.5%
Three	Uterine and Adnexa Procedures for Non-Malignancy Except Leiomyoma	0.00015	0.00015	0.0%
	TOTAL	0.00278	0.00277	-0.4%
	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	0.00046	0.00042	-8.7%
Two	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	0.00025	0.00020	-20.0%
Three	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	0.00016	0.00016	0.0%
	TOTAL	0.00087	0.00078	-10.3%
	Ventricular Shunt Procedures	0.00066	0.00073	10.6%
One	Ventricular Shunt Procedures	0.00018	0.00019	5.6%
Two	Ventricular Shunt Procedures	0.00039	0.00044	12.8%
Three	Ventricular Shunt Procedures	0.00007	0.00009	28.6%
	TOTAL	0.00130	0.00145	11.5%
	Free-Standing Vol/NP	0.15894	0.12973	-18.4%
	Free-Standing Proprietary	0.04051	0.06575	62.3%
	Free-Standing Government	0.03848	0.02302	-40.2%
	Facility-Based Vol/NP	0.29761	0.17454	-41.4%
	Facility-Based Proprietary	0.03609	0.01449	-59.9%
	Facility-Based Government	0.04096	0.02512	-38.7%
	Other Vol/NP	0.08881	0.09714	9.4%
	Other Proprietary	0.29400	0.46387	57.8%
	Other Government	0.00440	0.00574	30.5%
	Acute Care Hospital Payments in 120 Days Preceding Home Health Episode	$7,615.04	$6,777.28	-11.0%
	Long Term Care Hospital Payments in 120 Days Preceding Home Health Episode	$214.75	$355.39	65.5%
	Rehabilitation Facility Payments in 120 Days Preceding Home Health Episode	$807.67	$871.41	7.9%
	Medicare SNF Payments in 120 Days Preceding Home Health Episode	$1,177.73	$1,536.70	30.5%
	Log (1 + Acute Care Hospital Payments in 120 Days Preceding Home Health Episode)	5.72343	5.32329	-7.0%
	Log(1 + Long Term Care Hospital Payments in 120 Days Preceding Home Health Episode)	0.08944	0.13710	53.3%
	Log (1 + Rehabilitation Facility Payments in 120 Days Preceding Home Health Episode)	0.62603	0.60857	-2.8%
	Log (1 + Medicare SNF Payments in 120 Days Preceding Home Health Episode)	1.49664	1.53153	2.3%

Exhibit 8.1

Model Variable Averages for the Baseline (IPS) and PPS (2005) Files

Sev	Variable	Baseline Period (N = 358,694)	PPS Period (2005) (N = 876,119)	Percentage Change
	Total Payments All Four Settings in 120 Days Preceding Home Health Episode	$9,815.19	$9,540.79	-2.8%
	Log (1 + Total Payments All Four Settings in 120 Days Preceding Home Health Episode)	5.96890	5.60931	-6.0%

Notes: "Sev" indicates interactions between severity levels and APR DRGs (e.g., "One" indicates an interaction between and APR DRG and the 1st severity level).

8.4.2. Statistical Performance of Regression Models

We measured the statistical performance of the regression models using the adjusted R-squared statistic, a measure of the percentage of the variation in relative payment weight that is explained or predicted by variation in independent variables in the model, adjusting for the number of independent variables in the model.

- The statistical performance of Model 1, which included only demographic variables, was poor. The adjusted R-squared statistic was 0.0015, indicating that less than two tenths of 1% of the variation in relative payment weights is attributable to age, gender, and race (Exhibit 8.2).

- Model performance at the individual level was markedly better in the models that included measures of the incidence of preadmission inpatient stays and the number of inpatient days preceding the episode (Model 2). The adjusted R-squared of Model 2 was 0.1120 – indicating that over 11% of relative payment weight variation was accounted for by the independent variables in the model.

- Adding variables controlling for the living arrangements of the home health patient (Model 3) further increased adjusted R-squared to 0.1351 – indicating that these variables accounted for an additional 2.3% of the variation in individual relative payment weights.

- Including the APR DRG, APR DRG severity interaction, relative risk of mortality, and APR DRG medical and procedure indicators in the model increased adjusted R-squared to 0.1673, or a further 3.2% (Model 4).

- Adding measures of agency type to the model led to only a small improvement in the adjusted R-squared statistic, which was 0.1695 (0.2% higher than the level attained in Model 4).

- The inclusion of measures of Medicare payments led to very little improvement in statistical performance. The adjusted R-squared statistics for Model 6 (0.1708), Model 7 (0.1701), Model 8 (0.1703), and Model 9 (0.1697) were only 0.0002 to 0.0013 higher than that for Model 5. Comparison of Models 6 and 8 shows that statistical performance was slightly better in models that included separate measures of payment by type of service. The higher adjusted R-squared on Models 6 and 8 relative to Models 7 and 9 indicates that the statistical

performance of models that used the actual Medicare payment amount was slightly better than for models that used the log of the payment amount.

Exhibit 8.2

Statistical Performance of Regression Models: Adjusted R-Squared

Model	Description	Adjusted R-Squared
Model 1	Demographics only	0.0015
Model 2	Variables in Model 1 and additional variables related to utilization of acute or long-term care, rehabilitation facilities, and SNF	0.1120
Model 3	Variables in Model 2 and measures of patient living status	0.1351
Model 4	Variables in Model 3 and variables based on patient's acute care hospital inpatient history	0.1673
Model 5	Variables in Model 4 and measures of agency ownership type	0.1695
Model 6	Variables in Model 5 and Medicare payment for acute care hospital, long-term care hospital, rehabilitation facility, and SNF (separate variables for each type of service)	0.1708
Model 7	Variables in Model 5 and log of Medicare payment for acute care hospital, long-term care hospital, rehabilitation facility, and SNF (separate variables for each type of service)	0.1701
Model 8	Variables in Model 5 and Medicare payment for acute care hospital, long-term care hospital, rehabilitation facility, and SNF (sum of Medicare payments across all settings)	0.1703
Model 9	Variables in Model 5 and log of Medicare payment for acute care hospital, long-term care hospital, rehabilitation facility, and SNF (sum of Medicare payments across all settings)	0.1697

8.4.3. Regression Coefficients

Exhibit 8.3 presents the results from the nine regression models estimated using the IPS data. The models are presented in blocks of three – Models 1 to 3, followed by Models 4 to 6, and concluding with Models 7 to 9. Because of the large number of independent variables used in these models, including the use of many interaction terms, the potential presence of multicollinearity makes the interpretation of individual regression coefficients problematic, as we have an imprecise estimate of the impact of independent changes in covariates. We do discuss some of the more important coefficients from the models below, focusing on results from Model 6, which had the highest adjusted R-squared of any of the models that we estimated.

- ***Utilization in period preceding home health episode:*** The coefficients on the variables indicating the number of days of care in each setting in the 14 days preceding the home health episode and in the period 15 to 120 days prior were all positive and significant. This implies that having more days of care in these settings is associated with higher relative payment weights during the home health episode. In addition, the coefficients for the variables for days of care in the 14 days immediately preceding the home health episode were higher than those for the variables for days of care in the earlier period. Such a finding indicates that more-recent days of care in acute care hospital, long-term care hospital, rehabilitation facility, and SNF settings have a greater impact on the home health episode's relative payment weight.

- ***Patient's living arrangements:*** Relative to the reference category (those living with a friend), individuals living alone had a significantly lower relative payment weight, on average, while those living with a spouse, other family members, paid help, or someone else had higher relative payment weights. The coefficients for living alone (-0.0752) and living with paid

help (0.1262) were particularly interesting, in part because they identify the living arrangements associated with the lowest average case-mix (living alone) and highest average case-mix (living with paid help), after controlling for the other independent variables in the model. One possible explanation is a self-selection effect. Individuals with the lowest care needs are able and choose to live alone (assuming these individuals do not have a living spouse). Conversely, individuals with greater care needs may have already hired live-in help to provide custodial care and services.

- ***Hospital inpatient history:*** Most of the individual APR DRG variables were not significant. Note that the analysis was not intended to identify and explain all individual effects of APR DRGs on home health episode relative payment weights. There are far too many variables, and interpreting them is complicated, given the inclusion of APR DRG and severity interactions. The purpose of including these variables was to control for the type and severity of an individual's most recent acute care hospital stay preceding the home health episode. We did observe some relationships that are consistent with what is known about the effects of various conditions on home care needs. For example, APR DRG 45 – CVA and preverbal occlusion with infarction was associated with a relative payment weight increase of 0.4790 (an increase of more than 40%). Some types of hospitalization were associated with a lower relative payment weight – for example, many of the DRGs related to coronary and cardiac conditions.

- ***Agency type:*** Relative to agencies for which the agency type is unknown, relative payment weights were lower at freestanding voluntary/non-profit agencies and also lower for facility-based government facilities.

- ***Medicare payment amount:*** Adjusting for the other variables in the model, there was a negative relationship between relative payment weight and acute care hospital payments and a positive relationship between relative payment weight and Medicare payments for long-term care hospitals, rehabilitation facilities, and SNF. Each $1,000 (IPS) increase in payments was associated with the following change in case-mix:
  - Acute care hospital: -0.0025
  - Long-term hospital: 0.0026
  - Rehabilitation facility: 0.0024
  - SNF: 0.0105

The negative coefficient on the acute care hospital expenditures measure may be because the model already includes variables that could be related to inpatient payments – e.g., variables for stays and days of care in each care setting, as well as APR DRG data for the most recent acute care hospital stay. Given the large number of independent variables in the models, it is difficult to interpret the coefficients on the payment variables. One possibility is that these variables, when added to the model alongside the related variables, might be a further measure of intensity of service – i.e., the amount of service provided per day. If services are more intensive in other settings, particularly acute care hospital settings, care needs following acute care stays in the home health setting could be lower.

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models One, Two, and Three

Sev	Variable	Model 1 (n= 385,694)		Model 2 (n= 385,694)		Model 3 (n= 385,694)	
		Coeff.	P value	Coeff.	P value	Coeff.	P value
	Adjusted R Square Statistic	0.0015		0.1120		0.1351	
	Intercept	1.07644	<.0001	1.06681	<.0001	1.03774	<.0001
	Age 65 to 74	(0.00103)	0.941	(0.00359)	0.7836	(0.00110)	0.9323
	Age 75 to 84	0.01484	0.271	0.01443	0.2564	0.02152	0.0865
	Age 85 to 94	0.07689	<.0001	0.07304	<.0001	0.07195	<.0001
	Age 95+	0.14275	<.0001	0.15411	<.0001	0.13209	<.0001
	Age 65 to 74 * Male	(0.00983)	0.127	(0.00404)	0.5053	(0.01376)	0.0218
	Age 75 to 84 * Male	(0.00017)	0.978	0.00268	0.6409	(0.01563)	0.0061
	Age 85 to 94 * Male	(0.01305)	0.050	(0.01023)	0.1026	(0.02438)	<.0001
	Age 95+ * Male	(0.03650)	0.011	(0.03861)	0.0044	(0.04099)	0.0022
	Male	(0.00476)	0.381	(0.00351)	0.4944	(0.00929)	0.0668
	Age 65 to 74 * White	(0.00994)	0.478	(0.03175)	0.0162	(0.02893)	0.0264
	Age 75 to 84 * White	(0.00118)	0.931	(0.03341)	0.0091	(0.02889)	0.0223
	Age 85 to 94 * White	(0.04730)	0.002	(0.07004)	<.0001	(0.06317)	<.0001
	Age 95+ * White	(0.10421)	0.000	(0.12076)	<.0001	(0.11296)	<.0001
	White	0.01442	0.224	0.01189	0.2877	0.01969	0.0746
	Age 65 to 74 * African American	0.01463	0.336	0.00740	0.6055	0.01224	0.3866
	Age 75 to 84 * African American	0.03545	0.016	0.03103	0.0259	0.03478	0.0114
	Age 85 to 94 * African American	(0.01331)	0.416	(0.00419)	0.7856	(0.00151)	0.9207
	Age 95+ * African American	(0.05571)	0.080	(0.04593)	0.1262	(0.03933)	0.1845
	African American	0.00024	0.985	(0.00364)	0.7614	0.00369	0.7551
	Any Hospital in Prior 14 Days IP Claims			(0.09227)	<.0001	(0.08578)	<.0001
	Any Rehab in 14 Days Prior from IP Claims			0.14942	<.0001	0.15261	<.0001
	Any MCR SNF in 14 Days Prior From IP Claims			0.05896	<.0001	0.06010	<.0001
	No Hosp/Rehab/SNF in 14 Days From Prior IP Claims			(0.02983)	<.0001	(0.02905)	<.0001
	Acute Care Hospital Days in Period 14 Days Preceding Home Health Episode			0.00409	<.0001	0.00317	<.0001
	Acute Care Hospital Days in Period 15 to 120 Days Preceding Home Health Episode			0.00111	<.0001	0.00059	<.0001
	Long Term Care Hospital Days in Period 14 Days Preceding Home Health Episode			0.02551	<.0001	0.02520	<.0001
	Long Term Care Hospital Days in Period 15 to 120 Days Preceding Home Health Episode			0.00447	<.0001	0.00430	<.0001
	Rehabilitation Facility Days in Period 14 Days Preceding Home Health Episode			0.02439	<.0001	0.02441	<.0001
	Rehabilitation Facility Days in Period 15 to 120 Days Preceding Home Health Episode			0.01101	<.0001	0.01070	<.0001
	Medicare Skilled Nursing Facility (SNF) Days in Period 14 Days Preceding Home Health Episode			0.01654	<.0001	0.01717	<.0001
	Medicare Skilled Nursing Facility (SNF) Days in Period 15 to 120 Days Preceding Home Health Episode			0.00560	<.0001	0.00544	<.0001
	Patient Lives Alone					(0.08448)	<.0001
	Patient Lives with Other (Not Family, Friends, Paid Help or Spouse)					0.06222	<.0001
	Patient Lives with Other Family					0.06527	<.0001
	Patient Lives with Paid Help					0.14433	<.0001
	Patient Lives with Spouse					0.04978	<.0001

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	**Variable**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**
	Adjusted R Square Statistic	0.1673		0.1695		0.1708	
	Intercept	1.05284	<.0001	1.13216	<.0001	1.14425	<.0001
	Age 65 to 74	(0.00506)	0.6901	(0.00850)	0.5026	(0.01205)	0.3414
	Age 75 to 84	0.01546	0.2102	0.01281	0.2987	0.00820	0.5054
	Age 85 to 94	0.06447	<.0001	0.06280	<.0001	0.05738	<.0001
	Age 95+	0.12616	<.0001	0.12127	<.0001	0.11651	<.0001
	Age 65 to 74 * Male	(0.00803)	0.173	(0.00687)	0.2433	(0.00588)	0.3176
	Age 75 to 84 * Male	(0.00909)	0.1048	(0.00759)	0.1751	(0.00765)	0.1711
	Age 85 to 94 * Male	(0.01636)	0.0073	(0.01492)	0.0143	(0.01587)	0.0092
	Age 95+ * Male	(0.03191)	0.0152	(0.03076)	0.0191	(0.03170)	0.0156
	Male	(0.00862)	0.0837	(0.00951)	0.0558	(0.00864)	0.0824
	Age 65 to 74 * White	(0.02292)	0.0735	(0.01961)	0.1252	(0.01702)	0.1829
	Age 75 to 84 * White	(0.02332)	0.0606	(0.02036)	0.1009	(0.01778)	0.1517
	Age 85 to 94 * White	(0.05881)	<.0001	(0.05670)	<.0001	(0.05387)	<.0001
	Age 95+ * White	(0.11380)	<.0001	(0.10749)	<.0001	(0.10497)	<.0001
	White	0.02005	0.0646	0.02295	0.0343	0.02061	0.0571
	Age 65 to 74 * African American	0.01644	0.2365	0.01958	0.1579	0.02131	0.1242
	Age 75 to 84 * African American	0.03893	0.004	0.04060	0.0026	0.04249	0.0016
	Age 85 to 94 * African American	0.00086	0.9539	0.00100	0.9467	0.00327	0.8265
	Age 95+ * African American	(0.04468)	0.1247	(0.03933)	0.176	(0.03751)	0.1964
	African American	0.00302	0.7949	(0.00076)	0.9479	(0.00260)	0.8226
	Any Hospital in Prior 14 Days IP Claims	(0.09463)	<.0001	(0.09236)	<.0001	(0.08657)	<.0001
	Any Rehab in 14 Days Prior from IP Claims	0.08583	<.0001	0.08295	<.0001	0.08556	<.0001
	Any MCR SNF in 14 Days Prior From IP Claims	0.03506	<.0001	0.03538	<.0001	0.03660	<.0001
	No Hosp/Rehab/SNF in 14 Days From Prior IP Claims	(0.03674)	<.0001	(0.04064)	<.0001	(0.04535)	<.0001
	Acute Care Hospital Days in Period 14 Days Preceding Home Health Episode	0.00651	<.0001	0.00662	<.0001	0.00780	<.0001
	Acute Care Hospital Days in Period 15 to 120 Days Preceding Home Health Episode	0.00172	<.0001	0.00177	<.0001	0.00409	<.0001
	Long Term Care Hospital Days in Period 14 Days Preceding Home Health Episode	0.02378	<.0001	0.02338	<.0001	0.02094	<.0001
	Long Term Care Hospital Days in Period 15 to 120 Days Preceding Home Health Episode	0.00398	<.0001	0.00385	<.0001	0.00186	0.0268
	Rehabilitation Facility Days in Period 14 Days Preceding Home Health Episode	0.02389	<.0001	0.02418	<.0001	0.02230	<.0001
	Rehabilitation Facility Days in Period 15 to 120 Days Preceding Home Health Episode	0.00886	<.0001	0.00883	<.0001	0.00729	<.0001
	Medicare Skilled Nursing Facility (SNF) Days in Period 14 Days Preceding Home Health Episode	0.01608	<.0001	0.01606	<.0001	0.01248	<.0001
	Medicare Skilled Nursing Facility (SNF) Days in Period 15 to 120 Days Preceding Home Health Episode	0.00480	<.0001	0.00479	<.0001	0.00176	<.0001
	Patient Lives Alone	(0.07776)	<.0001	(0.07557)	<.0001	(0.07525)	<.0001
	Patient Lives with Other (Not Family, Friends, Paid Help or Spouse)	0.05325	<.0001	0.05154	<.0001	0.04981	<.0001
	Patient Lives with Other Family	0.06121	<.0001	0.06312	<.0001	0.06302	<.0001
	Patient Lives with Paid Help	0.13003	<.0001	0.12819	<.0001	0.12622	<.0001
	Patient Lives with Spouse	0.04370	<.0001	0.04612	<.0001	0.04676	<.0001
	Medical APR DRG	(0.10236)	0.8204	(0.08696)	0.8468	(0.03552)	0.9371
	Procedure APR DRG	0.25484	0.5882	0.26631	0.571	0.34612	0.4611
	Mortality Risk Level 1	(0.09162)	0.8428	(0.10553)	0.8191	(0.15406)	0.7382

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	Variable	Coeff.	P value	Coeff.	P value	Coeff.	P value
	Mortality Risk Level 2	(0.07439)	0.8721	(0.08840)	0.848	(0.13684)	0.7665
	Mortality Risk Level 3	(0.05133)	0.9115	(0.06548)	0.8871	(0.11417)	0.8044
	Mortality Risk Level 4	(0.03236)	0.9441	(0.04649)	0.9197	(0.09425)	0.838
	Unknown	0.09621	0.831	0.08120	0.8569	0.03006	0.9467
	Heart and/or Lung transplant	(0.46162)	0.0003	(0.45916)	0.0003	(0.30075)	0.0184
	Tracheotomy W Long Term Mechanical Ventilation W Extensive Procedure	(0.13494)	0.1705	(0.13338)	0.1749	(0.07990)	0.4161
	Tracheotomy W Long Term Mechanical Ventilation W/O Extensive Procedure	(0.11481)	0.2342	(0.11185)	0.2459	(0.08030)	0.4045
	Craniotomy except for Trauma	0.15815	0.1361	0.15541	0.1425	0.13875	0.19
	Ventricular Shunt Procedures	0.05700	0.745	0.06499	0.7104	0.06667	0.7031
	Extracranial Vascular Procedures	0.07899	0.5145	0.08174	0.4994	0.05011	0.6787
	Other Nervous System and Related Procedures	(0.24010)	0.2129	(0.23817)	0.216	(0.26899)	0.162
	Intracranial Hemorrhage	0.36132	0.0032	0.36073	0.0032	0.34774	0.0045
	CVA and Precerebral Occlusion W Infarction	0.48465	<.0001	0.48845	<.0001	0.47909	<.0001
	Nonspecific CVA and Precerebral Occlusion W/O Infarction	0.52941	<.0001	0.53884	<.0001	0.52571	<.0001
	Transient Ischemia	0.08714	0.6598	0.07867	0.6907	0.06567	0.7396
	Peripheral, Cranial and Autonomic Nerve Disorders	0.25697	0.1731	0.27416	0.1455	0.27544	0.1434
	Major Respiratory and Chest Procedures	(0.26694)	0.0153	(0.26375)	0.0164	(0.27776)	0.0115
	Other Respiratory and Chest Procedures	(0.25097)	0.0188	(0.24648)	0.0209	(0.23834)	0.0253
	Respiratory System Diagnosis W Ventilation Support 96+ Hours	0.19148	0.0649	0.18966	0.0672	0.20232	0.0507
	Pulmonary Edema and Respiratory Failure	0.07348	0.4724	0.07140	0.4845	0.08385	0.4113
	Respiratory Malignancy	(0.02932)	0.8123	(0.02578)	0.8344	(0.02167)	0.8604
	Major Respiratory Infections and Inflammations	0.28755	0.0052	0.28586	0.0054	0.28350	0.0058
	Other Pneumonia	0.09109	0.3756	0.08762	0.3935	0.08531	0.4057
	Chronic Obstructive Pulmonary Disease	0.00283	0.9782	0.00207	0.9841	0.00675	0.948
	Interstitial Lung Disease	0.09507	0.4997	0.09369	0.5054	0.08698	0.536
	Other Respiratory Diagnoses except Signs, Symptoms and Minor Diagnoses	0.12745	0.2682	0.12961	0.2595	0.13968	0.2239
	Respiratory Signs, Symptoms, and Diagnoses	0.31317	0.0383	0.33153	0.0281	0.32387	0.0318
	Cardiac Defibrillator and Heart Assist Implant	(0.29453)	0.0073	(0.29041)	0.0081	(0.22857)	0.0369
	Cardiac Valve Procedures W Cardiac Catheterization	(0.31452)	0.0021	(0.30948)	0.0024	(0.28447)	0.0052
	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	(0.24921)	0.0079	(0.24624)	0.0086	(0.22762)	0.0151
	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	(0.33642)	0.0007	(0.33338)	0.0008	(0.31693)	0.0014
	Other Cardiothoracic Procedures	(0.41786)	0.0003	(0.41347)	0.0004	(0.41197)	0.0004
	Major Thoracic and Abdominal Vascular Procedures	(0.26705)	0.0055	(0.26517)	0.0057	(0.26180)	0.0063
	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	(0.34574)	0.0216	(0.35039)	0.0197	(0.36310)	0.0156
	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	(0.15291)	0.1585	(0.14382)	0.1842	(0.15771)	0.145
	Other Vascular Procedures	(0.10290)	0.2736	(0.09920)	0.2906	(0.12608)	0.1789
	Percutaneous Cardiovascular Procedures W AMI	(0.37243)	0.0001	(0.36724)	0.0001	(0.36830)	0.0001
	Percutaneous Cardiovascular Procedures W/o AMI	(0.22897)	0.0211	(0.22844)	0.0212	(0.23604)	0.0172
	Cardiac Pacemaker and Defibrillator Device Replacement	(0.29142)	0.0479	(0.28452)	0.0531	(0.30856)	0.0358

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	Variable	Coeff.	P value	Coeff.	P value	Coeff.	P value
	Cardiac Pacemaker and Defibrillator Device Revision except Device Replacement	(0.36558)	0.0113	(0.35309)	0.0143	(0.37077)	0.0101
	Other Circulatory System Procedures	(0.20115)	0.0603	(0.19451)	0.0689	(0.22612)	0.0343
	Acute Myocardial Infarction	0.07986	0.4382	0.07918	0.4415	0.07653	0.4566
	Cardiac Catheterization W Circ Disorders except Ischemic Heart Disease	0.01669	0.8827	0.01882	0.8677	0.01484	0.8954
	Cardiac Catheterization for Ischemic Heart Disease	0.06576	0.6302	0.06750	0.6207	0.07808	0.5667
	Heart Failure	0.07802	0.4485	0.07634	0.4577	0.07108	0.489
	Major Stomach, Esophageal and Duodenal Procedures	(0.25993)	0.009	(0.25464)	0.0104	(0.25809)	0.0094
	Major Small and Large Bowel Procedures	(0.26359)	0.0043	(0.26069)	0.0047	(0.27705)	0.0026
	Other Stomach, Esophageal and Duodenal Procedures	(0.22595)	0.0558	(0.22639)	0.055	(0.25091)	0.0333
	Other Small and Large Bowel Procedures	(0.07196)	0.5652	(0.05766)	0.6445	(0.08309)	0.5058
	Peritoneal Adhesiolysis	(0.11515)	0.3619	(0.11072)	0.38	(0.13160)	0.2964
	Hernia Procedures except Inguinal, Femoral & Umbilical	(0.16374)	0.2661	(0.16239)	0.2694	(0.19014)	0.1957
	Other Digestive System and Abdominal Procedures	(0.36138)	0.0012	(0.35164)	0.0016	(0.36676)	0.001
	Peptic Ulcer and Gastritis	0.13929	0.2191	0.14519	0.1996	0.13705	0.2256
	Major Esophageal Disorders	0.20750	0.1508	0.20753	0.1502	0.19748	0.1706
	Other Esophageal Disorders	0.13264	0.3411	0.13127	0.3455	0.11275	0.4174
	Diverticulitis and Diverticulosis	0.17421	0.194	0.16794	0.2099	0.16418	0.2199
	Other and Unspecified Gastrointestinal Hemorrhage	0.03518	0.7668	0.03492	0.7682	0.02586	0.8272
	Other Digestive System Diagnoses	0.14998	0.205	0.14996	0.2044	0.14212	0.2287
	Major Pancreas, Liver and Shunt Procedures	(0.35483)	0.0011	(0.34927)	0.0013	(0.34747)	0.0013
	Cholecystectomy except Laparoscopic	(0.34160)	0.0013	(0.34310)	0.0012	(0.36712)	0.0005
	Laparoscopic Cholecystectomy	(0.15705)	0.1274	(0.15795)	0.1247	(0.18863)	0.0666
	Hip Joint Replacement	(0.08271)	0.4213	(0.07837)	0.4455	(0.10249)	0.3181
	Knee Joint Replacement	(0.03421)	0.7885	(0.03493)	0.7838	(0.07153)	0.574
	Hip and Femur Procedures For Trauma except Joint Replacement	(0.04099)	0.6784	(0.03544)	0.7196	(0.06725)	0.4955
	Fracture of Femur	0.36751	0.0636	0.35724	0.071	0.32176	0.1036
	Diabetes	0.05380	0.6447	0.05368	0.645	0.04436	0.7032
	Electrolyte Disorders except Hypovolemia Related	0.19364	0.1201	0.19650	0.1143	0.18116	0.1451
	Other Kidney, Urinary Tract and Related Procedures	(0.22430)	0.0623	(0.22264)	0.064	(0.22078)	0.066
	Renal Failure	0.13259	0.2158	0.13197	0.2174	0.12867	0.2287
	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	(0.02076)	0.8829	(0.03459)	0.8058	(0.03453)	0.806
	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	(0.13926)	0.326	(0.12920)	0.3615	(0.13431)	0.3425
	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	(0.57329)	0.0835	(0.58428)	0.0774	(0.62137)	0.0601
	Uterine and Adnexa Procedures for Non-Malignancy except Leiomyoma	(0.52815)	0.0006	(0.51713)	0.0008	(0.53957)	0.0005
	Uterine and Adnexa Procedures for Leiomyoma	(0.31149)	0.0093	(0.30478)	0.0108	(0.33652)	0.0048
	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.01722	0.9039	0.01707	0.9046	0.00720	0.9596
	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	(0.24307)	0.0134	(0.23598)	0.0162	(0.24436)	0.0127
	Septicemia and Disseminated Infections	0.18624	0.0704	0.18619	0.0702	0.18093	0.0782
	Other Complications of Treatment	0.49417	0.0013	0.49919	0.0012	0.49072	0.0014
	Other Aftercare and Convalescence	0.13247	0.2875	0.12832	0.3023	0.12495	0.3147

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	**Variable**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**
	HIV W Multiple Major HIV Related Conditions	(0.06111)	0.6129	(0.04906)	0.6842	(0.03819)	0.7513
	HIV W Major HIV Related Condition	(0.03005)	0.8102	(0.03761)	0.7635	(0.03338)	0.7892
One	Craniotomy except for Trauma	(0.16153)	0.0086	(0.15379)	0.0123	(0.15284)	0.0128
One	Ventricular Shunt Procedures	0.09939	0.5363	0.09526	0.5528	0.07943	0.6204
One	Extracranial Vascular Procedures	(0.25845)	0.0021	(0.25858)	0.0021	(0.25491)	0.0024
One	Other Nervous System and Related Procedures	0.21496	0.2416	0.22016	0.2298	0.22784	0.2136
One	Intracranial Hemorrhage	0.03515	0.6463	0.03946	0.606	0.04914	0.5203
One	CVA and Precerebral Occlusion W Infarction	(0.05200)	0.2179	(0.05337)	0.2054	(0.04813)	0.2531
One	Nonspecific CVA and Precerebral Occlusion W/O Infarction	(0.09975)	0.1471	(0.10996)	0.1096	(0.10055)	0.1431
One	Transient Ischemia	0.19313	0.2595	0.19739	0.2485	0.20610	0.2279
One	Peripheral, Cranial and Autonomic Nerve Disorders	0.05760	0.7198	0.04041	0.801	0.03454	0.8293
One	Major Respiratory and Chest Procedures	(0.05714)	0.4577	(0.05454)	0.4779	(0.05098)	0.5067
One	Other Respiratory and Chest Procedures	(0.07344)	0.3058	(0.07037)	0.3257	(0.09719)	0.1744
One	Pulmonary Edema and Respiratory Failure	(0.05077)	0.4742	(0.04916)	0.4879	(0.06046)	0.3931
One	Respiratory Malignancy	0.12065	0.2163	0.12009	0.2178	0.11788	0.226
One	Major Respiratory Infections and Inflammations	(0.19081)	<.0001	(0.19313)	<.0001	(0.19348)	<.0001
One	Other Pneumonia	0.02249	0.387	0.02409	0.3535	0.02146	0.4082
One	Chronic Obstructive Pulmonary Disease	0.02540	0.3387	0.02400	0.3654	0.01419000	0.5924
One	Interstitial Lung Disease	(0.14639)	0.2685	(0.14389)	0.2761	(0.14292000)	0.279
One	Other Respiratory Diagnoses except Signs, Symptoms and Minor Diagnoses	(0.00709)	0.925	(0.01246)	0.8685	(0.02287000)	0.7609
One	Respiratory Signs, Symptoms, and Diagnoses	(0.19046)	0.0964	(0.20999)	0.0665	(0.20560000)	0.0721
One	Cardiac Defibrillator and Heart Assist Implant	(0.10791)	0.3083	(0.10437)	0.3239	(0.12420)	0.24
One	Cardiac Valve Procedures W Cardiac Catheterization	(0.14275)	0.097	(0.14395)	0.0938	(0.12629)	0.1412
One	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	(0.18667)	<.0001	(0.18317)	<.0001	(0.18532)	<.0001
One	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	(0.11025)	0.0308	(0.10854)	0.0332	(0.11958)	0.0189
One	Major Thoracic and Abdominal Vascular Procedures	0.01376	0.8185	0.01694	0.7773	0.00079333	0.9894
One	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	-0.01048	0.9392	0.00245	0.9858	-0.00239	0.9861
One	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	-0.13379	0.0336	-0.1419	0.024	-0.14831	0.0182
One	Other Vascular Procedures	-0.13853	<.0001	-0.13854	<.0001	-0.13323	<.0001
One	Percutaneous Cardiovascular Procedures W AMI	0.08253	0.146	0.07683	0.1753	0.06172	0.2759
One	Percutaneous Cardiovascular Procedures W/o AMI	-0.06034	0.2028	-0.06236	0.1875	-0.07327	0.1212
One	Cardiac Pacemaker and Defibrillator Device Replacement	0.03246	0.7909	0.0307	0.8017	0.02718	0.824
One	Cardiac Pacemaker and Defibrillator Device Revision except Device Replacement	-0.00526	0.9682	-0.02203	0.8674	-0.02456	0.8522
One	Other Circulatory System Procedures	-0.08246	0.2365	-0.08365	0.2292	-0.079	0.2558
One	Acute Myocardial Infarction	-0.02928	0.3268	-0.02782	0.3508	-0.02622	0.3788
One	Cardiac Catheterization W Circ Disorders except Ischemic Heart Disease	0.04985	0.4792	0.04589	0.5142	0.04934	0.4827
One	Cardiac Catheterization for Ischemic Heart Disease	0.01292	0.8921	0.00454	0.9619	-0.00494	0.9585
One	Heart Failure	-0.04442	0.052	-0.04416	0.0531	-0.04053	0.0757
One	Major Stomach, Esophageal and Duodenal Procedures	-0.05786	0.318	-0.06	0.2997	-0.07313	0.206
One	Major Small and Large Bowel Procedures	-0.07258	0.0082	-0.06938	0.0113	-0.07418	0.0068
One	Other Small and Large Bowel Procedures	-0.22698	0.016	-0.23771	0.0115	-0.24079	0.0104

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	**Variable**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**
One	Peritoneal Adhesiolysis	-0.27431	0.0126	-0.2741	0.0125	-0.2845	0.0095
One	Hernia Procedures except Inguinal, Femoral & Umbilical	-0.11327	0.3485	-0.11691	0.3326	-0.12001	0.3195
One	Peptic Ulcer and Gastritis	0.01322	0.8163	0.00361	0.9493	0.00682	0.9044
One	Other Esophageal Disorders	-0.00471	0.9635	-0.00709	0.9451	0.00801	0.9379
One	Diverticulitis and Diverticulosis	-0.03646	0.6937	-0.03191	0.7299	-0.03249	0.7251
One	Other and Unspecified Gastrointestinal Hemorrhage	0.0639	0.3541	0.06326	0.3582	0.06952	0.3123
One	Other Digestive System Diagnoses	0.04413	0.4923	0.04084	0.5246	0.04618	0.4714
One	Cholecystectomy except Laparoscopic	0.09036	0.2224	0.09663	0.1914	0.09194	0.2135
One	Laparoscopic Cholecystectomy	-0.05614	0.3423	-0.05376	0.3625	-0.05294	0.3695
One	Hip Joint Replacement	0.05627	0.2731	0.056	0.2748	0.05594	0.2748
One	Knee Joint Replacement	-0.01262	0.8892	-0.0081	0.9287	0.00616	0.9457
One	Hip and Femur Procedures For Trauma except Joint Replacement	0.05757	0.1705	0.0552	0.1882	0.05777	0.1681
One	Fracture of Femur	0.0676	0.697	0.07785	0.6534	0.10901	0.5292
One	Diabetes	0.06013	0.3188	0.05461	0.3646	0.059	0.327
One	Electrolyte Disorders except Hypovolemia Related	-0.06435	0.419	-0.06945	0.3825	-0.05951	0.4539
One	Other Kidney, Urinary Tract and Related Procedures	-0.03825	0.7013	-0.04047	0.6845	-0.05145	0.6052
One	Renal Failure	0.03549	0.6425	0.03047	0.6899	0.03623	0.6349
One	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.15768	0.1221	0.17129	0.0926	0.16832	0.0981
One	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.22366	0.4885	0.24337	0.4505	0.24961	0.4385
One	Uterine and Adnexa Procedures for Non-Malignancy except Leiomyoma	0.18494	0.1524	0.17293	0.1803	0.16349	0.2049
One	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.08429	0.4105	0.08221	0.4215	0.08934	0.382
One	Septicemia and Disseminated Infections	-0.07595	0.182	-0.07762	0.172	-0.0704	0.2151
One	Other Complications of Treatment	-0.39421	0.0012	-0.40169	0.001	-0.39284	0.0013
Two	Tracheotomy W Long Term Mechanical Ventilation W/O Extensive Procedure	-0.20331	0.0152	-0.19747	0.0182	-0.18853	0.0241
Two	Craniotomy except for Trauma	-0.13484	0.0298	-0.12916	0.0372	-0.12898	0.0373
Two	Ventricular Shunt Procedures	0.01014	0.9479	0.00772	0.9603	-0.01173	0.9396
Two	Extracranial Vascular Procedures	-0.1579	0.0575	-0.1616	0.0516	-0.15923	0.0549
Two	Other Nervous System and Related Procedures	0.26259	0.1315	0.26113	0.1332	0.2656	0.1264
Two	Intracranial Hemorrhage	0.05341	0.4635	0.05429	0.4555	0.05902	0.4168
Two	CVA and Precerebral Occlusion W Infarction	-0.04333	0.2706	-0.04723	0.2293	-0.04313	0.2719
Two	Nonspecific CVA and Precerebral Occlusion W/O Infarction	-0.11378	0.087	-0.12443	0.0609	-0.1157	0.0811
Two	Transient Ischemia	0.20817	0.2225	0.21506	0.207	0.22302	0.1903
Two	Peripheral, Cranial and Autonomic Nerve Disorders	0.09209	0.5663	0.07461	0.6417	0.06948	0.6646
Two	Major Respiratory and Chest Procedures	-0.06214	0.3584	-0.06035	0.3718	-0.06103	0.366
Two	Other Respiratory and Chest Procedures	-0.07394	0.2419	-0.07381	0.2421	-0.09747	0.1222
Two	Respiratory System Diagnosis W Ventilation Support 96+ Hours	-0.01643	0.6969	-0.01339	0.7505	-0.0163	0.6985
Two	Pulmonary Edema and Respiratory Failure	-0.05424	0.04	-0.05319	0.0437	-0.06968	0.0082
Two	Respiratory Malignancy	0.01241	0.8673	0.00835	0.9103	0.00308	0.9668
Two	Major Respiratory Infections and Inflammations	-0.061	0.0089	-0.06026	0.0096	-0.06084	0.0089
Two	Other Pneumonia	0.02545	0.2279	0.02806	0.1832	0.02594	0.2181
Two	Chronic Obstructive Pulmonary Disease	0.0492	0.0527	0.04763	0.0604	0.03717	0.1427

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	Variable	Coeff.	P value	Coeff.	P value	Coeff.	P value
Two	Interstitial Lung Disease	-0.02877	0.7807	-0.02824	0.7844	-0.02662	0.7962
Two	Other Respiratory Diagnoses except Signs, Symptoms and Minor Diagnoses	-0.0124	0.8336	-0.01525	0.7958	-0.02511	0.6699
Two	Respiratory Signs, Symptoms, and Diagnoses	-0.1536	0.1757	-0.17315	0.1264	-0.1704	0.1322
Two	Cardiac Defibrillator and Heart Assist Implant	-0.03001	0.6796	-0.03165	0.6627	-0.05492	0.4488
Two	Cardiac Valve Procedures W Cardiac Catheterization	-0.09203	0.1051	-0.09237	0.1033	-0.08357	0.1402
Two	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	-0.1495	<.0001	-0.14955	<.0001	-0.15618	<.0001
Two	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	-0.07235	0.105	-0.06978	0.1174	-0.08302	0.0623
Two	Other Cardiothoracic Procedures	0.03238	0.7731	0.02936	0.7936	0.05649	0.6143
Two	Major Thoracic and Abdominal Vascular Procedures	-0.06847	0.0799	-0.0675	0.0839	-0.07459	0.0559
Two	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	0.03005	0.8098	0.03629	0.771	0.03367	0.787
Two	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	-0.11756	0.0569	-0.12414	0.0441	-0.13043	0.0343
Two	Other Vascular Procedures	-0.10321	0.0003	-0.10234	0.0004	-0.09626	0.0008
Two	Percutaneous Cardiovascular Procedures W AMI	0.02985	0.453	0.02856	0.4722	0.01399	0.7246
Two	Percutaneous Cardiovascular Procedures W/o AMI	-0.05456	0.2217	-0.05617	0.2077	-0.06512	0.1438
Two	Cardiac Pacemaker and Defibrillator Device Revision except Device Replacement	-0.10007	0.4445	-0.10605	0.4171	-0.10966	0.4011
Two	Other Circulatory System Procedures	-0.07381	0.263	-0.07367	0.2633	-0.06485	0.3244
Two	Acute Myocardial Infarction	-0.02898	0.2206	-0.02881	0.2226	-0.02685	0.2553
Two	Cardiac Catheterization W Circ Disorders except Ischemic Heart Disease	0.02976	0.6162	0.02503	0.673	0.03067	0.6047
Two	Cardiac Catheterization for Ischemic Heart Disease	0.02101	0.8227	0.01915	0.838	0.00883	0.9248
Two	Heart Failure	-0.02423	0.2628	-0.02356	0.2757	-0.02183	0.3121
Two	Major Stomach, Esophageal and Duodenal Procedures	-0.01711	0.7319	-0.01731	0.7284	-0.02571	0.6058
Two	Major Small and Large Bowel Procedures	-0.06432	0.0036	-0.06322	0.0041	-0.06509	0.0031
Two	Other Stomach, Esophageal and Duodenal Procedures	-0.02323	0.8345	-0.0239	0.8296	-0.01025	0.9264
Two	Other Small and Large Bowel Procedures	-0.21223	0.0224	-0.21972	0.0179	-0.21861	0.0184
Two	Peritoneal Adhesiolysis	-0.14237	0.1355	-0.14398	0.1306	-0.1476	0.1209
Two	Hernia Procedures except Inguinal, Femoral & Umbilical	-0.15583	0.191	-0.15655	0.1884	-0.15806	0.1838
Two	Other Digestive System and Abdominal Procedures	0.08149	0.3155	0.07544	0.3521	0.07857	0.3321
Two	Peptic Ulcer and Gastritis	0.00059692	0.991	-0.00796	0.8807	-0.00383	0.9424
Two	Major Esophageal Disorders	-0.00126	0.9911	-0.00493	0.9653	-0.000515	0.9964
Two	Other Esophageal Disorders	0.01213	0.9015	0.01142	0.9071	0.02656	0.7859
Two	Diverticulitis and Diverticulosis	-0.04743	0.5955	-0.04371	0.6242	-0.04492	0.6144
Two	Other and Unspecified Gastrointestinal Hemorrhage	0.12551	0.0499	0.12465	0.0512	0.13075	0.0406
Two	Other Digestive System Diagnoses	0.01246	0.8447	0.01298	0.8381	0.0179	0.778
Two	Major Pancreas, Liver and Shunt Procedures	-0.09808	0.2136	-0.10211	0.1948	-0.11071	0.1594
Two	Cholecystectomy except Laparoscopic	0.04829	0.4271	0.05414	0.3726	0.05385	0.3748
Two	Laparoscopic Cholecystectomy	-0.03134	0.5547	-0.02818	0.5948	-0.02612	0.6217
Two	Hip Joint Replacement	0.00305	0.9514	0.00189	0.9698	0.00215	0.9657
Two	Knee Joint Replacement	-0.02582	0.7758	-0.02119	0.8149	-0.00747	0.9342
Two	Hip and Femur Procedures For Trauma except Joint Replacement	0.05129	0.2135	0.04828	0.2409	0.05172	0.2087
Two	Fracture of Femur	0.00978	0.9547	0.01788	0.9171	0.04768	0.7813
Two	Diabetes	0.08984	0.1366	0.08787	0.145	0.09178	0.1276

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	**Variable**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**
Two	Electrolyte Disorders except Hypovolemia Related	-0.03421	0.646	-0.03889	0.6011	-0.02749	0.7115
Two	Other Kidney, Urinary Tract and Related Procedures	-0.05545	0.5183	-0.05245	0.5406	-0.07135	0.4049
Two	Renal Failure	-0.00897	0.8345	-0.01286	0.7644	-0.00914	0.8312
Two	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.14225	0.1563	0.14994	0.1346	0.1454	0.1465
Two	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	-0.2981	0.0124	-0.3052	0.0104	-0.32084	0.007
Two	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.30601	0.3405	0.32246	0.3145	0.32935	0.3039
Two	Uterine and Adnexa Procedures for Non-Malignancy except Leiomyoma	0.25991	0.0433	0.25541	0.0468	0.24555	0.0557
Two	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.0801	0.4342	0.08248	0.42	0.08791	0.3897
Two	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	0.05647	0.2899	0.05299	0.3201	0.04229	0.4271
Two	Septicemia and Disseminated Infections	0.02165	0.353	0.01969	0.3976	0.02254	0.3326
Two	Other Complications of Treatment	-0.38712	0.0011	-0.3936	0.0009	-0.3803	0.0013
Two	Musculoskeletal & Other Procedures for Multiple Significant Trauma	0.01867	0.8558	0.01964	0.8482	0.00039035	0.997
Two	Multiple Significant Trauma W/O O.R. Procedure	0.32928	0.0051	0.32245	0.006	0.32458	0.0056
Three	Tracheotomy W Long Term Mechanical Ventilation W Extensive Procedure	0.14863	0.0276	0.14894	0.027	0.12031	0.074
Three	Tracheotomy W Long Term Mechanical Ventilation W/O Extensive Procedure	0.02484	0.6371	0.02285	0.6639	0.03197	0.5429
Three	Craniotomy except for Trauma	-0.07112	0.292	-0.06641	0.3245	-0.0723	0.2831
Three	Ventricular Shunt Procedures	0.1041	0.5525	0.09742	0.5778	0.07557	0.6657
Three	Extracranial Vascular Procedures	-0.13276	0.123	-0.13416	0.1186	-0.13559	0.1144
Three	Other Nervous System and Related Procedures	0.30318	0.0837	0.30252	0.0839	0.30775	0.0785
Three	Intracranial Hemorrhage	0.07911	0.2878	0.07802	0.2939	0.08293	0.2642
Three	CVA and Precerebral Occlusion W Infarction	-0.05126	0.1998	-0.05549	0.1646	-0.05348	0.1801
Three	Nonspecific CVA and Precerebral Occlusion W/O Infarction	-0.10338	0.1263	-0.11561	0.0869	-0.10833	0.1084
Three	Transient Ischemia	0.14885	0.385	0.15609	0.3617	0.16321	0.3398
Three	Peripheral, Cranial and Autonomic Nerve Disorders	0.05457	0.7368	0.03863	0.8117	0.03202	0.8433
Three	Major Respiratory and Chest Procedures	-0.04791	0.5005	-0.04908	0.4895	-0.05336	0.452
Three	Other Respiratory and Chest Procedures	-0.05299	0.4238	-0.054	0.4144	-0.08051	0.2234
Three	Respiratory System Diagnosis W Ventilation Support 96+ Hours	-0.06531	0.0409	-0.06466	0.0427	-0.06504	0.0413
Three	Pulmonary Edema and Respiratory Failure	-0.02132	0.3457	-0.01997	0.3764	-0.03496	0.1215
Three	Respiratory Malignancy	0.02449	0.7402	0.01937	0.7929	0.01085	0.883
Three	Major Respiratory Infections and Inflammations	-0.00241	0.916	-0.00321	0.8883	-0.00513	0.8221
Three	Other Pneumonia	0.03154	0.1368	0.0343	0.1052	0.03023	0.153
Three	Chronic Obstructive Pulmonary Disease	0.03728	0.1527	0.03679	0.1575	0.02446	0.3472
Three	Interstitial Lung Disease	0.00832	0.9358	0.00813	0.9372	0.01025	0.9208
Three	Other Respiratory Diagnoses except Signs, Symptoms and Minor Diagnoses	0.02001	0.7408	0.0187	0.757	0.00859	0.8869
Three	Respiratory Signs, Symptoms, and Diagnoses	-0.16147	0.158	-0.17965	0.1158	-0.17712	0.1207
Three	Cardiac Defibrillator and Heart Assist Implant	-0.0982	0.1595	-0.09595	0.1688	-0.11406	0.1016
Three	Cardiac Valve Procedures W Cardiac Catheterization	-0.06668	0.2016	-0.0679	0.1928	-0.06474	0.214

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	**Variable**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**
Three	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	-0.11831	<.0001	-0.11921	<.0001	-0.12528	<.0001
Three	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	-0.00335	0.9422	-0.00398	0.9314	-0.01922	0.6772
Three	Other Cardiothoracic Procedures	-0.02456	0.7935	-0.0227	0.8085	-0.00477	0.9593
Three	Major Thoracic and Abdominal Vascular Procedures	-0.03049	0.4437	-0.02818	0.4784	-0.03044	0.4435
Three	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	0.08321	0.5103	0.09154	0.4683	0.0864	0.4933
Three	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	-0.14368	0.0249	-0.15076	0.0184	-0.16042	0.0121
Three	Other Vascular Procedures	-0.08409	0.0037	-0.08228	0.0044	-0.08126	0.0049
Three	Percutaneous Cardiovascular Procedures W AMI	0.04736	0.2875	0.04515	0.3099	0.02908	0.5129
Three	Percutaneous Cardiovascular Procedures W/o AMI	-0.12468	0.008	-0.1252	0.0077	-0.13596	0.0038
Three	Cardiac Pacemaker and Defibrillator Device Replacement	0.01144	0.9327	0.01163	0.9316	0.02033	0.8806
Three	Other Circulatory System Procedures	-0.07001	0.2711	-0.06771	0.2866	-0.06223	0.327
Three	Acute Myocardial Infarction	-0.01651	0.4905	-0.01635	0.4942	-0.01596	0.5044
Three	Cardiac Catheterization W Circ Disorders except Ischemic Heart Disease	-0.02786	0.604	-0.0318	0.5534	-0.02856	0.5942
Three	Cardiac Catheterization for Ischemic Heart Disease	-0.03219	0.7377	-0.03582	0.709	-0.04602	0.6314
Three	Heart Failure	-0.00241	0.9128	-0.00169	0.9388	-0.0026	0.9056
Three	Major Stomach, Esophageal and Duodenal Procedures	-0.03254	0.5023	-0.03403	0.4823	-0.04295	0.3749
Three	Major Small and Large Bowel Procedures	-0.03544	0.113	-0.03348	0.1338	-0.03826	0.0865
Three	Other Stomach, Esophageal and Duodenal Procedures	-0.24938	0.0087	-0.25646	0.0069	-0.2566	0.0068
Three	Other Small and Large Bowel Procedures	-0.11183	0.2552	-0.10851	0.269	-0.11525	0.24
Three	Peritoneal Adhesiolysis	-0.14663	0.2493	-0.14786	0.2447	-0.15104	0.2343
Three	Other Digestive System and Abdominal Procedures	0.07326	0.3562	0.06568	0.4075	0.05313	0.5025
Three	Peptic Ulcer and Gastritis	0.0381	0.4784	0.03167	0.5552	0.03527	0.5108
Three	Major Esophageal Disorders	-0.03562	0.7555	-0.03384	0.7671	-0.02913	0.7986
Three	Other Esophageal Disorders	0.06371	0.525	0.06286	0.5299	0.07655	0.444
Three	Diverticulitis and Diverticulosis	-0.03963	0.6625	-0.03214	0.723	-0.03587	0.6921
Three	Other and Unspecified Gastrointestinal Hemorrhage	0.12515	0.0535	0.12441	0.0546	0.12857	0.0468
Three	Other Digestive System Diagnoses	-0.00562	0.9309	-0.00454	0.944	-0.0012	0.9852
Three	Major Pancreas, Liver and Shunt Procedures	-0.00878	0.8999	-0.01237	0.8593	-0.02211	0.7511
Three	Cholecystectomy except Laparoscopic	0.08592	0.1708	0.08977	0.1519	0.08694	0.1649
Three	Laparoscopic Cholecystectomy	-0.10035	0.0631	-0.10017	0.0632	-0.10007	0.0633
Three	Hip Joint Replacement	-0.00724	0.8852	-0.0078	0.8762	-0.00759	0.8794
Three	Knee Joint Replacement	-0.04529	0.6247	-0.03887	0.6742	-0.02632	0.7758
Three	Hip and Femur Procedures For Trauma except Joint Replacement	0.04509	0.2847	0.04325	0.3042	0.04433	0.2919
Three	Fracture of Femur	-0.07978	0.6468	-0.07092	0.6834	-0.03991	0.8183
Three	Diabetes	0.0871	0.1547	0.0876	0.1518	0.08961	0.1423
Three	Electrolyte Disorders except Hypovolemia Related	0.01102	0.8845	0.00623	0.9345	0.01544	0.8384
Three	Other Kidney, Urinary Tract and Related Procedures	-0.02044	0.8174	-0.02035	0.818	-0.04649	0.5989
Three	Renal Failure	-0.01182	0.7546	-0.01208	0.7492	-0.01256	0.7393
Three	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.14273	0.1591	0.15513	0.1254	0.15021	0.1375
Three	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	-0.26254	0.0347	-0.26659	0.0318	-0.28865	0.02

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Four, Five, and Six

		Model 4 (n= 385,694)		Model 5 (n= 385,694)		Model 6 (n= 385,694)	
Sev	**Variable**	**Coeff.**	**P value**	**Coeff.**	**P value**	**Coeff.**	**P value**
Three	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.2771	0.3951	0.29785	0.36	0.30061	0.3552
Three	Uterine and Adnexa Procedures for Non-Malignancy except Leiomyoma	0.16435	0.2385	0.15314	0.2714	0.14267	0.3052
Three	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.06537	0.5301	0.06444	0.5354	0.07031	0.4986
Three	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	0.09104	0.0523	0.08711	0.063	0.0717	0.1257
Three	Septicemia and Disseminated Infections	0.02699	0.24	0.02706	0.2383	0.02698	0.2392
Three	Other Complications of Treatment	-0.33532	0.0056	-0.33922	0.0051	-0.32604	0.007
Three	HIV W Major HIV Related Condition	0.01902	0.8445	0.03468	0.7203	0.03385	0.7265
Three	Musculoskeletal & Other Procedures for Multiple Significant Trauma	0.03586	0.7309	0.03843	0.712	0.02025	0.8456
Three	Multiple Significant Trauma W/O O.R. Procedure	0.20346	0.0955	0.20479	0.0929	0.20701	0.0891
	Free-Standing Vol/NP			-0.10363	0.0479	-0.10623	0.0424
	Free-Standing Proprietary			-0.03823	0.4663	-0.04148	0.429
	Free-Standing Government			-0.08987	0.0869	-0.09381	0.0737
	Facility-Based Vol/NP			-0.1049	0.0452	-0.1086	0.0379
	Facility-Based Proprietary			-0.0703	0.1805	-0.07509	0.1523
	Facility-Based Government			-0.11188	0.033	-0.11569	0.0274
	Other Vol/NP			-0.06979	0.183	-0.07361	0.1599
	Other Proprietary			-0.05578	0.2868	-0.06003	0.2513
	Other Government			-0.07885	0.141	-0.08034	0.1333
	Acute Care Hospital Payments in 120 Days Preceding Home Health Episode					-0.000002500	<.0001
	Long Term Care Hospital Payments in 120 Days Preceding Home Health Episode					0.000002560	0.0074
	Rehabilitation Facility Payments in 120 Days Preceding Home Health Episode					0.000002350	0.0015
	Medicare SNF Payments in 120 Days Preceding Home Health Episode					0.000010530	<.0001
	Log (1 + Acute Care Hospital Payments in 120 Days Preceding Home Health Episode)						
	Log(1 + Long Term Care Hospital Payments in 120 Days Preceding Home Health Episode)						
	Log (1 + Rehabilitation Facility Payments in 120 Days Preceding Home Health Episode)						
	Log (1 + Medicare SNF Payments in 120 Days Preceding Home Health Episode)						
	Total Payments All Four Settings in 120 Days Preceding Home Health Episode						
	Log (1 + Total Payments All Four Settings in 120 Days Preceding Home Health Episode)						

Notes: "Sev" indicates interactions between severity levels and APR DRGs (e.g., "One" indicates an interaction between and APR DRG and the 1st severity level).

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694) Coeff.	Model 7 P value	Model 8 (n= 385,694) Coeff.	Model 8 P value	Model 9 (n= 385,694) Coeff.	Model 9 P value
	Adjusted R Square Statistic	0.1701		0.1703		0.1697	
	Intercept	1.16405	<.0001	1.13977	<.0001	1.14461	<.0001
	Age 65 to 74	(0.00844)	0.5054	(0.01125)	0.3748	-0.00824	0.5156
	Age 75 to 84	0.01194	0.3324	0.00949	0.4413	0.01252	0.3096
	Age 85 to 94	0.06185	<.0001	0.05839	<.0001	0.06248	<.0001
	Age 95+	0.11926	<.0001	0.11754	<.0001	0.12035	<.0001
	Age 65 to 74 * Male	(0.00656)	0.2655	(0.00597)	0.3109	-0.00667	0.2576
	Age 75 to 84 * Male	(0.00734)	0.1897	(0.00746)	0.1826	-0.00747	0.1822
	Age 85 to 94 * Male	(0.01466)	0.0161	(0.01534)	0.0118	-0.01462	0.0165
	Age 95+ * Male	(0.03082)	0.0188	(0.03113)	0.0176	-0.03045	0.0203
	Male	(0.00957)	0.0544	(0.00891)	0.0733	-0.0096	0.0536
	Age 65 to 74 * White	(0.01973)	0.1229	(0.01776)	0.1647	-0.0196	0.1253
	Age 75 to 84 * White	(0.02040)	0.1002	(0.01877)	0.1303	-0.02017	0.1041
	Age 85 to 94 * White	(0.05723)	<.0001	(0.05463)	<.0001	-0.05688	<.0001
	Age 95+ * White	(0.10759)	<.0001	(0.10581)	<.0001	-0.10771	<.0001
	White	0.02259	0.0371	0.02052	0.0582	0.02295	0.0342
	Age 65 to 74 * African American	0.01920	0.1662	0.02073	0.1348	0.01914	0.1675
	Age 75 to 84 * African American	0.04067	0.0026	0.04140	0.0021	0.04051	0.0027
	Age 85 to 94 * African American	0.00092	0.951	0.00264	0.8595	0.00069062	0.9631
	Age 95+ * African American	(0.03893)	0.1802	(0.03869)	0.1828	-0.03971	0.1717
	African American	(0.00091)	0.9376	(0.00245)	0.8326	-0.00069818	0.952
	Any Hospital in Prior 14 Days IP Claims	(0.09344)	<.0001	(0.08663)	<.0001	-0.08847	<.0001
	Any Rehab in 14 Days Prior from IP Claims	0.07103	<.0001	0.08564	<.0001	0.08313	<.0001
	Any MCR SNF in 14 Days Prior From IP Claims	0.00384	0.602	0.03498	<.0001	0.03512	<.0001
	No Hosp/Rehab/SNF in 14 Days From Prior IP Claims	(0.06805)	<.0001	(0.04409)	<.0001	-0.05127	<.0001
	Acute Care Hospital Days in Period 14 Days Preceding Home Health Episode	0.00667	<.0001	0.00749	<.0001	0.00661	<.0001
	Acute Care Hospital Days in Period 15 to 120 Days Preceding Home Health Episode	0.00241	<.0001	0.00368	<.0001	0.00222	<.0001
	Long Term Care Hospital Days in Period 14 Days Preceding Home Health Episode	0.02130	<.0001	0.02457	<.0001	0.02302	<.0001
	Long Term Care Hospital Days in Period 15 to 120 Days Preceding Home Health Episode	0.00347	<.0001	0.00561	<.0001	0.00408	<.0001
	Rehabilitation Facility Days in Period 14 Days Preceding Home Health Episode	0.02348	<.0001	0.02543	<.0001	0.02424	<.0001
	Rehabilitation Facility Days in Period 15 to 120 Days Preceding Home Health Episode	0.00841	<.0001	0.01033	<.0001	0.0091	<.0001
	Medicare Skilled Nursing Facility (SNF) Days in Period 14 Days Preceding Home Health Episode	0.01552	<.0001	0.01657	<.0001	0.01602	<.0001
	Medicare Skilled Nursing Facility (SNF) Days in Period 15 to 120 Days Preceding Home Health Episode	0.00419	<.0001	0.00537	<.0001	0.00497	<.0001
	Patient Lives Alone	(0.07579)	<.0001	(0.07544)	<.0001	-0.07564	<.0001
	Patient Lives with Other (Not Family, Friends, Paid Help or Spouse)	0.05080	<.0001	0.05049	<.0001	0.0511	<.0001
	Patient Lives with Other Family	0.06325	<.0001	0.06324	<.0001	0.06318	<.0001
	Patient Lives with Paid Help	0.12736	<.0001	0.12774	<.0001	0.12786	<.0001
	Patient Lives with Spouse	0.04638	<.0001	0.04690	<.0001	0.04617	<.0001
	Medical APR DRG	(0.07820)	0.862	(0.04578)	0.919	-0.08265	0.8543
	Procedure APR DRG	0.27605	0.5568	0.33712	0.473	0.2684	0.5679
	Mortality Risk Level 1	(0.10129)	0.8261	(0.14482)	0.7535	-0.10197	0.825

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694)		Model 8 (n= 385,694)		Model 9 (n= 385,694)	
		Coeff.	P value	Coeff.	P value	Coeff.	P value
	Mortality Risk Level 2	(0.08407)	0.8553	(0.12748)	0.7822	-0.08469	0.8543
	Mortality Risk Level 3	(0.06139)	0.8941	(0.10479)	0.8202	-0.06191	0.8932
	Mortality Risk Level 4	(0.04291)	0.9259	(0.08501)	0.8537	-0.04315	0.9255
	Unknown	0.08232	0.8549	0.04020	0.9288	0.08381	0.8523
	Heart and/or Lung transplant	(0.45889)	0.0003	(0.33708)	0.0082	-0.45785	0.0003
	Tracheotomy W Long Term Mechanical Ventilation W Extensive Procedure	(0.14643)	0.1362	(0.09378)	0.34	-0.13909	0.1571
	Tracheotomy W Long Term Mechanical Ventilation W/O Extensive Procedure	(0.12334)	0.2005	(0.08649)	0.3693	-0.11728	0.2236
	Craniotomy except for Trauma	0.14926	0.1588	0.14066	0.1842	0.15178	0.152
	Ventricular Shunt Procedures	0.05959	0.7335	0.07214	0.6801	0.06467	0.7118
	Extracranial Vascular Procedures	0.07694	0.5248	0.04863	0.6877	0.08269	0.4944
	Other Nervous System and Related Procedures	(0.24121)	0.2101	(0.27948)	0.1464	-0.24014	0.2122
	Intracranial Hemorrhage	0.34921	0.0043	0.34985	0.0042	0.35758	0.0035
	CVA and Precerebral Occlusion W Infarction	0.48307	<.0001	0.48184	<.0001	0.48617	<.0001
	Nonspecific CVA and Precerebral Occlusion W/O Infarction	0.53210	<.0001	0.52991	<.0001	0.5362	<.0001
	Transient Ischemia	0.07133	0.7182	0.06698	0.7347	0.07632	0.6994
	Peripheral, Cranial and Autonomic Nerve Disorders	0.27840	0.1393	0.27528	0.1437	0.26994	0.1518
	Major Respiratory and Chest Procedures	(0.27186)	0.0134	(0.27885)	0.0112	-0.26434	0.0162
	Other Respiratory and Chest Procedures	(0.25902)	0.0151	(0.24611)	0.021	-0.25121	0.0185
	Respiratory System Diagnosis W Ventilation Support 96+ Hours	0.18434	0.0751	0.20166	0.0515	0.18737	0.0705
	Pulmonary Edema and Respiratory Failure	0.07017	0.4919	0.08136	0.4255	0.07141	0.4844
	Respiratory Malignancy	(0.02944)	0.8113	(0.02210)	0.8577	-0.02718	0.8255
	Major Respiratory Infections and Inflammations	0.28096	0.0062	0.28573	0.0054	0.28378	0.0058
	Other Pneumonia	0.08385	0.414	0.08579	0.4032	0.08639	0.4001
	Chronic Obstructive Pulmonary Disease	(0.00065)	0.995	0.00707	0.9455	0.00187	0.9856
	Interstitial Lung Disease	0.09043	0.5202	0.08918	0.5259	0.09217	0.5123
	Other Respiratory Diagnoses except Signs, Symptoms, and Minor Diagnoses	0.12691	0.2694	0.13744	0.2316	0.12831	0.2643
	Respiratory Signs, Symptoms, and Diagnoses	0.32774	0.0299	0.32523	0.0312	0.33053	0.0286
	Cardiac Defibrillator and Heart Assist Implant	(0.29522)	0.007	(0.24749)	0.0239	-0.29122	0.0079
	Cardiac Valve Procedures W Cardiac Catheterization	(0.31078)	0.0023	(0.29344)	0.004	-0.30787	0.0025
	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	(0.25046)	0.0075	(0.23633)	0.0116	-0.24529	0.0088
	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	(0.33622)	0.0007	(0.32687)	0.001	-0.33164	0.0009
	Other Cardiothoracic Procedures	(0.41590)	0.0003	(0.41356)	0.0004	-0.40995	0.0004
	Major Thoracic and Abdominal Vascular Procedures	(0.26979)	0.0049	(0.26859)	0.0051	-0.26534	0.0057
	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	(0.35183)	0.0192	(0.36337)	0.0156	-0.34853	0.0204
	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	(0.14566)	0.1785	(0.16407)	0.1296	-0.14179	0.1904
	Other Vascular Procedures	(0.10771)	0.251	(0.12454)	0.1844	-0.10079	0.2829
	Percutaneous Cardiovascular Procedures W AMI	(0.36747)	0.0001	(0.37479)	<.0001	-0.36448	0.0001
	Percutaneous Cardiovascular Procedures W/O AMI	(0.22805)	0.0214	(0.23786)	0.0164	-0.22549	0.0229
	Cardiac Pacemaker and Defibrillator Device Replacement	(0.28621)	0.0516	(0.30813)	0.0361	-0.28198	0.0552

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694)		Model 8 (n= 385,694)		Model 9 (n= 385,694)	
		Coeff.	P value	Coeff.	P value	Coeff.	P value
	Cardiac Pacemaker and Defibrillator Device Revision except Device Replacement	(0.36014)	0.0125	(0.37260)	0.0097	-0.35368	0.0141
	Other Circulatory System Procedures	(0.20453)	0.0557	(0.22424)	0.0359	-0.19716	0.0652
	Acute Myocardial Infarction	0.07653	0.4568	0.07707	0.4536	0.07875	0.444
	Cardiac Catheterization W Circ Disorders except Ischemic Heart Disease	0.01574	0.8892	0.01705	0.88	0.01759	0.8762
	Cardiac Catheterization for Ischemic Heart Disease	0.06291	0.6445	0.07771	0.5687	0.06469	0.6353
	Heart Failure	0.07242	0.481	0.07282	0.4785	0.07494	0.466
	Major Stomach, Esophageal and Duodenal Procedures	(0.26003)	0.0089	(0.26011)	0.0089	-0.25506	0.0103
	Major Small and Large Bowel Procedures	(0.26710)	0.0037	(0.27805)	0.0025	-0.26109	0.0046
	Other Stomach, Esophageal and Duodenal Procedures	(0.23331)	0.0479	(0.25102)	0.0333	-0.22659	0.0547
	Other Small and Large Bowel Procedures	(0.06374)	0.6099	(0.08155)	0.5139	-0.05738	0.6461
	Peritoneal Adhesiolysis	(0.11708)	0.3531	(0.13248)	0.2933	-0.11044	0.3812
	Hernia Procedures except Inguinal, Femoral & Umbilical	(0.17297)	0.2393	(0.19231)	0.1908	-0.16497	0.2619
	Other Digestive System and Abdominal Procedures	(0.35406)	0.0015	(0.37211)	0.0008	-0.3509	0.0016
	Peptic Ulcer and Gastritis	0.14337	0.2052	0.14041	0.2146	0.14476	0.2009
	Major Esophageal Disorders	0.20559	0.1539	0.19995	0.1655	0.20741	0.1504
	Other Esophageal Disorders	0.12673	0.3622	0.12500	0.3688	0.12747	0.3596
	Diverticulitis and Diverticulosis	0.16501	0.2178	0.16650	0.2136	0.16572	0.2159
	Other and Unspecified Gastrointestinal Hemorrhage	0.03140	0.791	0.02546	0.8298	0.03389	0.7749
	Other Digestive System Diagnoses	0.14138	0.2314	0.14666	0.2144	0.14668	0.2145
	Major Pancreas, Liver and Shunt Procedures	(0.35105)	0.0012	(0.35703)	0.001	-0.34832	0.0013
	Cholecystectomy except Laparoscopic	(0.34949)	0.001	(0.36852)	0.0005	-0.34395	0.0012
	Laparoscopic Cholecystectomy	(0.16305)	0.1129	(0.18908)	0.066	-0.15768	0.1254
	Hip Joint Replacement	(0.08525)	0.4065	(0.10489)	0.3071	-0.07687	0.4542
	Knee Joint Replacement	(0.03983)	0.7543	(0.06511)	0.609	-0.03546	0.7806
	Hip and Femur Procedures For Trauma except Joint Replacement	(0.04229)	0.6683	(0.06748)	0.4941	-0.03612	0.7144
	Fracture of Femur	0.33936	0.0862	0.33595	0.0893	0.34865	0.078
	Diabetes	0.04981	0.669	0.04674	0.6882	0.05269	0.6511
	Electrolyte Disorders except Hypovolemia Related	0.18645	0.1339	0.18376	0.1395	0.19362	0.1196
	Other Kidney, Urinary Tract and Related Procedures	(0.22562)	0.0604	(0.22878)	0.0569	-0.22097	0.0659
	Renal Failure	0.12521	0.2417	0.13083	0.2212	0.12832	0.2303
	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	(0.03343)	0.8121	(0.04100)	0.7707	-0.0363	0.7964
	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	(0.12757)	0.3675	(0.13955)	0.3242	-0.1248	0.3781
	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	(0.58862)	0.0751	(0.61653)	0.0623	-0.57987	0.0796
	Uterine and Adnexa Procedures for Non-Malignancy except Leiomyoma	(0.52496)	0.0006	(0.54368)	0.0004	-0.51781	0.0008
	Uterine and Adnexa Procedures for Leiomyoma	(0.30806)	0.0099	(0.33665)	0.0048	-0.30395	0.011
	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.01606	0.9102	0.00844	0.9527	0.01756	0.9018
	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	(0.24624)	0.0121	(0.24756)	0.0116	-0.23867	0.015
	Septicemia and Disseminated Infections	0.18168	0.0771	0.18418	0.0731	0.18391	0.0736
	Other Complications of Treatment	0.49307	0.0013	0.49701	0.0012	0.4959	0.0013
	Other Aftercare and Convalescence	0.12369	0.3199	0.12605	0.3107	0.12555	0.3128
	HIV W Multiple Major HIV Related Conditions	(0.04926)	0.6829	(0.03784)	0.7537	-0.04921	0.6833

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694)		Model 8 (n= 385,694)		Model 9 (n= 385,694)	
		Coeff.	P value	Coeff.	P value	Coeff.	P value
	HIV W Major HIV Related Condition	(0.03686)	0.768	(0.03272)	0.7934	-0.0363	0.7714
One	Craniotomy except for Trauma	(0.14935)	0.015	(0.15759)	0.0103	-0.14769	0.0162
One	Ventricular Shunt Procedures	0.09898	0.5373	0.07203	0.6534	0.0988	0.5381
One	Extracranial Vascular Procedures	(0.25663)	0.0022	(0.25422)	0.0024	-0.25846	0.0021
One	Other Nervous System and Related Procedures	0.21664	0.2372	0.23783	0.1943	0.22145	0.227
One	Intracranial Hemorrhage	0.04801	0.5302	0.04803	0.53	0.04161	0.5864
One	CVA and Precerebral Occlusion W Infarction	(0.05078)	0.2282	(0.04939)	0.2411	-0.05164	0.2205
One	Nonspecific CVA and Precerebral Occlusion W/O Infarction	(0.10629)	0.1218	(0.10407)	0.1297	-0.10813	0.1156
One	Transient Ischemia	0.19993	0.2423	0.20604	0.2282	0.19769	0.2478
One	Peripheral, Cranial and Autonomic Nerve Disorders	0.03208	0.8414	0.03578	0.8233	0.04385	0.7844
One	Major Respiratory and Chest Procedures	(0.04661)	0.544	(0.05445)	0.4784	-0.05083	0.5083
One	Other Respiratory and Chest Procedures	(0.05793)	0.4184	(0.09067)	0.2053	-0.0624	0.3835
One	Pulmonary Edema and Respiratory Failure	(0.05014)	0.479	(0.05897)	0.4051	-0.05045	0.4765
One	Respiratory Malignancy	0.12564	0.1971	0.11838	0.2242	0.12257	0.2084
One	Major Respiratory Infections and Inflammations	(0.19091)	<.0001	(0.19533)	<.0001	-0.19241	<.0001
One	Other Pneumonia	0.02403	0.3545	0.02232	0.3899	0.02351	0.3652
One	Chronic Obstructive Pulmonary Disease	0.02509	0.3438	0.0147800	0.5771	0.02376	0.3702
One	Interstitial Lung Disease	(0.14490)	0.2726	(0.141880)	0.2827	-0.14274	0.2799
One	Other Respiratory Diagnoses except Signs, Symptoms and Minor Diagnoses	(0.01068)	0.8871	(0.020780)	0.7823	-0.01144	0.8791
One	Respiratory Signs, Symptoms, and Diagnoses	(0.21067)	0.0655	(0.206570)	0.0709	-0.21105	0.0651
One	Cardiac Defibrillator and Heart Assist Implant	(0.09740)	0.357	(0.11955)	0.2582	-0.09905	0.3491
One	Cardiac Valve Procedures W Cardiac Catheterization	(0.13817)	0.1076	(0.13170)	0.1251	-0.13843	0.107
One	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	(0.17401)	<.0001	(0.18612)	<.0001	-0.17796	<.0001
One	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	(0.10163)	0.0461	(0.11739)	0.0212	-0.10446	0.0404
One	Major Thoracic and Abdominal Vascular Procedures	0.02186	0.7151	0.00349	0.9535	0.02058	0.7311
One	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	-0.00007624	0.9996	-0.00394	0.9771	0.00106	0.9939
One	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	-0.14221	0.0237	-0.14437	0.0216	-0.14224	0.0237
One	Other Vascular Procedures	-0.13059	<.0001	-0.1374	<.0001	-0.13379	<.0001
One	Percutaneous Cardiovascular Procedures W AMI	0.07507	0.1853	0.06488	0.2523	0.07609	0.1795
One	Percutaneous Cardiovascular Procedures W/O AMI	-0.06341	0.1801	-0.07414	0.117	-0.06264	0.1855
One	Cardiac Pacemaker and Defibrillator Device Replacement	0.03093	0.8002	0.02571	0.8334	0.03	0.8062
One	Cardiac Pacemaker and Defibrillator Device Revision except Device Replacement	-0.01519	0.9083	-0.02611	0.843	-0.01844	0.8888
One	Other Circulatory System Procedures	-0.07685	0.2691	-0.08087	0.2448	-0.07879	0.2574
One	Acute Myocardial Infarction	-0.02664	0.3715	-0.0272	0.3614	-0.02791	0.3493
One	Cardiac Catheterization W Circ Disorders except Ischemic Heart Disease	0.04778	0.4969	0.04812	0.4938	0.04615	0.5118
One	Cardiac Catheterization for Ischemic Heart Disease	0.00732	0.9386	-0.00466	0.9609	0.0063	0.9472
One	Heart Failure	-0.04065	0.0749	-0.04171	0.0676	-0.04246	0.0629
One	Major Stomach, Esophageal and Duodenal Procedures	-0.05588	0.334	-0.07407	0.2003	-0.0575	0.3203
One	Major Small and Large Bowel Procedures	-0.06456	0.0184	-0.07576	0.0057	-0.06618	0.0157
One	Other Small and Large Bowel Procedures	-0.23553	0.0123	-0.24213	0.01	-0.23729	0.0117
One	Peritoneal Adhesiolysis	-0.27103	0.0135	-0.28284	0.0099	-0.27335	0.0128

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694)		Model 8 (n= 385,694)		Model 9 (n= 385,694)	
		Coeff.	P value	Coeff.	P value	Coeff.	P value
One	Hernia Procedures except Inguinal, Femoral & Umbilical	-0.11027	0.3606	-0.11883	0.3245	-0.11327	0.3478
One	Peptic Ulcer and Gastritis	0.00238	0.9665	0.00488	0.9316	0.00232	0.9675
One	Other Esophageal Disorders	-0.00782	0.9394	-0.00279	0.9783	-0.00603	0.9532
One	Diverticulitis and Diverticulosis	-0.03298	0.7211	-0.03424	0.711	-0.03196	0.7295
One	Other and Unspecified Gastrointestinal Hemorrhage	0.06341	0.357	0.07003	0.3089	0.0622	0.3663
One	Other Digestive System Diagnoses	0.04739	0.4602	0.04208	0.5118	0.04311	0.5017
One	Cholecystectomy except Laparoscopic	0.09891	0.181	0.09234	0.2116	0.09802	0.185
One	Laparoscopic Cholecystectomy	-0.05481	0.3531	-0.05278	0.3711	-0.05427	0.3579
One	Hip Joint Replacement	0.0598	0.2433	0.05677	0.2679	0.05738	0.263
One	Knee Joint Replacement	-0.0038	0.9665	-0.00221	0.9805	-0.0036	0.9683
One	Hip and Femur Procedures For Trauma except Joint Replacement	0.05875	0.1612	0.05731	0.1716	0.05834	0.1642
One	Fracture of Femur	0.09156	0.5973	0.09461	0.5851	0.08569	0.6211
One	Diabetes	0.05476	0.3632	0.05747	0.3398	0.05382	0.3715
One	Electrolyte Disorders except Hypovolemia Related	-0.06283	0.4293	-0.06096	0.4432	-0.06745	0.3963
One	Other Kidney, Urinary Tract and Related Procedures	-0.03441	0.7296	-0.05011	0.6147	-0.03868	0.6977
One	Renal Failure	0.04044	0.5963	0.03581	0.639	0.03668	0.6309
One	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.16919	0.0966	0.17485	0.0859	0.17288	0.0896
One	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.24684	0.4439	0.24447	0.4482	0.24106	0.4547
One	Uterine and Adnexa Procedures for Non-Malignancy except Leiomyoma	0.17638	0.1716	0.16708	0.1953	0.17408	0.1774
One	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.08218	0.4215	0.08884	0.3849	0.08158	0.4251
One	Septicemia and Disseminated Infections	-0.07762	0.1719	-0.07507	0.1863	-0.07757	0.1722
One	Other Complications of Treatment	-0.39951	0.001	-0.39762	0.0011	-0.39929	0.001
Two	Tracheotomy W Long Term Mechanical Ventilation W/O Extensive Procedure	-0.19053	0.0227	-0.19304	0.0209	-0.19264	0.0213
Two	Craniotomy except for Trauma	-0.12368	0.0459	-0.13258	0.0323	-0.1226	0.0479
Two	Ventricular Shunt Procedures	0.01239	0.9362	-0.01661	0.9145	0.01026	0.9472
Two	Extracranial Vascular Procedures	-0.16012	0.0537	-0.15782	0.0572	-0.16151	0.0517
Two	Other Nervous System and Related Procedures	0.25954	0.1355	0.27436	0.1145	0.26329	0.13
Two	Intracranial Hemorrhage	0.06224	0.3922	0.06116	0.4003	0.05651	0.4373
Two	CVA and Precerebral Occlusion W Infarction	-0.04536	0.2481	-0.04362	0.2666	-0.04569	0.2447
Two	Nonspecific CVA and Precerebral Occlusion W/O Infarction	-0.12117	0.0679	-0.1188	0.0734	-0.12247	0.065
Two	Transient Ischemia	0.2194	0.1978	0.22286	0.1908	0.21635	0.2042
Two	Peripheral, Cranial and Autonomic Nerve Disorders	0.06662	0.6778	0.06997	0.6625	0.07814	0.6261
Two	Major Respiratory and Chest Procedures	-0.05239	0.438	-0.06381	0.3448	-0.05631	0.4047
Two	Other Respiratory and Chest Procedures	-0.0613	0.3312	-0.09269	0.1417	-0.06584	0.2968
Two	Respiratory System Diagnosis W Ventilation Support 96+ Hours	-0.01275	0.762	-0.01543	0.714	-0.01325	0.7531
Two	Pulmonary Edema and Respiratory Failure	-0.05534	0.0358	-0.06584	0.0125	-0.05439	0.0392
Two	Respiratory Malignancy	0.01353	0.8552	0.00423	0.9545	0.01105	0.8815
Two	Major Respiratory Infections and Inflammations	-0.05902	0.0112	-0.06228	0.0074	-0.05952	0.0106
Two	Other Pneumonia	0.02899	0.169	0.0263	0.2119	0.02836	0.1785
Two	Chronic Obstructive Pulmonary Disease	0.04817	0.0575	0.03802	0.1339	0.0474	0.0617
Two	Interstitial Lung Disease	-0.02695	0.7939	-0.02694	0.7939	-0.02624	0.7992

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694) Coeff.	Model 7 P value	Model 8 (n= 385,694) Coeff.	Model 8 P value	Model 9 (n= 385,694) Coeff.	Model 9 P value
Two	Other Respiratory Diagnoses except Signs, Symptoms and Minor Diagnoses	-0.0141	0.8108	-0.02237	0.7042	-0.01461	0.8042
Two	Respiratory Signs, Symptoms, and Diagnoses	-0.17362	0.1253	-0.17083	0.1314	-0.17408	0.1244
Two	Cardiac Defibrillator and Heart Assist Implant	-0.02551	0.7251	-0.05066	0.4849	-0.02672	0.7127
Two	Cardiac Valve Procedures W Cardiac Catheterization	-0.08817	0.1199	-0.08666	0.1263	-0.08887	0.1171
Two	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	-0.14223	<.0001	-0.15638	<.0001	-0.14525	<.0001
Two	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	-0.06445	0.148	-0.07998	0.0726	-0.06661	0.135
Two	Other Cardiothoracic Procedures	0.03724	0.7398	0.04762	0.6711	0.03255	0.7716
Two	Major Thoracic and Abdominal Vascular Procedures	-0.06193	0.1127	-0.07287	0.0619	-0.06334	0.1048
Two	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	0.03786	0.7613	0.03027	0.8081	0.03803	0.7604
Two	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	-0.12349	0.0451	-0.12652	0.0401	-0.12349	0.0452
Two	Other Vascular Procedures	-0.09473	0.001	-0.10021	0.0005	-0.09736	0.0007
Two	Percutaneous Cardiovascular Procedures W AMI	0.02856	0.472	0.01753	0.659	0.02896	0.466
Two	Percutaneous Cardiovascular Procedures W/o AMI	-0.05657	0.2044	-0.06651	0.1356	-0.05614	0.2079
Two	Cardiac Pacemaker and Defibrillator Device Revision except Device Replacement	-0.10345	0.4285	-0.10667	0.4142	-0.1032	0.4297
Two	Other Circulatory System Procedures	-0.06883	0.2958	-0.0686	0.2974	-0.0696	0.2905
Two	Acute Myocardial Infarction	-0.02705	0.2519	-0.0272	0.2493	-0.02829	0.2309
Two	Cardiac Catheterization W Circ Disorders except Ischemic Heart Disease	0.02772	0.64	0.02862	0.6292	0.02642	0.6558
Two	Cardiac Catheterization for Ischemic Heart Disease	0.02249	0.8102	0.00928	0.921	0.02149	0.8185
Two	Heart Failure	-0.02101	0.3309	-0.02291	0.289	-0.02227	0.3028
Two	Major Stomach, Esophageal and Duodenal Procedures	-0.01225	0.8058	-0.02838	0.5691	-0.01381	0.7817
Two	Major Small and Large Bowel Procedures	-0.05749	0.0091	-0.06713	0.0023	-0.0598	0.0067
Two	Other Stomach, Esophageal and Duodenal Procedures	-0.01808	0.8706	-0.01486	0.8935	-0.01991	0.8577
Two	Other Small and Large Bowel Procedures	-0.21715	0.0193	-0.22139	0.017	-0.21829	0.0187
Two	Peritoneal Adhesiolysis	-0.14049	0.14	-0.1488	0.118	-0.14165	0.1369
Two	Hernia Procedures except Inguinal, Femoral & Umbilical	-0.14841	0.2123	-0.15651	0.1883	-0.15218	0.201
Two	Other Digestive System and Abdominal Procedures	0.07764	0.338	0.08244	0.309	0.07709	0.3416
Two	Peptic Ulcer and Gastritis	-0.01015	0.8482	-0.00615	0.9076	-0.00942	0.8591
Two	Major Esophageal Disorders	-0.0063	0.9556	-0.000703	0.995	-0.00683	0.9518
Two	Other Esophageal Disorders	0.01414	0.8851	0.01503	0.8779	0.0144	0.8831
Two	Diverticulitis and Diverticulosis	-0.04482	0.6154	-0.04654	0.6018	-0.04339	0.6267
Two	Other and Unspecified Gastrointestinal Hemorrhage	0.12657	0.0476	0.13154	0.0395	0.12513	0.0503
Two	Other Digestive System Diagnoses	0.0189	0.766	0.01388	0.827	0.01504	0.8129
Two	Major Pancreas, Liver and Shunt Procedures	-0.09816	0.2124	-0.10398	0.1865	-0.09859	0.2105
Two	Cholecystectomy except Laparoscopic	0.05771	0.3417	0.05405	0.3732	0.05667	0.3506
Two	Laparoscopic Cholecystectomy	-0.02687	0.612	-0.02667	0.6146	-0.02773	0.6006
Two	Hip Joint Replacement	0.00643	0.8977	0.00298	0.9524	0.00364	0.9419
Two	Knee Joint Replacement	-0.01754	0.8464	-0.01578	0.8616	-0.01701	0.851
Two	Hip and Femur Procedures For Trauma except Joint Replacement	0.05113	0.2142	0.05135	0.2121	0.05116	0.2139
Two	Fracture of Femur	0.0303	0.86	0.0349	0.839	0.02568	0.8812
Two	Diabetes	0.08869	0.1411	0.09014	0.1347	0.08762	0.146
Two	Electrolyte Disorders except Hypovolemia Related	-0.03133	0.6736	-0.02937	0.6929	-0.03668	0.6219
Two	Other Kidney, Urinary Tract and Related Procedures	-0.04884	0.5688	-0.06588	0.4421	-0.05073	0.554

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694)		Model 8 (n= 385,694)		Model 9 (n= 385,694)	
		Coeff.	P value	Coeff.	P value	Coeff.	P value
Two	Renal Failure	-0.00708	0.8689	-0.01095	0.7984	-0.00895	0.8347
Two	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.1464	0.1439	0.15307	0.1265	0.15072	0.1325
Two	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	-0.30478	0.0104	-0.318	0.0075	-0.30562	0.0103
Two	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.32476	0.3109	0.32436	0.3114	0.32013	0.318
Two	Uterine and Adnexa Procedures for Non-Malignancy except Leiomyoma	0.26018	0.0427	0.24961	0.0519	0.25746	0.045
Two	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.08194	0.4229	0.08793	0.3898	0.08129	0.4267
Two	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	0.0603	0.2577	0.04381	0.4108	0.05805	0.276
Two	Septicemia and Disseminated Infections	0.02011	0.3875	0.02028	0.3835	0.0203	0.3832
Two	Other Complications of Treatment	-0.38911	0.001	-0.38634	0.0011	-0.39065	0.001
Two	Musculoskeletal & Other Procedures for Multiple Significant Trauma	0.01503	0.8835	-0.00247	0.9808	0.02105	0.8374
Two	Multiple Significant Trauma W/O O.R. Procedure	0.31975	0.0064	0.32425	0.0057	0.32203	0.006
Three	Tracheotomy W Long Term Mechanical Ventilation W Extensive Procedure	0.15049	0.0254	0.11842	0.0787	0.14954	0.0264
Three	Tracheotomy W Long Term Mechanical Ventilation W/O Extensive Procedure	0.02544	0.6284	0.02702	0.6072	0.02479	0.6373
Three	Craniotomy except for Trauma	-0.06501	0.3346	-0.0723	0.2833	-0.06193	0.3582
Three	Ventricular Shunt Procedures	0.0925	0.597	0.06661	0.7034	0.09634	0.582
Three	Extracranial Vascular Procedures	-0.1343	0.1181	-0.13348	0.1203	-0.13468	0.1171
Three	Other Nervous System and Related Procedures	0.30087	0.0855	0.31706	0.07	0.30503	0.0814
Three	Intracranial Hemorrhage	0.08442	0.2559	0.08416	0.2573	0.07931	0.286
Three	CVA and Precerebral Occlusion W Infarction	-0.05404	0.1758	-0.05353	0.1798	-0.05423	0.1744
Three	Nonspecific CVA and Precerebral Occlusion W/O Infarction	-0.11288	0.0945	-0.11083	0.1006	-0.11399	0.0914
Three	Transient Ischemia	0.15998	0.3497	0.16346	0.3393	0.15727	0.358
Three	Peripheral, Cranial and Autonomic Nerve Disorders	0.03144	0.8462	0.0337	0.8352	0.04223	0.7945
Three	Major Respiratory and Chest Procedures	-0.04481	0.5279	-0.05367	0.4496	-0.04683	0.5096
Three	Other Respiratory and Chest Procedures	-0.04472	0.499	-0.07555	0.2534	-0.04785	0.4695
Three	Respiratory System Diagnosis W Ventilation Support 96+ Hours	-0.06346	0.0466	-0.06653	0.037	-0.06461	0.0428
Three	Pulmonary Edema and Respiratory Failure	-0.02018	0.3713	-0.03148	0.1632	-0.02009	0.3736
Three	Respiratory Malignancy	0.02336	0.7514	0.01196	0.8711	0.02157	0.77
Three	Major Respiratory Infections and Inflammations	-0.00195	0.9318	-0.00639	0.7795	-0.00263	0.9082
Three	Other Pneumonia	0.03482	0.0999	0.0312	0.1404	0.03445	0.1036
Three	Chronic Obstructive Pulmonary Disease	0.03717	0.1532	0.02593	0.3192	0.03635	0.1625
Three	Interstitial Lung Disease	0.00961	0.9258	0.00894	0.9309	0.01011	0.9219
Three	Other Respiratory Diagnoses except Signs, Symptoms and Minor Diagnoses	0.01956	0.7461	0.0111	0.8541	0.01923	0.7502
Three	Respiratory Signs, Symptoms, and Diagnoses	-0.17921	0.1165	-0.1773	0.1204	-0.18006	0.1149
Three	Cardiac Defibrillator and Heart Assist Implant	-0.09016	0.1958	-0.10996	0.1146	-0.09125	0.1905
Three	Cardiac Valve Procedures W Cardiac Catheterization	-0.06674	0.2004	-0.06707	0.1982	-0.06631	0.2034
Three	Coronary Artery Bypass W Cardiac Cath or Percutaneous Cardiac Procedure	-0.11376	<.0001	-0.12551	<.0001	-0.11617	<.0001

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694)		Model 8 (n= 385,694)		Model 9 (n= 385,694)	
		Coeff.	P value	Coeff.	P value	Coeff.	P value
Three	Coronary Artery Bypass W/O Cardiac Cath or Percutaneous Cardiac Procedure	-0.00035296	0.9939	-0.01605	0.7282	-0.00156	0.973
Three	Other Cardiothoracic Procedures	-0.02212	0.8133	-0.01109	0.9058	-0.02326	0.8039
Three	Major Thoracic and Abdominal Vascular Procedures	-0.02384	0.5486	-0.03077	0.4388	-0.02481	0.5325
Three	Permanent Cardiac Pacemaker Implant with AMI, Heart Failure, or Shock	0.08982	0.4765	0.08411	0.505	0.0909	0.4714
Three	Permanent Cardiac Pacemaker Implant W/O AMI, Heart Failure, or Shock	-0.15167	0.0177	-0.15573	0.0148	-0.1506	0.0185
Three	Other Vascular Procedures	-0.07679	0.0079	-0.08315	0.004	-0.07854	0.0066
Three	Percutaneous Cardiovascular Procedures W AMI	0.04471	0.3145	0.03222	0.4686	0.04535	0.3078
Three	Percutaneous Cardiovascular Procedures W/O AMI	-0.1264	0.0071	-0.13662	0.0036	-0.12544	0.0076
Three	Cardiac Pacemaker and Defibrillator Device Replacement	0.01094	0.9356	0.01747	0.8973	0.01095	0.9355
Three	Other Circulatory System Procedures	-0.06176	0.3309	-0.06553	0.3021	-0.06415	0.3126
Three	Acute Myocardial Infarction	-0.01453	0.5434	-0.01571	0.5112	-0.01575	0.5103
Three	Cardiac Catheterization W Circ Disorders except Ischemic Heart Disease	-0.03037	0.5712	-0.03029	0.5722	-0.03063	0.568
Three	Cardiac Catheterization for Ischemic Heart Disease	-0.03361	0.7262	-0.04599	0.6317	-0.03393	0.7238
Three	Heart Failure	-0.00016656	0.9939	-0.00314	0.8862	-0.00073953	0.9731
Three	Major Stomach, Esophageal and Duodenal Procedures	-0.03179	0.5114	-0.04614	0.3406	-0.03182	0.5112
Three	Major Small and Large Bowel Procedures	-0.03032	0.1745	-0.03968	0.0755	-0.03139	0.1598
Three	Other Stomach, Esophageal and Duodenal Procedures	-0.25546	0.0071	-0.25911	0.0063	-0.25596	0.007
Three	Other Small and Large Bowel Procedures	-0.10708	0.2752	-0.11487	0.2417	-0.10863	0.2684
Three	Peritoneal Adhesiolysis	-0.14225	0.2629	-0.15	0.2377	-0.14507	0.2537
Three	Other Digestive System and Abdominal Procedures	0.06464	0.4148	0.06041	0.4459	0.06555	0.4083
Three	Peptic Ulcer and Gastritis	0.02995	0.5768	0.03327	0.5353	0.03078	0.5663
Three	Major Esophageal Disorders	-0.03307	0.7722	-0.0307	0.788	-0.03436	0.7636
Three	Other Esophageal Disorders	0.06393	0.5228	0.06556	0.5122	0.06588	0.5104
Three	Diverticulitis and Diverticulosis	-0.03267	0.7186	-0.03633	0.6886	-0.03077	0.7343
Three	Other and Unspecified Gastrointestinal Hemorrhage	0.12485	0.0537	0.1301	0.0444	0.12436	0.0547
Three	Other Digestive System Diagnoses	0.00254	0.9686	-0.00468	0.9423	-0.00197	0.9757
Three	Major Pancreas, Liver and Shunt Procedures	-0.01186	0.8649	-0.01694	0.808	-0.01136	0.8706
Three	Cholecystectomy except Laparoscopic	0.09175	0.1429	0.08693	0.1651	0.09138	0.1447
Three	Laparoscopic Cholecystectomy	-0.09946	0.065	-0.09943	0.0651	-0.09949	0.065
Three	Hip Joint Replacement	-0.00309	0.9508	-0.00669	0.8937	-0.00612	0.9028
Three	Knee Joint Replacement	-0.03711	0.6881	-0.03418	0.7115	-0.03585	0.6982
Three	Hip and Femur Procedures For Trauma except Joint Replacement	0.0464	0.2702	0.04537	0.2809	0.04586	0.2759
Three	Fracture of Femur	-0.06073	0.7268	-0.05492	0.752	-0.06502	0.7084
Three	Diabetes	0.088	0.1498	0.08896	0.1454	0.08774	0.1511
Three	Electrolyte Disorders except Hypovolemia Related	0.01464	0.8467	0.01433	0.8499	0.00836	0.9122
Three	Other Kidney, Urinary Tract and Related Procedures	-0.01967	0.824	-0.03965	0.6538	-0.02047	0.817
Three	Renal Failure	-0.00729	0.847	-0.01318	0.7271	-0.00894	0.8129
Three	Other Kidney and Urinary Tract Diagnoses, Signs, and Symptoms	0.14998	0.1383	0.15667	0.1215	0.15547	0.1245
Three	Uterine and Adnexa Procedures for Ovarian and Adnexal Malignancy	-0.26997	0.0297	-0.28295	0.0226	-0.26851	0.0306
Three	Uterine and Adnexa Procedure for non-Ovarian and Non-Adnexal Malig	0.29894	0.3581	0.2973	0.3607	0.29475	0.365

Exhibit 8.3

Regression Estimates for the Nine Models Estimated with IPS Data
Models Seven, Eight, and Nine

Sev	Variable	Model 7 (n= 385,694)		Model 8 (n= 385,694)		Model 9 (n= 385,694)	
		Coeff.	P value	Coeff.	P value	Coeff.	P value
Three	Uterine and Adnexa Procedures for Non-Malignancy except Leiomyoma	0.1558	0.263	0.14578	0.2949	0.15357	0.27
Three	Other Anemia and Disorders of Blood and Blood-Forming Organs	0.06409	0.5375	0.07067	0.4966	0.06371	0.5401
Three	Infectious and Parasitic Diseases Including HIV W O.R. Procedure	0.09222	0.049	0.07248	0.1218	0.0902	0.0542
Three	Septicemia and Disseminated Infections	0.02681	0.2424	0.02583	0.26	0.02744	0.2317
Three	Other Complications of Treatment	-0.33787	0.0052	-0.32972	0.0064	-0.33754	0.0053
Three	HIV W Major HIV Related Condition	0.03328	0.731	0.03258	0.7364	0.03321	0.7316
Three	Musculoskeletal & Other Procedures for Multiple Significant Trauma	0.0348	0.7381	0.02234	0.83	0.03937	0.7053
Three	Multiple Significant Trauma W/O O.R. Procedure	0.2021	0.0971	0.20357	0.0947	0.20412	0.0939
	Free-Standing Vol/NP	-0.10724	0.0406	-0.10337	0.0484	-0.10507	0.0449
	Free-Standing Proprietary	-0.04202	0.4232	-0.03839	0.4643	-0.0398	0.4482
	Free-Standing Government	-0.09358	0.0745	-0.09252	0.0778	-0.0916	0.0809
	Facility-Based Vol/NP	-0.10838	0.0384	-0.10573	0.0434	-0.10608	0.0428
	Facility-Based Proprietary	-0.07373	0.1601	-0.07189	0.1707	-0.07146	0.1734
	Facility-Based Government	-0.11552	0.0277	-0.11371	0.0302	-0.11315	0.0311
	Other Vol/NP	-0.07337	0.1614	-0.07084	0.1763	-0.07119	0.1743
	Other Proprietary	-0.05979	0.2534	-0.05686	0.2773	-0.05743	0.2728
	Other Government	-0.08158	0.1276	-0.07818	0.1442	-0.07989	0.1358
	Acute Care Hospital Payments in 120 Days Preceding Home Health Episode						
	Long Term Care Hospital Payments in 120 Days Preceding Home Health Episode						
	Rehabilitation Facility Payments in 120 Days Preceding Home Health Episode						
	Medicare SNF Payments in 120 Days Preceding Home Health Episode						
	Log (1 + Acute Care Hospital Payments in 120 Days Preceding Home Health Episode)	-0.00456	<.0001				
	Log(1 + Long Term Care Hospital Payments in 120 Days Preceding Home Health Episode)	0.00245	0.1555				
	Log (1 + Rehabilitation Facility Payments in 120 Days Preceding Home Health Episode)	0.00186	0.0329				
	Log (1 + Medicare SNF Payments in 120 Days Preceding Home Health Episode)	0.00499	<.0001				
	Total Payments All Four Settings in 120 Days Preceding Home Health Episode			-0.000002	<.0001		
	Log (1 + Total Payments All Four Settings in 120 Days Preceding Home Health Episode)					-0.00267	<.0001

Notes: "Sev" indicates interactions between severity levels and APR DRGs (e.g., "One" indicates an interaction between an APR DRG and the 1st severity level).

8.4.4. Estimating Real and Nominal Case-Mix Change

Using the nine models described above in section 8.3.1, we calculated predicted case-mix values for the 2005 period for each model. Predicted case-mix is calculated based on the regression coefficients from Exhibit 8.3 and the mean values from Exhibit 8.1. We also calculated the differences between actual case-mix for the IPS period and the predicted case-mix values for each of the nine models in 2005, and compared them to the actual total change in case-mix from the IPS to 2005 (Exhibit 8.4).

Between the periods, the actual average case-mix increased from 1.0998 to 1.2293, an increase of 0.1295. As we noted in Section 8.2, this comparison is based on two samples constructed for the analysis of this chapter—a 10% sample of simulated episodes from FFY 2000 and a 20% sample from 2005. The increase of .1295 between these two samples is smaller than the increase calculated for the Final Rule (1.2361-1.0960=.1401), but we believe the Final Rule calculation used more reliable data for purposes of estimating national averages. Notably, the Final Rule calculation employed a much larger (100%) sample of simulated episodes from FFY2000. The Final Rule used the same 20% sample as the modeling sample analyzed in this chapter, but the file was more extensively cleaned, notably, by excluding Requests for Anticipated Payment records (i.e., RAP claims), with their lower reliability, by excluding claims with certain date and visit errors, and by calculating more-complete case mix weights for SCIC episodes (using the average of the multiple HHRGs on the SCIC episodes rather than using the HHRG with the earliest date). The 10% IPS sample (modeling sample) had a 0.0038 higher average case mix weight than the 100% sample used for the Final Rule calculation—a difference likely attributable to sampling variability. The 20% modeling sample for 2005 had a .0068 lower average case mix weight than the 20% 2005 sample used for the Final Rule—a difference we attribute to the slightly more stringent selection rules applied to the Final Rule sample, as described above. The combined effect of these two differences is a smaller calculated increase between the two modeling samples.

The IPS modeling sample, containing 358,694 records, is of sufficient size to estimate the relationships between the predictive variables and case mix weights in FFY2000. The relationships and the 2005 values of the predictive variables themselves were used to compute predictions of 2005 case mix. When we examined the predictions from Models 1 through 9, they hardly drew closer to the actual 2005 modeling sample average. In other words, almost none of the increase between the two modeling samples was associated with changes in the prevalence of the independent variables included in each of the nine models, and, therefore, almost all of the increase presumably reflected changes in agency coding practices or other nominal factors.

- Predicted case-mix in 2005 varied from a low of 1.0994 for Model 1 to a high of 1.1102 for Model 6. In all of the models, most of the change in case-mix that occurred between the two periods was not predicted by changes in the prevalence of the independent variables that were included in the models. These results suggest that at least 92% of the increase in case-mix between 1999 and 2005 was due to factors that were not included in any of the models – i.e., what appears to be coding change.

- The predicted case-mix was higher for Models 5-9 (between 1.1085 and 1.1102) than for Models 1-4 (between 1.0994 and 1.1063). The fact that Models 5-9 differ from the others in their inclusion of the variables for home health agencies' ownership and facility type suggests that some of the increase in case-mix that occurred between the two periods was due to decreases in the proportion of patients served by non-profit agencies, which were associated with lower case-mix weights.

Exhibit 8.4
Comparing Actual and Predicted Case-Mix for 2005

Actual Case-Mix

	Actual	Difference
IPS	1.0998	
2005	1.2293	0.1295

Predicted Case-Mix for 2005

	Predicted Relative Payment Weight	Unpredicted	Unpredicted as % of Actual Increase in Case-Mix
Model 1	1.0994	0.1299	100.3%
Model 2	1.1063	0.1230	95.0
Model 3	1.1011	0.1281	98.9
Model 4	1.1001	0.1291	99.7
Model 5	1.1085	0.1208	93.3
Model 6	1.1102	0.1191	92.0
Model 7	1.1088	0.1205	93.1
Model 8	1.1079	0.1214	93.7
Model 9	1.1088	0.1205	93.1

8.5. Sensitivity Analysis

Three potential limitations of the analysis presented in this chapter are worthy of note and further explanation and analysis.

8.5.1. Changes in the Relationship Between Patient Characteristics and Case-Mix

There could have been a structural shift in the relationship between patient characteristics and home health case-mix between the two periods. For example, patients hospitalized for a particular APR DRG in the baseline period might have used fewer services in home care (and thus have had a lower case-mix) than patients hospitalized for the same APR DRG in the PPS period. This might occur if there were changes in the delivery of care that resulted in the earlier shift of some patients from the acute care hospital setting to home health so that, by 2005, these patients had a higher case-mix in home care. If this pattern were common, then using regression coefficients from the models estimated on the baseline period data to estimate predicted case-mix change in 2005 could be problematic.

To analyze the potential for this type of shift, we estimated the nine regression models using data from the 2005 period to predict case-mix in the baseline period. This is the reverse of the approach described above, which used models from the baseline period to predict 2005 case-mix. We wanted to evaluate whether both approaches yield similar results with respect to the estimated proportion of real and nominal case-mix change. If they do, it would suggest that any structural changes that may have occurred during this period do not alter the basic conclusions of our analyses.

The results of this analysis are presented in Exhibit 8.5. The predicted case-mix for the baseline period is much higher (1.2233 to 1.2527) than the actual case-mix (1.0998) for the period. Across the nine models, between 95% and 118% of the actual change in case-mix from the baseline period to 2005 was unpredicted and assumed to reflect coding changes or other nominal factors. Based on this test, we conclude that structural shifts do not appear to have much effect on the results.

Exhibit 8.5

Predicted IPS Case-Mix Based on Regression Models Estimated Using the 2005 Data Set

Actual Case-Mix	Actual	Difference	
IPS	1.0998		
2005	1.2293	0.1295	
Predicted Case-Mix	**Predicted**	**Unpredicted (Coding Change)**	**Coding Change as % of Actual Increase in Case-Mix**
Model 1	1.2302	0.1304	100.7%
Model 2	1.2233	0.1235	95.3%
Model 3	1.2517	0.1519	117.3%
Model 4	1.2527	0.1529	118.1%
Model 5	1.2327	0.1329	102.7%
Model 6	1.2312	0.1314	101.5%
Model 7	1.2324	0.1326	102.4%
Model 8	1.2366	0.1368	105.7%
Model 9	1.2325	0.1327	102.5%

8.5.2. Changes in Hospital Coding Practices

The prevalence rates of a number of the APR DRGs changed between the two periods. This raises the possibility of differences between the two periods in how hospitals make case-mix group assignments, notwithstanding that we employed the APR DRG code mapper to address diagnosis code set changes across years.

To examine the potential impact of changes in hospital coding practices on the measurement of real case-mix changes for home health patients, we identified all APR DRGs that had a change in prevalence between the two periods of 0.0050 (one-half of a percentage point) or more. We then calculated how much the predicted case-mix in 2005 changed, holding the prevalence of those APR DRGs constant across the two periods.

The results of that analysis are provided next in Exhibit 8.6. At the top of the exhibit, the effects on coding change estimates are presented in case-mix units. Negative values indicate that predicted case-mix would be lower in 2005 if the prevalence of the APR DRG in question remained constant from the IPS to 2005 – i.e., coding change effects increased. Conversely, positive values indicate that coding change effects decreased. At the bottom of the exhibit, the same effects are presented as percentages of the actual change in average case-mix between the IPS and 2005 (0.1295).

The effects are quite small. At most, the estimates of unpredicted case-mix change would have decreased by 2.4 to 2.5 percentage points (for Nonspecific CVA and Precerebral Occlusion W/O Infarction). Many of the effects are negative, indicating that assuming constant prevalence for these APR DRGs would actually have increased the estimates of unpredicted case-mix change. The results across the models are also quite consistent; the one notable difference was for the "unknown" APR DRG, which had smaller effects (in absolute value) for Models 6 and 8 compared to Models 4, 5, 7, and 9. Based on this analysis, it is unlikely that changes in hospital coding practices would affect the corresponding estimates of home health agency coding changes between the baseline period and 2005.

Exhibit 8.6

Estimated Effects on Coding Change Estimates from IPS to 2005 of Assuming Constant Prevalence for APR DRGs with Prevalence Changes of 0.50 Percentage Points or More

APR DRG	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Case-Mix Effects (in case-mix units)						
Coronary Artery Bypass With Cardiac Cath or Percutaneous Cardiac Procedure	(0.0043)	(0.0042)	(0.0041)	(0.0042)	(0.0042)	(0.0042)
Heart Failure	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Knee Joint Replacement	0.0007	0.0007	0.0010	0.0007	0.0010	0.0006
Major Respiratory Infections and Inflammations	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
Nonspecific CVA and Precerebral Occlusion W/O Infarction	0.0032	0.0032	0.0032	0.0032	0.0032	0.0032
Renal Failure	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Unknown	(0.0018)	(0.0015)	(0.0005)	(0.0015)	(0.0007)	(0.0015)
TOTAL	(0.0018)	(0.0016)	(0.0002)	(0.0016)	(0.0005)	(0.0016)
Effects as Percentage of Change in Case-Mix Index from IPS to 2005 (0.1295)						
Coronary Artery Bypass With Cardiac Cath or Percutaneous Cardiac Procedure	-3.3%	-3.3%	-3.2%	-3.3%	-3.2%	-3.2%
Heart Failure	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Knee Joint Replacement	0.6%	0.5%	0.8%	0.5%	0.8%	0.5%
Major Respiratory Infections and Inflammations	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Nonspecific CVA and Precerebral Occlusion W/O Infarction	2.5%	2.5%	2.4%	2.5%	2.5%	2.5%
Renal Failure	-0.6%	-0.6%	-0.5%	-0.5%	-0.5%	-0.6%
Unknown	-1.4%	-1.1%	-0.4%	-1.2%	-0.6%	-1.2%
TOTAL	-1.4%	-1.2%	-0.2%	-1.2%	-0.4%	-1.2%

8.5.3. Alternative Definitions of APR DRG Variables

When using the APR DRG for an inpatient stay to predict the home health case-mix weight for a future home health episode, it may make sense to use shorter look-back periods for some APR DRGs than for others. For example, there may be some APR DRGs where impacts on home health care needs (and case-mix) persist for long periods – for example, acute care health problems resulting in permanent loss of functional status. Conversely, there may be other APR DRGs whose correlation with future home health resource use may be shorter in duration – e.g., having an inpatient stay for pneumonia six years ago may have little to no effect on home health care needs today.

To consider whether different look-back periods should be applied to different APR DRGs, we consulted with clinicians and assigned different look-back periods to each of the APR DRGs based on how long the condition would be expected to impact the resource use associated with home health care. Based on clinician input, we developed a 5-level look-back hierarchy (up to 6 weeks, up to 3 months, up to 6 months, up to 2 years, and up to 4 years). Applying these restrictions reduced the number of home health episodes with an associated hospital record to 146,800 in the baseline period sample, and to 289,482 in the PPS sample. We also developed a simplified/collapsed two-level look-back hierarchy (up to 6 months, up to 4 years). Applying these restrictions reduced the number of home health episodes with an associated hospital record to 208,424 in the baseline period sample, and to 403,351 in the PPS sample.

Exhibit A.2 (in the Appendix) lists the look-back periods assigned to each APR DRG using a 5-level and the two-level look-back hierarchies.

Once the look-back periods were applied, we examined prevalence of the APR DRGs, particularly those with large declines between the two periods. We consulted with 3M (producers of the APR DRG software) to ensure that the algorithm was being applied correctly, and determined that the historical grouper was successful in correctly assigning APR DRGs for codes that changed over the time period in the file. However, changes in coding guidance that occurred are not considered. For example, coding guidance released around 2004 resulted in a shift of many CVA cases from ICD9 code 436 to code 434.9. (Specifically, prior to 2004, non-specific stroke was coded as 436 and assigned to APR DRG 46 [Nonspecific CVA & preverbal occlusion w/o infarct], depending on whether a procedure was performed. After 2004 it would be coded as 434.91 and go to APR DRG 45 [CVA w/infarct] – again, depending on whether a procedure was performed.) Our data showed a significant drop in the relative frequency of cases assigned to APR DRG 46 between the two samples. Based on this, we decided to combine APR DRGs 45 and 46 in our re-analysis.

We also consulted with coding experts to determine whether there were other changes in coding guidance that occurred between 1996 and 2005 that could have affected APR-DRG assignments. We asked them to review for changes in relevant coding guidance a list of APR DRGs for which the APR DRG represented at least 0.2% of the IPS sample, and change between IPS and PPS was equal to at least 20%. We added to this list a few additional groups that did not meet these criteria but could have a relatively large impact on our case-mix index prediction (Exhibit 8.7). The experts were provided with an analysis of the five most common diagnoses and procedures that placed the admissions in the APR DRGs.

Feedback from the coding experts indicated that some changes in coding guidance had occurred between 1996 and 2005 related to several of the APR DRGs, but these changes affected codes that made up only a very small percentage of the cases in the DRGs, and so did not account for changes in overall APR DRG frequency.

As a further check of the original results, another series of case-mix regression models were estimated using the same data sets, leading to a new set of coding change estimates. Compared to the original Models 1 to 9, the new models incorporated the following changes:

- All models merged APR DRG 45 (CVA and preverbal occlusion with infarction) and APR DRG 46 (non-specific CVA and preverbal occlusion without infarction) together – this generated a new set of Models 4 through 9.

- The two alternative sets of "look-back" assumptions were used to code the APR DRG variables. The alternative look-back assumptions in turn generated two additional sets of Models 4 through 6.

Exhibit 8.8 presents the predicted coding change as a percentage of actual coding change from the IPS to 2005 for all models, including the nine "original" models. Using the new set of look-back definitions increased the percentage of unpredicted case-mix change to between 98 and 105% of actual coding change (using the 5-level look-back) and to between 100 and 108% of actual coding change (using the two-level look-back period). Combining APR DRG 45 and 46 had almost no impact on our results.

Exhibit 8.7

APR DRGs Reviewed by Coding Experts for Changes in Diagnosis Coding Guidance

APR_DRG	APR DRG Description
045	CVA w infarct
046	Nonspecific CVA & preverbal occlusion w/o infarct
047	Transient ischemia
058	Other disorders of nervous system
120	Major respiratory procedures
133	Pulmonary edema & respiratory failure
137	Respiratory infections & inflammations
139	Simple pneumonia
144	Respiratory system signs, symptoms & other diagnoses
165	Coronary bypass w/o malfunctioning coronary bypass w cardiac cath
166	Coronary bypass w/o malfunctioning coronary bypass w/o cardiac cath
169	Major abdominal vascular procedures
171	Perm cardiac pacemaker implant w/o AMI, heart failure or shock
173	Other vascular procedures
174	Percutaneous cardiovascular procedures w AMI
175	Percutaneous cardiovascular procedures w/o AMI
190	Circulatory disorders w AMI
194	Heart failure
221	Major small & large bowel procedures
241	Peptic ulcer & gastritis
244	Diverticulitis & diverticulosis
301	Major joint & limb reattach proc of lower extremity for trauma
302	Major joint & limb reattach proc of lower extrem exc for trauma
308	Hip & femur procedures except major joint for trauma
460	Renal failure
663	Red blood cell disorders except sickle cell anemia crisis
720	Septicemia

Exhibit 8.8

Coding Change as Percentage of Actual Increase in Case-Mix Using Alternative APR-DRG Look-Backs

Model	Percentage of Unpredicted Case-Mix Change			
	Original	Original with APR DRG 45 and 46 Combined	5-Level Look-Back Definitions (APR DRG 45 and 46 Combined)	2-Level Look-Back Definitions (APR DRG 45 and 46 Combined)
One	100.3%			
Two	95.0			
Three	98.9			
Four	99.7	99.8	105.1	107.8
Five	93.3	93.3	98.7	101.3
Six	92.0	92.0	97.7	100.0
Seven	93.1	93.1	100.1	101.6
Eight	93.7	93.8	99.4	101.9
Nine	93.1	93.2	99.6	101.5

9. Nonroutine Medical Supplies

9.1. Summary

Prior to PPS, nonroutine medical supplies (NRS) were payable on a reasonable cost basis. Under the original PPS, NRS were reimbursed with a flat rate bundled within the episode payment rate. The bundled payment included $43.54 per 60-day episode for NRS, and an additional $6.08 per episode to cover NRS that may have been billed under Medicare Part B and thus not reflected in the home health cost report data that were used to determine the amount of the NRS payment. The total of the two amounts, or $49.62, was added to the national total prospective payment. This amount was case mix and wage-adjusted during payment operations. The NRS payment rate has been updated implicitly each year in the annual rate update.

A limitation of this approach is that the case-mix adjustments do not correlate well with the characteristics of patients who need NRS or with NRS costs. NRS use varies widely across episodes of care – the majority of episodes have no NRS use and a small number of episodes account for a disproportionate share of NRS costs. As a result, the NRS payment amount is too high for most episodes but too low for episodes with moderate or high NRS use. There was concern that the NRS payment amount was inadequate for some patients with pressure ulcers, stasis ulcers, other ulcers, wounds, burns or trauma, cellulitis, and skin cancers.

The PPS refinements published in 2007 make changes to the payment for NRS that are intended to address these concerns. Instead of including payment for NRS in the episode payment, under the new system, episodes are assigned to one of six severity levels based on the patient's clinical conditions. Payment for NRS is adjusted by a case-mix index that represents the mean estimated NRS costs for each group.

This approach was developed based on statistical analyses of the relationship between clinical characteristics and NRS cost that was conducted by Abt Associates. In 2002 we completed an analysis of data from early in the HH PPS, which followed up an earlier analysis we conducted on data from the pre-PPS period. The data used to develop these models had a number of limitations. This report describes updated analysis and modeling efforts that improve on the previous analyses in several key ways:

- The updated analyses use a PPS-era file that includes100 percent of episodes from selected home health agencies. The earlier analysis used a 20 percent random sample of claims from fewer agencies (called the "partial 2001 file" in this chapter).

- The updated analyses include both earlier and later episodes in a series of adjacent home health episodes. The previous analyses included only the first episode. Given that the PPS covers all episodes, this is a more appropriate design.

- For the updated analysis, we could estimate NRS costs using agency-specific cost-to-charge ratios rather than the imputed cost-to-charge ratios used previously.[38] The use of imputed cost-to-charge ratios was a significant limitation of the earlier analyses, and using agency-specific cost-to-charge ratios is felt to improve the accuracy of our estimates of NRS costs significantly.

The types of analyses that we conducted were similar to those used in the previous analyses of NRS costs. We developed a statistical model that identified clinical conditions associated with the probability and level of NRS use, excluding conditions that were clinically inappropriate or that may have unwanted incentives. Based on results from this model, we developed a five-level severity scale for NRS that groups episodes based on patients' clinical conditions.[39]

This report describes the results of our key exploratory and developmental analyses that led up to the CMS proposals for the HH PPS refinement regulation (CMS-1541-P, May 4, 2007) and the results of final validation analyses that led to the final regulation provision on payment of NRS costs (CMS-1541-FC, August 29, 2007).

9.2. Data and Creation of Analytic File for the NPRM

9.2.1. Data Sources

Analyses that led to the proposals were conducted using the National Home Health Datalink File created by Fu Associates of Arlington, VA. We linked records from this file to Home Health Medicare Cost Reports, which were needed to determine cost-to-charge ratios. The data are from the year 2001-2002.

9.2.2. Measuring NRS Costs

Medicare billing instructions require that agencies report the units and charges associated with the NRS for each episode of care. Supplies are reported on HH PPS claims using revenue code 027x. Additionally, special instructions have allowed for the separate reporting of wound care supplies, which may be identified on HH PPS claims using revenue code 0623. There is some concern that, despite these longstanding instructions, non-routine supplies have been underreported since the implementation of HH PPS in October 2000. Medicare systems under the original HH PPS were unable to enforce the requirement for reporting supply charges. Not all HH episodes involve non-routine supplies and no other indicator on the HH PPS claim showed whether such supplies were called for in a particular case.

A measure of the costs of NRS provided for each episode would be the ideal measure for this analysis, but the claims data report NRS charges for each episode, not costs. Charges tend to be highly variable among agencies, and reflect not only costs but also local market conditions and provider-specific pricing behavior. Cost data are available on agency cost reports, but not on claims. We used information derived

[38] To estimate NRS costs, we convert NRS charge information from claims to estimated costs using cost-to-charge ratios from Medicare Cost Reports (see Section 9.2.2). In the original analyses that we conducted in 2002, we had access to cost-to-charge ratio data for 365 agencies, and we therefore developed a method to impute cost-to-charge ratios (based on agency ownership type and region) so that we could include additional agencies' data.

[39] A sixth severity level was added as a result of analyses we conducted for CMS after it proposed the HH PPS refinement regulation in May 2007 (CMS-1541-P).

from cost reports on agency cost-to-charge ratios, defined as the ratio of total cost that the agency spent on NRS during a fiscal year over the total charges of NRS that the agency submitted for reimbursement for the same time period. A cost-to-charge ratio smaller than 1 suggests that the NRS cost s are less than total NRS charges, and vice versa for a cost-to-charge ratio greater than 1.

9.2.3. Selecting Agencies with Reliable Cost to Charge Ratio

Measurement of NRS costs requires accurate information on agency cost-to-charge ratios. As a result, our analytic sample is limited to home health episodes from agencies with reliable cost-to-charge information. We applied three types of exclusion criteria to identify this subset of agencies.

Exclude agencies with implausibly high or low cost to charge ratios

The distribution of cost-to-charge ratios was highly skewed. Of the 2,864 mostly freestanding HHAs with a cost report, the average NRS cost-to-charge ratio was 230.7 and the median was 0.91. More than 25% of agencies had a cost-to-charge ratio of zero; other agencies had an implausibly high value. Some agencies had errors in their cost report data; for example, some reported information on total supply charges in the field that is supposed to report their cost-to-charge ratio. Even after fixing these data errors, there were some agencies that still had implausibly high cost-to-charge ratios, and these agencies were excluded from our analyses. We also excluded agencies with cost/charge equal to zero. In addition, we excluded agencies that were listed as facility-based (n=44) and agencies that had missing information in the agency type field (n=92). We were left with 1,537 agencies we believed to have NRS cost report data that were sufficiently reliable to be compared to claims data. Even for this subset, the skewed distribution of agency NRS cost-to-charge ratios is a concern, suggesting the presence of large differences in accounting and billing practices across agencies.

Exclude agencies with inconsistencies between NRS reported on cost reports and claims data

We analyzed Medicare claims for the 1,537 agencies that had sufficiently reliable cost report data. From claims, we created a measure of total NRS charges for each agency. From the cost reports, we computed a similar measure of total NRS charges. This was calculated as the sum of Part A charges for non-routine supplies and Part B charges for supplies not subject to deductibles and coinsurance. We then compared the NRS charge information from the claims and cost report data.

Of the 1,537 agencies, 1,509 (98%) had an approximate or exact match between NRS charges measured from claims and cost-report data, where an approximate match was defined as a difference of less than 50% between the two measures. NRS matched exactly for 349 agencies (9%). We excluded the 2% of agencies that had a difference of more than 50% in NRS charges from our analyses. While this threshold was arbitrary, we believe that differences of more than 50% between the two data sources suggest the presence of data errors.

Exclude agencies in the bottom or top decile of cost-to-charge ratio

We examined the distribution of cost-to-charge ratios for the 1,509 agencies that had an approximate or exact match in NRS charges from claims and cost reports. For these agencies, the mean cost to charge ratio was 2.73 and the median was 1.13, with a range from 0.004 to 129. As a final step to eliminate agencies with unreliable cost-to-charge information, we excluded agencies in either the lowest or highest cost-to-charge ratio decile. This amounted to dropping agencies with supply cost/charge ratios less than 0.50 or higher than 3.99. This produced a sample of 1,207 agencies (Exhibit 9.1). For this sample, the average NRS cost-to-charge ratio was 1.345 and the median was 1.129 (Exhibit 9.2).

The agencies in the analytic sample include many fewer cost reports that had the general data problems reported in the February 2004 General Accounting Office report on Medicare home health payment margins.[40] For example, 36% of the original sample had one or more negative cost centers, compared to only 14% of the final analytic sample.[41] Twenty-five percent of the original sample reported no patients (unduplicated census), compared to none in the analytic sample used in our analyses.

In our final analytic sample, for-profit and urban agencies are over-represented, while agencies from the South are under-represented. In our analytic sample, 66% of agencies were for-profit, 73% were from an urban area, and 49% were from the South. Nationwide, 59% of agencies were for-profit, 65% were urban, and 57% were from the South. Agencies in our analytic sample had an average unduplicated census of 394 patients, which was higher than the overall average of 311 patients.

Exhibit 9.1

Selection of HHAs with Reliable Non-Routine Medical Supply Cost to Charge Ratios

Total number of agencies*	**2,864**
Exclusion	
NRS cost to charge ratio in cost report = 0	1,105
Non-freestanding HHAs or unknown type	136
HHAs without any matching Medicare Part A claims for the agency of the studied fiscal year	86
Poor matching with the claim-based charges and cost-report based total NRS charge	28
Excluding CCR in highest or lowest decile	302
Total number of agencies excluded	**1,657**
Agencies selected for NRS analysis	**1,207**

*: Total number of agencies in the cost report file

Source: Abt Associates analysis of Home Health Agency Cost Report Data 2001-2002 (n=2,864)

Exhibit 9.2

Distribution of Cost to Charge Ratio for NRS Analytic Sample: Descriptive Statistics

Statistic	Value
Mean	1.345
Standard error of the mean	0.020
Standard deviation	0.701
Variance	0.492
Median	1.129
Range	3.489
Interquartile range	0.821

N= 1,207

Source: Abt Associates analysis of Home Health Agency Cost Reports, 2001-2002

[40] See http://www.gao.gov/new.items/d04359.pdf. The GAO excluded more than 1,000 agencies from its analysis because key data in their cost reports were missing or had implausible values.

[41] We did not believe that the problems captured by these screens would compromise our analyses of NRS costs, so we did not consider them in developing our analytic sample.

9.2.4. Selection of Episodes for NRS Analysis

Our analytic sample of 1,207 agencies had a total of 752,262 episodes that started on or after December 1, 2000 and ended on or before December 31, 2001. We excluded several types of episodes from our analyses:

- Episodes with less than four total visits (not paid under per-episode PPS).
- Episodes without a matched OASIS assessment.
- Episodes with data problems - conflicting information on use of hospital, skilled nursing or rehabilitation facilities (e.g., stay dates overlap home health episode start), episodes for which staff visits were reported but that had no minutes reported, etc.
- Episodes that fell outside the fiscal year for the matched cost report

After applying these exclusions, we had 512,307 episodes included our analytic sample. The results discussed below are based on this analytic sample.

9.2.5. Distribution of NRS Cost

The distribution of estimated NRS costs, based on applying the CCRs, was highly skewed. More than half of the episodes had no NRS cost. About 20% of episodes had an NRS cost greater than $50, and about 5% of episodes had an NRS cost greater than $300. There were a few NRS cost outliers: the top 1% of episodes had NRS cost of $910 or more, and the maximum value was $51,298 (Exhibit 9.3).

Exhibit 9.3

Distribution of NRS Costs

Distribution	All episodes	Early episodes	Later episodes
Minimum	$0	$0	$0
10th percentile	0	0	0
20th percentile	0	0	0
30th percentile	0	0	0
40th percentile	0	0	0
50th percentile	0	0	3
60th percentile	1	0	17
70th percentile	13	5	49
80th percentile	50	28	112
85th percentile	88	56	166
90th percentile	155	110	253
95th percentile	306	237	450
96th percentile	368	287	527
97th percentile	455	363	637
98th percentile	599	486	828
99th percentile	910	747	1217
Maximum	51,298	51,298	11,482

N= 512,307 episode (360,913 early episodes; 151,394 later episodes)

Source: Abt Associates analysis of 2001 Home Health Datalink File

We compared the distribution of estimated NRS cost between early (the first or second episode in a sequence) and later episodes. In general, the NRS cost was lower in early episodes than later episodes. Almost 60% of early episodes had no NRS cost compared to 40% of later episodes. About 15% of early episodes had an NRS cost greater than $50, compared to about 30% of later episodes. Early episodes also had a lower proportion of NRS cost outliers than the later episodes.

9.3. Comparison of Model Performance for Initial and Later Episodes

We conducted a set of analyses to determine whether there should be changes to the clinical conditions used to assign episodes to NRS payment groups. To inform decisions about whether the models should include all episodes or only the initial episode (as in our previous analyses), we compared model performance across the two specifications.

9.3.1. Identifying Clinical Conditions to Include in Models

We conducted a series of analyses to identify the characteristics of home health patients that are associated with NRS use and costs. This included analysis of individual measures of clinical characteristics derived from OASIS assessment data and the identification of clinical items associated with higher NRS costs for the subset of home health patients with skin conditions. We explored how the inclusion of these items affected the statistical performance of the payment models.

Identifying potential covariates

Review of Medicare lists of supplies subject to consolidated billing, and consultation with clinicians, suggested that significant amounts of the NRS billed under home health is related to wound care, management of bladder or bowel incontinence, and administration of medication. Accordingly, we chose a set of clinical characteristics likely to be associated with these three treatment categories, and compared the distribution of NRS costs between groups of episodes with and without the selected categories.

Information about the clinical characteristics was obtained from either OASIS items or ICD-9 codes recorded in OASIS. For OASIS items with multiple response categories, we listed the distribution of NRS across the categories for two purposes – to identify the trend of NRS use across the response categories, and to assist in determining how to combine the categories in the multivariate modeling.

We found that episodes with conditions that required wound care or incontinence management were associated with higher cost than episodes without these treatments. Furthermore, in some instances, cases whose condition was more severe or had higher counts, i.e., pressure ulcers or stasis ulcers, had higher cost. However, this pattern was not observed for surgical wounds. Limitations in activities of daily living (including toileting, transferring, and ambulation) and cognitive impairment were also associated with higher cost. NRS costs for disabled patients (under age 65) were higher than costs for aged patients.

Identifying potential interaction terms

We hypothesized that NRS costs for patients with skin conditions may be higher for those who also have certain types of other clinical conditions. For example, the wound care is much more complicated in patients with diabetes than patients without diabetes; as a result, NRS costs may also be higher for patients with diabetes. If NRS costs are higher for those who have both a skin condition and certain types of clinical conditions, then it may be appropriate to include interaction terms in the model that reflect these higher costs.

Identifying patients with skin conditions
Patients with skin conditions were defined as those who had any of the following conditions in the identified episodes:

- Stage 3 or 4 pressure ulcer
- Stage 2 or 3 stasis ulcer
- Surgical wounds
- Conditions included in burn/trauma diagnosis
- Non-pressure, non-trauma wounds
- Non-pressure ulcer
- Cellulitis
- Skin cancer

These were defined using OASIS items, including the primary and secondary ICD-9 codes reported on the assessment. Both primary and secondary diagnoses were considered, since NRS may be required when a patient has skin conditions, regardless of whether these conditions are coded primary or secondary.

Clinical conditions that may complicate care of skin conditions
We identified from literature a list of clinical conditions that may complicate the care of skin conditions. We then compared the NRS cost for patients with skin conditions, stratifying by the presence or absence of any of the selected conditions/comorbidities. The clinical conditions that we examined included:

- Primary diagnosis of diabetes
- Secondary diagnosis of diabetes
- Using a catheter
- Having an ostomy
- Secondary diagnosis of cirrhosis
- Secondary diagnosis of tuberculosis
- Secondary diagnosis of certain neurologic conditions[42]
- Secondary diagnosis of late effect of cerebrovascular disease/CVA
- Having limitations in activities of daily living (including toileting, transferring, and ambulation)

The interaction terms between skin condition and tuberculosis, certain neurologic conditions, late effect of cerebrovascular disease/CVA, and limitations on activities of daily living were weak. Thus, these interaction terms were dropped from further analysis.

9.3.2. Methods for Comparing Model Performance

We used two types of models to explore the relationship between patients' characteristics and NRS costs. We used probit models to examine the likelihood of having any NRS costs and ordinary least squares (OLS) regression models to examine NRS costs conditional on these costs being greater than zero. We

[42] The ICD-9 codes that were used to identify the cases were: 290, 331.0, 332, 344, 430, and 438.

began with an analysis that was restricted to the initial episode, replicating the approach that we used in our prior analyses, and then also estimated models that included both the initial episode and later episodes. This analysis included both probit and ordinary least squares (OLS) models.

Probit models

Probit models were based on the "Clinical On Top" (COT) model used for case-mix scoring until January 1, 2008.[43] In the probit model, we included the same explanatory variables from the COT model. We also included two additional explanatory developed in previous analyses: the presence of 2-4 surgical wounds (nsrgwnd4) and a burn or trauma related diagnosis, defined based on either the primary or a secondary diagnosis (btrmsp_o).

OLS models on episodes with non-zero NRS costs

We estimated several OLS regression models to examine the association between patient characteristics for the subset of episodes that had nonzero NRS costs. Our initial model (referred to as the NRS COT model) was built based on the COT model, and included the two additional wound-related variables that were also included in the probit models.

We also tested an enhanced version of the NRS COT model. We added counts of pressure ulcers, surgical wounds, and stasis ulcers. We included OASIS variables without combining the response categories. We also added terms that captured interactions between skin conditions and comorbidities/conditions. Because the statistical performance of this model was better than that of the COT model, it was used for our later analyses, including the pooled and two-level models.

9.3.3. Initial Episodes

From the probit model, we found that skin conditions were associated with significantly higher probability of incurring NRS costs. Similarly, bowel incontinence, bladder incontinence, and ostomy were also associated with significantly higher probability of NRS use.

Coefficients from the NRS COT OLS regression based on initial episodes with nonzero NRS costs are given in Exhibit 9.4. Comparison of our results to those from the earlier analysis conducted in 2002 on the partial 2001 PPS file showed that most of the regression coefficients had the same sign but a smaller value than the regression coefficients derived from the partial 2001 PPS file. This model explained 7.9% of the variance in NRS costs. This was somewhat higher than the predictive power obtained from our earlier analyses on the partial PPS file, which accounted for 5.1% of the variation in NRS costs. The addition of the NRS-related clinical conditions (to create the "enhanced NRS COT" model) had only a small impact on statistical performance—this model explained 9.7 percent of the variance in NRS costs in initial episodes (data not shown).

[43] The COT model was an OLS model that Abt Associates developed for the HH PPS. With the total episode resource use as the dependent variable, the model included 32 variables on clinical conditions, functional status, and service use to explain the variations in the total resource use per home health episode. The 80-HHRG payment under the original PPS is based on the COT model.

Exhibit 9.4

NRS COT Model for Initial Episodes with Nonzero NRS Costs

Variable	Description	Parameter Estimate	Standard Error	Pr > |t|
Intercept	Intercept	63.0	3.6	<.0001
dig1bz_o	OASIS ortho DIG, based on PRIDIG_O & SECDIG_O	-24.9	3.0	<.0001
dig2bz_o	OASIS neuro DIG, based on PRIDIG_O & SECDIG_O	-23.2	3.9	<.0001
dx250xxo	Bin: Diabetes fm OASIS M0230a & M0240b	4.4	3.5	0.2113
btM0440o	Bin: M0440/Burn/Trauma fm OASIS M0230a & M0240b	38.4	5.6	<.0001
vis_ge1	M0390>=1 (Vision partially or severely impaired)	-4.0	2.1	0.064
pain23	M0420 >=2 (daily or constant pain)	7.7	2.0	0.0001
Multpulc	Multiple wounds (Pressure Ulcers M0450d,e)	90.8	10.3	<.0001
press12	M0460 (pressure ulcer stage 1,2)	59.1	3.3	<.0001
press34	M0460 (pressure ulcer stage 3,4)	186.4	5.6	<.0001
stasis2	M0476 (stasis ulcer status 2, partial granulation)	129.9	5.8	<.0001
stasis3	M0476 (stasis ulcer status 3, not healing)	191.2	5.6	<.0001
surg2	M0488 (surgical wound status 2, partial granulation)	20.0	2.6	<.0001
surg3	M0488 (surgical wound status 3, not healing)	107.6	4.6	<.0001
dysp234	M0490>=2 (dyspnea with moderate or minimal exertion or at rest)	-1.9	2.0	0.329
Ucontnew	M0530 >=2 (urinary incont day night or night+day)	-4.6	2.5	0.0692
bcont2_5	M0540>=2 (bowel incont >= once 2 per week)	25.4	3.4	<.0001
ostomy12	M0550>>=1 (has ostomy)	202.5	5.2	<.0001
_M0610	sum(M06101 -- M06106) > 0 any behavior problems last week	-4.9	2.5	0.0482
dress13	M0650 or M0660 >=1 Dress upper or lower body with minimal assistance (cloth handed to pt) to totally dependent	2.4	2.7	0.3815
bth_ge2	M0670>=2 (bathing with minimum assistance to totally dependent	2.9	3.0	0.3204
toi_ge2	M0680>=2 (from using bedside commode to totally dependent)	12.9	3.5	0.0003
tfr_ge1	M0690>=1 (Transferring with at least min assistance)	-0.2	2.8	0.9454
tfr_ge2	M0690>=2 (unable to transfer self)	6.9	4.0	0.0875
loco_ge1	M0700>=1 (Ambulation use device or worse)	-5.8	3.5	0.0991
loco_ge3	M0700>=3 (chair fast, but can wheel self)	33.1	3.8	<.0001
ther_i	Ther at home: IV/Infusion	80.9	5.7	<.0001
Ther_e	Ther at home: Enteral	18.6	5.7	0.0011
C051A	USED HOSPITAL: PAST 14 DAYS	-3.8	2.4	0.107
Nhrbhosp	Used Hosp, Inp Rehab or SNF: Past 14 days(C051A/C052A/C053A)	-15.6	6.2	0.0116
Nhrehab	Used Inp Rehab or SNF: Past 14 days (C052A/C053A)	6.3	3.2	0.0495
th_10vis	10 or More Therapy Visits	-2.6	2.3	0.2712
btrmsp_o	Bin: Burn/Trauma fm OASIS dx 1-6	28.5	4.5	<.0001
nsrgwnd4	2-4 surg wounds	15.2	3.1	<.0001
ucont2	M0520=2 –indwelling catheter	24.5	3.8	<.0001

Note: Models restricted to initial episodes and only include episodes with NRS cost>0

Source: Abt Associates analysis of 2001 Home Health Datalink File.

9.3.4. All Episodes

NRS use and costs for initial home health episodes differs from that in later episodes. To explore how these differences might impact the statistical performance of our models, we expanded our analytical sample to include all episodes. These analyses included the same covariates as the analyses on the initial episodes described above.

First we tested the basic NRS COT model. Its statistical performance improved when all episodes were used, accounting for 10.7 percent of the variance in costs, compared to 7.9 percent on initial episodes. The statistical performance of the enhanced NRS COT model (Exhibit 9.5) was also improved,

accounting for 12.9 percent of the variance in NRS costs (versus 9.7 percent for initial episodes only). Both of these were superior to the statistical performance of the 80-group case-mix system, which accounted for only 3.9 percent of the variation in NRS costs.[44]

Given the improvement in statistical performance of both models when the sample included all episodes, subsequent analyses included both initial and later episodes.

9.4. Statistical Performance of Enhanced NRS COT Model and NRS Cost Thresholds

We developed a payment model based on the enhanced NRS COT model and compared it to a payment model that is based on NRS cost thresholds. We compared the statistical performance of these two approaches, and we also examined a hybrid model that includes combinations of clinical items and thresholds.

9.4.1. Enhanced NRS COT Model

Using the enhanced NRS COT model, we assigned scores to variables that were associated with significantly higher NRS costs. We assigned NRS scores to conditions with positive and significant coefficients to create NRS use categories. We then assigned one point to each $5 increment in costs for each coefficient. The last column in Exhibit 9.5 shows the scores that we assigned to each clinical condition included in the enhanced NRS COT model

Episode scores ranged from zero to 173. The distribution of the scores was similar to the distribution obtained in the previous NRS analysis (data not shown), but had a longer tail at the upper extreme. We grouped the scores into five score categories: 1) zero, 2) 1-3, 3) 4-16, 4) 17-34, 5) 35+, and examined the distribution of NRS costs by the five score categories. As expected, the proportion of episodes with positive NRS costs increased with increasing scores, as did the average NRS cost. We measured the statistical performance of this model using an OLS regression in which the score categories were the only independent variables. This model accounted for 11% of the variation in NRS costs.

[44] Note that this poorer performance of the 80-group model alone was still an improvement relative to our 2002 analyses on the partial 2001 PPS file, which found that it accounted for only 2.7 percent of the variation in NRS costs.

Exhibit 9.5

NRS COT Model for All Episodes with Nonzero NRS Costs

Variable	Label	Regression Coefficient	P value	NRS Score
Intercept	Intercept	5.1	<.0001	
Dig1bz_o	OASIS ortho DIG, based on PRIDIG_O & SECDIG_O	-6.1	<.0001	
dig2bz_o	OASIS neuro DIG, based on PRIDIG_O & SECDIG_O	-6.0	<.0001	
dx250xxo	Bin: Diabetes fm OASIS M0230a & M0240b	1.1	0.4576	
btM0440o	Bin: M0440/Burn/Trauma fm OASIS M0230a & M0240b	61.2	<.0001	12
vis_ge1	M0390>=1 Vision moderately or severely impaired	-1.8	0.0154	
pain23	M0420>=2 daily or constant pain	3.0	<.0001	1
pu12cnt_1	OASIS count of pressure ulcer, stage ½	39.4	<.0001	8
pu12cnt_23	2 or 3 Pressure ulcers (stage 1/2)	78.6	<.0001	16
pu12cnt_4p	4+ Pressure ulcers (stage 1/2)	128.2	<.0001	26
pu34cnt_12	1 or 2 Pressure ulcers (stage 3/4)	141.2	<.0001	28
pu34cnt_3	3 Pressure ulcers stage ¾	221.3	<.0001	44
pu34cnt_4	4 Pressure ulcers stage ¾	307.1	<.0001	61
pu34cnt_5p	5+ Pressure ulcers (stage 3/4)	416.0	<.0001	83
PUunobs	M0450: unobserved PU	88.9	<.0001	18
stasis2	M0476 stasis ulcer status 2, partial granulation	39.6	<.0001	8
stasis3	M0476 stasis ulcer status 3, not healing	88.2	<.0001	18
stasiscnt_23	2 or 3 stasis ulcers	46.3	<.0001	9
stasiscnt_4	2 or 3 stasis ulcers	124.5	<.0001	25
surg2	4 or more stasis ulcers	15.5	<.0001	3
surg3	M0488=2 surgical wound status, partial granulation	78.2	<.0001	16
surgcnt_34	3 or 4 surgical wounds	10.4	<.0001	2
dysp234	M0490>=2 dyspnea with exertion or at rest	0.7	0.2739	
Ucontnew	M0530 >=2 urinary incont day night or night+day	3.0	0.0018	1
bcont2_5	M0540>=2 bowel incont >= once 2 per week	7.1	<.0001	1
ostomy_1	OASIS ostomy, not related to inpt stay	53.5	<.0001	11
ostomy_2	OASIS ostomy, related to inpt stay	186.2	<.0001	37
_M0610	sum(M06101 -- M06106) > 0, behavioral problems in past week	-2.3	0.0076	
dress13	M0650 or M0660 >=1 Dress upper or lower body with minimal assistance (cloth handed to pt) to totally dependent	1.7	0.0962	
bth_ge2	M0670>=2 bathing with minimum assistance to totally dependent	2.1	0.0578	
toi_23	M0680=2 3 toilet use bedside commode or bedpan	5.6	<.0001	1
toi_4	M0680=4 toilet totally dependent	14.6	<.0001	3
tfr_45	M0670>=45 bedfast	15.1	<.0001	3
loco_ge3	M0700>=3 chair fast, but can wheel self to bedfast	7.1	<.0001	1
ther_i	Ther at home: IV/Infusion	43.8	<.0001	9
ther_e	Ther at home: Enteral	25.4	<.0001	5
C051A	USED HOSPITAL: PAST 14 DAYS	-1.4	0.0773	
Nhrbhosp	Used Hosp, Inp Rehab or SNF: Past 14 days(C051A/C052A/C053A)	-3.4	0.0884	
Nhrehab	Used Inp Rehab or SNF: Past 14 days (C052A/C053A)	-0.4	0.6766	
th_10vis	10 or More Therapy Visits	-1.0	0.1828	
btrmsp_o	Bin: Burn/Trauma fm OASIS dx 1-6	27.9	<.0001	6
ucont2	M0520=2 –need catheter	37.2	<.0001	7
Pnpulcer	Primary dx: Non-pressure/non-stasis ulcer	104.7	<.0001	21
Snpulcer	Secondary dx: Non-pressure/non-stasis ulcer	49.9	<.0001	10
Pcellul	Primary dx: Cellulitis (681/682)	-55.4	<.0001	
Scellul	Secondary dx: Cellulitis (681/682)	-47.7	<.0001	
Pwounds	Primary dx: Non-ulcer/non-trauma wounds	114.6	<.0001	23
Swounds	Secondary dx: Non-ulcer/non-trauma wounds	65.4	<.0001	13
Pskincanc	Primary dx: Skin Cancer (171/172)	69.1	<.0001	14
Sskincanc	Secondary dx: Skin Cancer (171/172)	24.9	0.0416	5

Exhibit 9.5

NRS COT Model for All Episodes with Nonzero NRS Costs

Variable	Label	Regression Coefficient	P value	NRS Score
Pmalnutr	Primary dx: Malnutrition	-2.2	0.5707	
Smalnutr	Secondary dx: Malnutrition	2.5	0.1788	
Sdiab	Secondary dx: Diabetes	2.7	0.0151	1
Sneuro	Secondary dx: Neuro DG	-3.1	0.0197	
Sparaly	Secondary dx: Paralysis (340-344, 430-434)	12.5	<.0001	3
Scereb	Secondary dx: Cerebrovascular conditions (430-434)	-19.9	0.0004	
Paffect	Primary dx: Affective/Depression (296/331)	-0.5	0.887	
Saffect	Secondary dx: Affective/Depression (296/331)	0.8	0.7263	
Pneul	Primary dx: Late Effect of CVA (438)	-10.2	0.0092	
Sneul	Secondary dx: Late Effect of CVA (438)	-0.9	0.7185	
Pmyop	Primary dx: Myopathy (359)	-5.6	0.7239	
Smyop	Secondary dx: Myopathy (359)	-14.7	0.2126	
Sproshyp	Secondary dx: Prostate Hyperplasia (600)	-2.9	0.4912	
agelt65	Age<65	20.4	<.0001	4
cog_34	Cognitive function: confused during day+night	6.4	0.0003	1
skin_neuroDG	interx: neuro DG x any skin conditions	-15.2	0.0001	
skin_diabDG	interx: diabetes DG x any skin conditions	29.1	<.0001	6
skin_orthDG	interx: ortho DG x any skin conditions	-10.9	<.0001	
skin_srneuro	interx: restricted neuro (Secondary) x any skin conditions	4.8	0.1356	
skin_liver	interx: Cirrhosis (secondary) x any skin conditions	7.4	0.5545	
skin_TB	interx: TB (Secondary) x any skin conditions	-9.8	0.8146	
skin_sdiab	interx: DM (secondary) x any skin conditions	7.4	0.0001	1
skin_cath	interx: catheter x any skin conditions	7.9	0.0379	2
skin_ucont	interx: urinary incont x any skin conditions	-9.4	<.0001	
skin_bcont	interx: bowel incont. x any skin conditions	8.6	0.0076	2
skin_ostomy1[&]	interx: ostomy=1 x any skin conditions	72.1	<.0001	14
skin_ostomy2	interx: ostomy=2 x any skin conditions	37.3	<.0001	7
skin_dress13	interx: dress>=1 x any skin conditions	1.2	0.531	
skin_bathge2	interx: bath>=2 x any skin conditions	2.4	0.2257	
skin_toil4	interx: toileting=4 x any skin conditions	3.6	0.4173	
skin_tran45	interx: transfer=4,5 x any skin conditions	16.0	0.0037	3
skin_locoge3	interx: ambulation>=3 x any skin conditions	20.1	<.0001	4

Models include both initial and later episodes and only include episodes with NRS cost>0.

[a] The index variable "Any skin conditions" is defined as: if the patient has any of the following variables equals 1: btM0440o, stasis2, stasis3, press34, surg2, surg3, pnpulcer, snpulcer, pwounds, swounds, btrmsp_o, pcellul, scellul, pskincanc, or sskincanc.

[&] The coefficient of the interaction term suggests there is additional cost for patients with ostomy and skin conditions compared to patients with either ostomy or skin conditions alone. Therefore, skin_ostomy1 and skin_ostomy2 are classified as category 4.

Source: Abt Associates analysis of 2001 Home Health Datalink File

9.4.2. NRS Cost Thresholds

One option for improving statistical performance would be to base payment on costs incurred, using a set of cost thresholds. We considered five alternative cost thresholds: zero, $15, $100, $300, and $1,000. The first four thresholds were identified in our previous analyses; the $1,000 threshold was created to reflect the higher NRS cost in the full PPS file. This model accounted for 69.5% of the variance in NRS costs. Note that almost all of the predictive power of this model is from the high cost thresholds: a model that included only the two "outlier" threshold ($300 and $1,000) accounted for 63.9% of the variance in NRS costs.

9.4.3. Models That Include Combinations of Clinical Items and Thresholds

We also tested the performance of models that included a combination of thresholds and clinical items. We tested several methods of combining clinical items and thresholds, including using the regression coefficients from the clinical conditions and using the scoring system for clinical items described above. We also experimented with models that included interaction terms between the thresholds and the clinical items.

Statistical performance was higher in models that included both thresholds and clinical items. The inclusion of clinical conditions and score categories generally improves the model fit by 2 to 5 percentage points. The use of interaction terms led to only small improvements in statistical performance. Consistent with the NRS threshold models discussed above, the statistical performance of models with a higher threshold was consistently higher. Exhibit 9.6 contains a summary of the statistical performance of the various models that are discussed in this section.

Exhibit 9.6

Percentage of Variance in NRS Costs Accounted for in OLS Models That Included All Episodes

Threshold/Model	Threshold Only	Threshold + Score Categories	Threshold + Score Categories + Threshold x Score Categories	Threshold + Clinical Conditions	Threshold + Clinical Conditions + Threshold x Clinical Conditions
Threshold 1 (Cost>0)	9.98%	15.3%	17.0%	16.3%	18.5%
Threshold 2 (Cost>=$25)	18.7%	20.9%	22.2%	21.8%	23.6%
Threshold 3 (Cost>=$100)	31.0%	31.9%	32.5%	32.4%	33.7%
Threshold 4 (Cost>=$300)	43.7%	45.2%	45.3%	45.5%	46.1%
Threshold 5 (Cost>=$1000)	44.4%	50.1%	50.5%	50.6%	51.3 %

Source: Abt Associates analysis of 2001 Home Health Datalink File

9.5. Comparison of the Two-level and Pooled Regression Models

There may be differences in the NRS cost between early and later episodes for patients whose clinical condition does not change between episodes. For example, patients with burns may require more NRS during their first months of care. As wounds heal, the need for NRS may decrease over time. This change in the patients' condition may not be reflected in their OASIS assessments. To account for potential differences in NRS costs for different episodes, we developed a payment system depending on the episode timing in a sequence of episodes (the episode sequence number). For these analyses, we defined early episodes as the first two episodes (episode sequence number ≤ 2) and later episodes as those with an episode sequence number > 2. These models included the same clinical variables as the enhanced COT model (see Exhibit 9.5).

We compared two models, the pooled model and the two-level model, to account for differences in NRS costs between early and later episodes.

- ***Pooled model:*** In the pooled model the same coefficient is estimated for each clinical condition regardless of the episode's sequence number.

- ***Two-level model:*** The two-level model is a fully interactive model with clinical variables and interaction terms between clinical variables and variables identifying whether the episode is an early or later episode. Because the weights of each clinical variable can differ between early and later episodes, episodes with the same clinical conditions may have a different total score depending on whether the episode is early or later.

The pooled model accounted for 15.3% of the variation in NRS costs; the statistical performance of the two-level model was similar – it accounted for 15.6% of the variance in NRS costs.

Based on the results from these models, we identified 30 clinical conditions that seemed the most promising for predicting high NRS costs. The regression coefficients for all of these clinical conditions were positive and statistically significant, and the impact of the conditions on NRS use was moderate to substantial (i.e., score > 3). The 30 selected conditions included burn/trauma, ulcers, wounds, skin cancer, and ostomy (Exhibit 9.7).

Exhibit 9.7

NRS Scores of Selected Clinical Conditions Included in the Two-Level and Pooled Models

Variable	Label	Two-Level model		Pooled model
		Early epodes	Later episodes	
surg2	OASIS: M0488 (surgical wound status=2: early/partial granulation)	4	8	4
btrmsp_o	Burn/Trauma fm OASIS dx 1-6	5	5	5
Sskincanc	Secondary dx: Skin Cancer (171/172)	6	6	6
skin_ostomy2&	Interaction: ostomy=2 (related to inpt stay or need trt change) x any skin conditions*	7	7	7
ther_e	OASIS: Ther at home-Enteral	7	7	9
Snpulcer	Secondary dx: Non-pressure/non-stasis ulcer	8	8	8
diab_ulcr	Interax: diabetes x ulcer	9	9	9
pu12cnt_1	OASIS: 1 pressure ulcer, stage ½	9	9	9
stasis2	OASIS: M0476 (stasis ulcer status=2: early/partial granulation)	9	14	11
ther_I	OASIS: Ther at home-IV/Infusion	9	12	10
ucont2	OASIS: Catheter (M520=2: require catheter)	9	13	11
Pskincanc	Primary dx: Skin Cancer (171/172)	11	11	10
btM0440o	Bin: M0440/Burn/Trauma fm OASIS M0230a & M0240b	12	9	11
Stasiscnt_23	OASIS: 2 or 3 stasis ulcers	12	21	15
ostomy_1	OASIS: ostomy=1 (not related to inpt stay, not need change in trt)	13	33	23
Swounds	Secondary dx: Non-ulcer/non-trauma wounds	13	13	14
pu12cnt_23	OASIS: 2 or 3 Pressure ulcers (stage 1/2)	16	16	16
PUunobs	OASIS: M0450-unobserved PU	16	16	16
surg3	OASIS: M0488 (surgical wound status: not healing)	17	15	16
stasis3	OASIS: M0476 (stasis ulcer status: not healing)	18	24	19
Pnpulcer	Primary dx: Non-pressure/non-stasis ulcer	19	21	20
skin_ostomy1&	Interaction: ostomy=1 x any skin conditions	21	21	23
Pwounds	Primary dx: Non-ulcer/non-trauma wounds	22	22	22
pu12cnt_4p	OASIS: 4+ Pressure ulcers (stage 1/2)	28	28	26
Stasiscnt_4	OASIS: 4 stasis ulcers	28	38	32
pu34cnt_12	OASIS: 1 or 2 Pressure ulcers (stage 3/4)	29	35	32
ostomy_2	OASIS ostomy not related to inpt stay, not need change trt)	37	37	36
pu34cnt_3	OASIS: 3 Pressure ulcers (stage 3/4)	52	70	62
pu34cnt_4	OASIS: 4 Pressure ulcers (stage 3/4)	56	74	66
pu34cnt_5p	OASIS: 5+ Pressure ulcers (stage 3/4)	74	146	129

Exhibit 9.7

NRS Scores of Selected Clinical Conditions Included in the Two-Level and Pooled Models

Variable	Label	Two-Level model		Pooled model
		Early epodes	Later episodes	

a The index variable "Any skin conditions" is defined as: if the patient has any of the following variables equals 1: btM0440o, stasis2, stasis3, press34, surg2, surg3, pnpulcer, snpulcer, pwounds, swounds, btrmsp_o, pcellul, scellul, pskincanc, or sskincanc.

& The weight of the interaction term suggests there is additional cost for patients with ostomy and skin conditions compared to patients with either ostomy or skin conditions alone. Therefore, skin_ostomy1 and skin_ostomy2 are classified as category 4.

Source: Abt Associates analysis of 2001 Home Health Datalink File

9.6. Grouping Episodes Based on NRS Use

A payment system that pays for NRS based on patient clinical conditions (i.e., from the pooled or two-level models) can reduce the incentive to provide unnecessary care that may be present in a payment system based on NRS costs (i.e., using the NRS cost thresholds).

We therefore focused our further work on developing and testing NRS payment systems based on the pooled and two-level models. In the payment system, the episodes were divided by the level of NRS use, using the episode NRS scores. The payment rate for each NRS use group was set as the average NRS cost in the group. We examine two approaches for grouping episodes into NRS use categories:

- ***Highest condition score method:*** This method groups episodes based on the highest score for an individual condition present in the patient during the episode.

- ***Summed score method:*** This method considers all of the conditions present in the patient during an episode.

Our results indicated that the summed score model better aligned the payment to NRS cost. In collaboration with CMS, we adopted the summed score model. This section describes the results from both methods.

Highest condition score method

We used the 30 clinical conditions that we identified as predictive of NRS costs (see Exhibit 9.7) to calculate episode NRS scores. We first categorized the 30 conditions into low, medium, high, and very high NRS use conditions, and then divided the episodes based the highest condition present for the episode. The NRS scoring conditions were categorized as:

- ***Category 1*** – conditions with low NRS cost: score 0-9
- ***Category 2*** – conditions with medium NRS cost: score 10-19
- ***Category 3*** – conditions with high NRS cost: score 20-29
- ***Category 4*** – conditions with very high NRS cost: score>29

Exhibit 9.8 lists the assignment of NRS use category to the 30 conditions.

Exhibit 9.8

Weight and Categorization of Selected Clinical Conditions Stratified by Episode Number

	Episodes Number <=2		Episodes Number > 2	
Label	Score	Category	Score	Category
OASIS: M0488 (surgical wound status 2)	4	1	8	1
Bin: Burn/Trauma fm OASIS dx 1-6	5	1	5	1
Secondary dx: Skin Cancer (171/172)	6	1	6	1
Interx: ostomy=2 x any skin conditions*&	7	4	7	4
OASIS: Ther at home-Enteral	7	1	7	1
Secondary dx: Non-pressure/non-stasis ulcer	8	1	8	1
Interax: diabetes x ulcer	9	1	9	1
OASIS: 1pressure ulcer, stage 1/2	9	1	9	1
OASIS: M0476 (stasis ulcer status 2)	9	1	14	2
OASIS: Ther at home-IV/Infusion	9	1	12	2
OASIS: Catheter (M520=2)	9	1	13	2
Primary dx: Skin Cancer (171/172)	11	2	11	2
Bin: M0440/Burn/Trauma fm OASIS M0230a & M0240b	12	2	9	1
OASIS: 2 or 3 stasis ulcers	12	2	21	3
OASIS: ostomy=1	13	2	33	4
Secondary dx: Non-ulcer/non-trauma wounds	13	2	13	2
OASIS: 2 or 3 Pressure ulcers (stage 1/2)	16	2	16	2
OASIS: M0450-unobserved PU	16	2	16	2
OASIS: M0488 (surgical wound status 3)	17	2	15	2
OASIS: M0476 (stasis ulcer status 3)	18	2	24	3
Primary dx: Non-pressure/non-stasis ulcer	19	2	21	3
Interx: ostomy=1 x any skin conditions&	21	4	21	4
Primary dx: Non-ulcer/non-trauma wounds	22	3	22	3
OASIS: 4+ Pressure ulcers (stage 1/2)	28	3	28	3
OASIS: 4 stasis ulcers	28	3	38	4
OASIS: 1 or 2 Pressure ulcers (stage 3/4)	29	3	35	4
OASIS ostomy=1	37	4	37	4
OASIS: 3 Pressure ulcers (stage 3/4)	52	4	70	4
OASIS: 4 Pressure ulcers (stage 3/4)	56	4	74	4
OASIS: 5+ Pressure ulcers (stage 3/4)	74	4	146	4

a The index variable "Any skin conditions" is defined as: if the patient has any of the following variables equals 1: btM0440o, stasis2, stasis3, press34, surg2, surg3, pnpulcer, snpulcer, pwounds, swounds, btrmsp_o, pcellul, scellul, pskincanc, or sskincanc.

&The weight of the interaction term suggests there is additional cost for patients with ostomy and skin conditions than patients with either ostomy or skin conditions alone. Therefore, skin_ostomy1 and skin_ostomy2 are classified as category 4.

Source: Abt Associates analysis of 2001 Home Health Datalink File

Reimbursement rates for NRS would be based on the average NRS cost in each of the episode groups. To ensure budget neutrality,[45] we created adjusted reimbursement rates using a 0.886 adjustment factor. That is the ratio of the implicit total NRS reimbursement of all the episodes in the second wave PPS data under the current payment system (calculated using the original amount bundled into the episode payment for NRS, trended forward) to the total NRS costs estimated from the PPS second wave claims. The adjusted reimbursement rates were calculated as the product of mean NRS cost for a group times the 0.886 adjustment factor. Exhibit 9.9 shows the number of episodes, mean NRS cost, and adjusted reimbursement rates for payment groups defined using the highest condition score method.

[45] For purposes of this analysis, budget neutrality is defined as having the total payment under the new system equal to the total payment for the 2001 period included in our analyses.

Exhibit 9.9

Average NRS Cost and Proposed Reimbursement Rate of the 10 Episode Categories

Episode Number	Categories of Episodes	Number of Episodes	Mean NRS Cost	Adjusted Reimbursement Rate
≤ 2	None	231,372	10	9
	Moderate	70,827	52	46
	Medium	35,807	142	126
	Higher	17,673	212	188
	Very High	5,234	304	270
>2	None	88,197	22	20
	Moderate	12,635	107	95
	Medium	29,662	136	121
	Higher	7,585	238	211
	Very High	13,315	383	339

Source: Abt Associates analysis of 2001 Home Health Datalink File

In any prospective payment system, payment for some episodes will be higher than the actual cost of the episode, while other episodes will be underpaid. We assessed the "accuracy" of the maximum score model by comparing the difference between reimbursement and costs for the original PPS and reimbursement rates based on the highest condition score method.

- Under the original PPS system, overall payment per episode is estimated to be $6.80 lower than costs (Exhibit 9.10). Early episodes are overpaid by $7.50, while the payment for later episodes is $41 less than costs.

- Using adjusted reimbursement rates from Exhibit 9.9, both early and late episodes are underpaid, but payments are redistributed so that the differences between early and later episodes are smaller. Payment is $5.20 less than costs for early episodes and $10.80 less than costs for later episodes.

The proportion of episodes that are under-reimbursed is around 20% using either the original PPS system or the adjusted reimbursement rates. Use of the adjusted reimbursement rates increases the proportion of early episodes that are underpaid (from 15% using the original PPS system to 17%) while decreasing the proportion of later episodes that are underpaid (from 29 to 23%).

We repeated the analysis of payment and costs as we gradually reduced the number of episode categories. We tested three alternative specifications:

- Eight-categories: combined the "high cost" and "very high cost" categories.
- Six-categories: combined the "none" and "moderate cost" categories.
- Four-categories: combined the "none", "moderate cost" and "medium cost" categories.

There was little change in the proportion of episodes that were under-reimbursed under these specifications, but the variability in the difference between payment and costs increased as the number of categories decreased.

Exhibit 9.10

Payment-Cost Difference by Episodes Number Based on Highest Condition Score Method and Original PPS System

Episodes sequence Number	Episode number	All episodes		Under-reimbursed episodes (payment< cost)			Over-reimbursed episodes (payment >= cost)		
		Mean Payment - Cost	Std Dev Payment - Cost	%	Mean Payment - Cost	Std Dev Payment - Cost	%	Mean Payment - Cost	Std Dev Payment - Cost
Original PPS									
≤2	360,913	7.5	211.6	15%	-221.3	477.2	85%	49.3	10.1
>2	151,394	-41.1	283.0	29%	-255.1	457.8	71%	47.0	12.4
All	512,307	-6.8	236.0	20%	-236.3	469.0	81%	48.7	10.8
Rate based on highest condition score method									
≤2	360,913	-5.2	201.9	17%	-171.9	442.6	83%	29.2	42.7
>2	151,394	-10.8	261.7	23%	-237.3	469.5	77%	55.2	70.5
All	512,307	-6.9	221.3	19%	-195.2	453.4	81%	36.5	53.3

Source: Abt Associates analysis of 2001 Home Health Datalink File

In Exhibit 9.11, we show the payment-to-cost ratios of NRS costs and total costs under the current reimbursement method and a reimbursement method based on the highest condition score method. A payment-to-cost ratio less than one indicates that payment is less than costs; a ratio greater than one indicates that payment exceeds costs.

- Under the current system, NRS payment for those without any of the selected clinical conditions was much higher than costs (the payment-to-cost ratio for NRS was 5.2 for early episodes and 2.4 for later episodes; see Exhibit 9.11).

- For those with medium cost or higher, payment was much less than costs under the current system. For patients with medium cost, the NRS payment-to-cost ratio was 0.37 for early episodes and 0.39 for later episodes. For patients with very high cost, these payment-to-cost ratios were 0.18 for early episodes and 0.14 in later episodes.

- Using a reimbursement methodology based on the highest score condition method, payment rates are set based on the average cost per episode category, and the payment-to-cost ratios are the same across all of the categories. The uniform payment-to-cost ratios shown here (.89) would be 1.00 but for the budget-neutrality adjustment noted earlier.

Exhibit 9.11

Group-Level Predictive Ratio of NRS Payment Based on Highest Condition Score Method and Original PPS

Episode	Original PPS			Alternative Reimbursement System		
		Payment-to-cost ratio			Payment-to-cost ratio	
Categories	Payment Rate ($)	NRS	Total costs	Payment Rate ($)	NRS	Total costs
Episode ≤ 2						
W/out selected conditions	53.3	5.20	1.15	9	0.89	1.06
Conditions w/ moderate cost	53.3	1.02	1.04	46	0.89	1.03
Conditions w/ medium cost	53.3	0.37	0.80	126	0.89	0.92
Conditions with high cost	53.3	0.25	0.68	188	0.89	0.85
Conditions with very high cost	53.3	0.18	0.61	270	0.89	0.86
Episode > 2						
W/out selected conditions	53.3	2.37	1.04	20	0.89	0.96
Conditions w/ moderate cost	53.3	0.50	0.89	95	0.89	0.96
Conditions w/ medium cost	53.3	0.39	0.81	121	0.89	0.93
Conditions with high cost	53.3	0.22	0.61	211	0.89	0.82
Conditions with very high cost	53.3	0.14	0.55	339	0.89	0.84

Source: Abt Associates analysis of 2001 Home Health Datalink File

Summed score model

We tested a second alternative way to categorize episodes based on the sum of scores for all relevant clinical conditions. This summed score model differs from the highest condition score method, which considers only the highest condition score for the episode. For each episode, the score is calculated as

$$\text{score} = \sum \text{variable}_i \times \text{weight}_i ,$$

where i indexes the ith variable selected for the score calculation.

Multiple conditions were common on episodes with some NRS costs: about 41% of early episodes and 50% of later episodes had multiple NRS scoring conditions. The episode NRS scores were estimated based on pooled and two-level models. The average episode score derived from the two models was similar. The scores derived from the pooled model had a smaller range. For the two-level model based scores, the median was 14, 75th percentile was 29, and the 95th percentile was 61. For the pooled-model based scores, the median, 75th percentile, and 95th percentile were 16, 30, and 60 respectively (Exhibit 9.12).

Exhibit 9.12

Distribution of Episode NRS Scores Derived from the Summed Score Model: Descriptive Statistics

Statistic	Amount
Scores derived from the two-level model	
Mean	21.33
Standard error mean	0.04
Standard deviation	19.59
Variance	383.93
Median	14
Range	263
Interquartile range	20
Scores derived from the pooled model	
Mean	21.19
Standard error mean	0.04
Standard deviation	19.08
Variance	364.26
Median	16
Range	242
Interquartile range	22

N= 192,738

Source: Abt Associates analysis of 2001 Home Health Datalink File

After re-examining the distribution of scores generated by summing within episodes, and noting a fairly pronounced shift toward higher scores, we defined a new set of score category cut points, which was different from the set derived from our previous analyses conducted using the partial 2001 PPS file. These cutoffs were chosen based on the distribution of total scores of episodes (Exhibit 9.12):

- Category 1: No use (zero score)
- Category 2: Low use (1-16 points)
- Category 3: Medium use (17-34 points)
- Category 4: High use (35-59 points)
- Category 5: Very high use (60 or more points)

We used Analysis of Variable (ANOVA) models to evaluate the fit of the summed score model. The two-level version of this method includes 10 groups, with separate categories for early and late episodes. The pooled model includes the five categories with no distinction based on episode sequence. The two-level version of the model accounted for 13.1% of the variance in NRS costs; this was slightly higher than the statistical performance of the pooled model, which accounted for 12.3% of the variance in NRS costs.

Mean NRS costs, by score group

In both the pooled and two-level models, average NRS cost was higher for patients in the higher cost categories, suggesting that the grouping of episodes was valid.

- In the pooled model, average NRS costs were $13.63 for patients in the no use category, $66.96 for the low use category, $152.52 for the medium use category, $257.48 for the high use category, and $457.55 for the very high use category (Exhibit 9.13).

- In the two-level model, average costs were higher for later episodes. The relationship between costs and categories was similar to what was observed in the pooled model. The difference in costs between early and later episodes suggests that a payment system based on the two-level model would better align the payment to cost than a system based on the pooled model.

Exhibit 9.13

Mean NRS Costs, by NRS Cost Categories Derived from the Summed Score Model

	Pooled Model	Two-Level Model	
Episodes		**Early Episodes**	**Later Episodes**
None: score=0	$13.63	$10.25	$22.48
Low use 1<=Score<=15	66.96	51.64	105.45
Medium use: 16<=score<=29	151.52	142.09	173.62
High use: 30<=score<=59	257.48	237.70	283.00
Very high use score: >=60	457.55	391.24	500.34

Source: Abt Associates analysis of 2001 Home Health Datalink File

Performance of alternative payment models

We assessed the "accuracy" of the maximum score model by analyzing the consistency between costs and payments based on the summed score model, using the same types of analyses as those we conducted for the maximum score method described above. Our analyses showed:

- As with the maximum score method, for those with a score of one or higher, the summed score model achieves reductions in the percentage of episodes that are underpaid, and reduces the average (negative) difference between payment and costs. For example, under the bundled payment model, 47% of episodes with a secondary diagnosis of non-ulcer/non-trauma wounds are underpaid, and the average difference between payment and costs for all such episodes is - $114. Under the two-level maximum score model, the percent of underpaid episodes drops to 27% and the average payment-cost difference shrinks to -$3. Under the all episodes maximum score model, changes are somewhat less dramatic: 30% of episodes underpaid, with an average payment-cost of -$25. Under the summed score model, the corresponding figures are 1) for the two-level model, 25% of episodes are underpaid, and there is an average overpayment of $10, and 2) for the all episodes model, 25% of episodes are underpaid, and there is an average overpayment of $8.

- The average difference between payment and costs changed from negative to positive for episodes that had any of these conditions:

  - surgical wound status= 2 (surgical wounds partially granulating);
  - ostomy= 2 (ostomy related to inpatient stay);
  - ostomy interacted with various skin conditions;
  - primary diagnosis of skin cancer; or
  - primary diagnosis of non-ulcer/non-trauma wounds.

- For the remainder of the NRS scoring conditions, episodes are still underpaid under the proposed payment systems, but the size of underpayment is smaller than under both the bundled and maximum score models.

- Certain conditions are underpaid under all payment systems, but these differences tended to be smaller under the summed score model. For example, for 3, 4, and 5 or more stage 3 or 4 pressure ulcers, 80% of episodes are underpaid under the bundled payment system, with the average underpayment amount ranging from $474 to $860, depending on the number of ulcers. Using the maximum score model, the percentage of underpaid episodes decreased to between 50 and 60%, and the average size of the underpayment decreased to between $250 and $600. With the summed score models, the percentage of underpaid episodes was slightly lower (39 to 57%), as was the size of the underpayment ($134 to $584).

Because the summed score model provides better statistical performance with little increase in complexity, our recommendation to CMS was to use the summed score model rather than the maximum score model for determining NRS payments.

9.7. NRS Costs for Outlier Episodes

We compared the NRS costs for regular (non-outlier) episodes to those in episodes which qualified as outliers under the original PPS. (Note that under the original PPS rules, episodes qualify for outlier payments based solely on the volume of visits provided; an episode's NRS costs have no effect on this calculation.) We also examined the impact of including outlier episodes in NRS analysis on the weighting and categorization of the home health (HH) episodes.[46]

Our analytical sample had 512,307 HH episodes that ended between January 29, 2001, and December 31, 2002. Of these, 496,237 (96.86%) were regular HH episodes and 16,070 (3.14%) were outlier episodes. To examine the impact of including outlier episodes in NRS analysis on the weighting system, we first compared NRS cost between regular and outlier episodes. We found that outlier episodes had higher NRS costs than regular episodes. Over 60% of regular episodes had no NRS cost, and 4.5% had NRS cost over $300 (Exhibit 9.14). In contrast, only 26% of outlier episodes had no NRS cost, and 24% had NRS cost over $300.

Outlier episodes also had higher rates of the clinical conditions that were predictive of higher NRS costs. The proportion of episodes with wounds, ulcers, other skin conditions and ostomy was much higher in outlier episodes than in regular episodes (Exhibit 9.15).

As a result of the higher NRS costs of outlier episodes and the higher rates of clinical conditions that were predictive of higher NRS costs, regression coefficients and the associated payment rates for several key variables were higher in models that included both regular and outlier episodes. Weights derived from regular and outlier episodes were the same as or higher than those from regular episodes, except for secondary skin cancer, stage 2 stasis ulcer, and having 5 or more stage 3 or 4 pressure ulcers (Exhibit 9.16). For most conditions the weight difference was between zero and two.

Compared to regular episodes, a higher proportion of outlier episodes was in the medium (17-35), high (36-59), or very high (60+) NRS use categories (Exhibit 9.17).

The use of coefficients from a model that includes both regular and outlier episodes results in the assignment of more episodes to higher NRS use groups. Using scores estimated from regular and outlier

[46] In this section, we discuss results from the pooled model, but results from the two-level model were similar.

episodes, about 10% of episodes moved to the next highest payment category (Exhibit 9.18). The movement was mostly uni-directional— only 8 episodes were categorized into a lower NRS-use category. This reflects the higher weight given to some clinical conditions using a model that includes outlier episodes.

In the five-group payment system, NRS payment weights are proportional to the average NRS cost in each of five NRS use categories. The changes in the distribution of episodes across NRS use categories in models that include outlier episodes result in changes in the average NRS cost within each category. The inclusion of outlier episodes has little impact on average NRS cost for the first four categories. For episodes with very high NRS costs, the average NRS cost was $10 lower based on weights derived from both types of episodes (Exhibit 9.19).

Exhibit 9.14

Comparison of NRS Cost Between Regular Episodes and Outlier Episodes

Episodes		Cost of NRS ($)						Total
		0	0-25	25-100	100-300	300-1000	1000+	
Regular	N	299,984	75,726	57,247	40,902	18,920	3,458	496,237
	%*	(60.45)	(15.26)	(11.54)	(8.24)	(3.81)	(0.70)	
Outlier	N	4,140	1,427	2,674	3,923	3,018	888	16,070
	%	(25.76)	(8.88)	(16.64)	(24.41)	(18.78)	(5.53)	
Total	N	304,124	77,153	59,921	44,825	21,938	4,346	512,307
	%	(59.36)	(15.06)	(11.70)	(8.75)	(4.28)	(0.85)	

*Row percentages add up to 100%.

Source: Abt Associates, Inc. Analysis of 2001Home Health Datalink File

Exhibit 9.15

Comparison of Prevalence of Clinical Conditions Between Regular and Outlier Episodes

Conditions	Regular Episodes %	Outliers %
M0488 Status, most problematic surgical wound: Early/partial granulating	10.93	15.80
M0488 Status, most problematic surgical wound: Not healing	1.77	6.08
M0476 Status, most problematic stasis ulcer: Early/partial granulating	1.69	5.94
M0476 Status, most problematic stasis ulcer: Not healing	1.34	4.14
2 or 3 stasis ulcers	1.02	3.43
4 stasis ulcers	0.51	1.99
M0450: unobserved PU	0.59	1.24
1 Pressure ulcer, stage 1 or 2	4.36	5.51
2 or 3 Pressure ulcers (stage 1 or 2)	2.19	2.93
4+ Pressure ulcers (stage 1 or 2)	0.43	0.65
1 or 2 Pressure ulcers (stage 3 or 4)	2.80	7.67
3 Pressure ulcers (stage ¾)	0.22	0.61
4 Pressure ulcers (stage ¾)	0.11	0.40
5+ Pressure ulcers (stage 3/4)	0.02	0.05
M0550 ostomy not related to inpt stay	1.38	2.35
M0550 ostomy related to inpt stay	0.68	1.16
M0520-Urinary incont: catheter	8.72	10.53
Therapy at home: Enteral	2.89	2.16
Therapy at home: IV/Infusion	1.88	2.78
Bin: Burn/Trauma fm OASIS dx 1-8	6.06	15.60
Bin: M0440/Burn/Trauma fm OASIS M0230a & M0240b	3.36	10.58
Primary dx: Skin Cancer (171/172)	0.06	0.20
Secondary dx: Skin Cancer (171/172)	0.07	0.11
Primary dx: Non-pressure/non-stasis ulcer	2.08	7.92
Secondary dx: Non-pressure/non-stasis ulcer	1.85	5.08
Primary dx: Non-ulcer/non-trauma wounds	1.94	7.88
Secondary dx: Non-ulcer/non-trauma wounds	1.91	5.15
interaction: ostomy not related to inpt stay x any skin conditions	0.48	1.80
interaction: ostomy related to inpt stay x any skin conditions	0.39	0.96
Interaction: diab x ulcr	0.42	1.64

Source: Abt Associates, Inc Analysis of 2001 Home Health Datalink File

Exhibit 9.16

Comparison of Weights of Selected Clinical Conditions Derived from Different Analytical Samples

Variable		Weight (based on regular episodes)	Weight (based on regular and outlier episodes)
surg2	OASIS: M0488 (surgical wound status: partial granulation	3	4
btrmsp_o	Burn/Trauma fm OASIS dx 1-6	3	5
skin_ostomy2	Interaction: ostomy=2 (related to inpt stay or need trt change) x any skin conditions*	5	7
Pskincanc	Primary dx: Skin Cancer (171/172)	7	10
Snpulcer	Secondary dx: Non-pressure/non-stasis ulcer	7	8
Sskincanc	Secondary dx: Skin Cancer (171/172)	7	6
diab_ulcr	Interax: diabetes x ulcer	8	9
ther_e	OASIS: Ther at home-Enteral	8	8
pu12cnt_1	OASIS: 1 pressure ulcer, stage ½	9	9
btM0440o	Bin: M0440/Burn/Trauma fm OASIS M0230a & M0240b	10	11
ther_I	OASIS: Ther at home-IV/Infusion	10	10
ucont2	OASIS: Catheter (M520=2: require catheter)	11	11
stasis2	OASIS: M0476 (stasis ulcer status=2: early/partial granulation)	11	10
Swounds	Secondary dx: Non-ulcer/non-trauma wounds	11	14
surg3	OASIS: M0488 (surgical wound status: not healing)	13	17
Puunobs	OASIS: M0450-unobserved PU	14	16
stasiscnt_23	OASIS: 2 or 3 stasis ulcers	14	15
pu12cnt_23	OASIS: 2 or 3 Pressure ulcers (stage 1/2)	15	16
Pwounds	Primary dx: Non-ulcer/non-trauma wounds	16	22
Pnpulcer	Primary dx: Non-pressure/non-stasis ulcer	17	20
stasis3	OASIS: M0476 (stasis ulcer status: not healing)	19	19
skin_ostomy1	Interaction: ostomy=1 x any skin conditions	22	23
ostomy_1	OASIS: ostomy=1 (not related to inpt stay, not need change in trt)	23	23
pu12cnt_4p	OASIS: 4+ Pressure ulcers (stage 1/2)	26	27
stasiscnt_4	OASIS: 4 stasis ulcers	28	32
pu34cnt_12	OASIS: 1 or 2 Pressure ulcers (stage 3/4)	29	31
ostomy_2	OASIS ostomy not related to inpt stay, not need change trt)	35	36
pu34cnt_4	OASIS: 4 Pressure ulcers (stage 3/4)	59	66
pu34cnt_3	OASIS: 3 Pressure ulcers (stage 3/4)	61	62
pu34cnt_5p	OASIS: 5+ Pressure ulcers (stage 3/4)	133	128

Source: Abt Associates, Inc analysis of 2001 Home Health Datalink File

Exhibit 9.17

Categorization of Regular and Outlier Episodes Based on NRS Use

Episode		Weights derived from regular and outlier episodes					Total
		0	1-16	17-35	36-59	60+	
Regular	N	312,969	104,492	46,388	23,769	8,619	496,237
	(%*)	(63.07)	(21.06)	(9.35)	(4.79)	(1.74)	
Outlier	N	6,600	2,792	3,432	2,271	975	16,070
	(%)	(41.07)	(17.37)	(21.36)	(14.13)	(6.07)	
Total	N	319,569	107,284	49,820	26,040	9,594	512,307
	(%)	(62.38)	(20.94)	(9.72)	(5.08)	(1.87)	

*Row percentages add up to 100%.

Source: Abt Associates, Inc analysis of 2001 Home Health Datalink File

Exhibit 9.18

Cross Tabulation of NRS-Use Categories Based on Scores From Regular Episodes Only and Scores from Regular and Outlier Episodes

NRS category scoring from regular and outlier episodes	NRS category scoring from regular episodes only						
	0	1-16	17-35	36-59	60+	Total	(%)
0	312,969	0	0	0	0	312,969	(63.07)
1-16	0	104,484	10,755	0	0	115,239	(23.22)
17-35	0	8	35,633	4,475	0	40,116	(8.08)
36-59	0	0	0	19,294	2,283	21,577	(4.35)
60+	0	0	0	0	6,336	6,336	(1.28)
Total	312,969	104,492	46,388	23,769	8,619	496,237	
	(63.07)	(21.06)	(9.35)	(4.79)	(1.74)		

Source: Abt Associates, Inc. analysis of Home Health Datalink File of 2001.

Exhibit 9.19

Average NRS Cost of Home Health Episodes

NRS Use Categories	NRS Score	# of Episodes	Average NRS Cost ($)
Distribution of episodes and average NRS score for NRS scores derived from regular episodes only			
None	0	312,969	12.3
Low	1-16	115,239	67.9
Medium	17-35	40,116	158.2
High	36-59	21,577	268.0
Very high	60+	6,336	454.1
Distribution of episodes and average NRS score for NRS scores derived from regular and outlier episodes			
None	0	319,569	13.6
Low	1-16	107,284	69.2
Medium	17-35	49,820	156.4
High	36-59	26,040	267.8
Very high	60+	9,594	444.5

Source: Abt Associates, Inc analysis of 2001 Home Health Datalink File

To explore how the inclusion of outlier episodes in the determination of payment rates impacted payment-to-cost differences, we compared payment-to-cost ratios for the then-current bundled payment rate of the original HH PPS system to payment rates based on (a) weights derived from regular episodes only, and (b) weights derived from regular and outlier episodes. We found that the average difference between payment and cost was lower if outlier episodes were considered in the NRS weights. Additionally, the size of the underpayment for patients with certain types of clinical conditions that are underpaid in models that did not consider outlier episodes was smaller when outlier episodes were included. The only exception was for episodes with 3 or 5 or more stage 3 or 4 pressure ulcers. For clinical conditions that are overpaid in models based only on non-outlier episodes, the average difference between payment and costs increased. For all 30 clinical conditions, the proportion of episodes that were underpaid remained the same or decreased when outlier episodes were included in the analysis. As a result, in subsequent analyses, we pooled outlier episodes with all other episodes.

9.8. The Reduced NRS Model

After the TEP Meeting on March, 2006, we updated the NRS model. Some of the diagnostic variables included in the models presented above were no longer in use in the modified COT model (i.e., the four-equation model). To be consistent with the modified COT model, we estimated two alternative NRS models and examined the feasibility of replacing the old diagnostic variables with new ones that are included in the four-equation model, so that no additional variables would be required solely to calculate the NRS weights.

In addition to replacing clinical items with the ones included in the four-equation models, and updating some of the OASIS items, we also dropped the variable on enteral therapy from the model. Medical supplies related to enteral therapy are not supposed to be included as NRS charges. It is unclear why the item on enteral therapy had a high and positive weight. To explore this, we tested interaction terms between enteral therapy and a subset of clinical conditions. The clinical conditions were those for which a cross-tabulation of mean NRS costs by enteral therapy status and the clinical condition suggests that there might be a synergic effect on NRS use. The clinical conditions included pressure ulcers, trauma, GI wounds, brain disorders, and ADL limitations. We hypothesized that people with these conditions who receive enteral therapy may have high NRS costs that are not explained by the variables in the NRS model. After including the interaction terms in the model, the enteral therapy variable coefficient became insignificant, indicating that, adjusting for other factors, users of enteral nutrition did not have higher average NRS costs than non-users**.**

CMS subsequently learned that some of the HHAs reported charges for enteral therapy and supplies on their claims. It is difficult to separate the effect of misreporting in the claims and the synergistic effect we found when certain clinical conditions and enteral therapy were present at the same time. Therefore, the decision was made to drop enteral nutrition from the NRS model.

9.8.1. Comparison of Models with Different Explanatory Variables

We estimated three NRS models on the 512,307 regular and outlier home health episodes, including episodes with and without NRS cost:

- ***Model A:*** A full model with over a hundred explanatory variables that might be related to NRS use. The explanatory variables were derived from either OASIS items or ICD-9 diagnosis codes recorded in OASIS. Of them, 30 variables had significant and positive

coefficients greater than or equal to five, and were used to calculate the episode NRS weight. The results were discussed at the TEP meeting (March, 2006).

- ***Model B:*** A reduced model with only the statistically significant and positive 30 variables that were used to calculate episode NRS weight.

- ***Model C:*** This is an updated version of Model B. Some of the diagnostic variables derived from ICD-9 codes were modified slightly in the four-equation model. In model C, we replaced the old ICD-9-derived variables with the new ones that are included in the current four-equation COT model, updated some of the OASIS items (e.g., count of pressure ulcers), and dropped enteral therapy from the model.

Results showed that after we dropped all the variables that are not used in the calculation of episode NRS score, the model fit decreased from 0.1533 to 0.1454 (Model A versus Model B). There was a slight further decrease in the model fit as we replaced the old diagnostic variables with new ones (0.1454 versus 0.1452) (Table A9.20). The scores for the individual items in these models were similar except for the variables on stage 2 or 3 stasis ulcer (stasis2 and stasis3).

From the scores listed in Table A9.20, we calculated the NRS scores for each episode. Regardless of how the scores are estimated, over half of the episodes had a score of 0. Of the three sets of scores, the distribution was more similar for scores derived from Models B and C. We recommended that CMS use Model C, believing that the efficiency of having a single set of variables that generates both the case-mix group and the NRS group was worth the slight loss in model fit. In the next section, we further discuss the performance of this model.

9.8.2. Performance of the Reduced Model

We further evaluated the performance of the reduced model. The average NRS cost increased across the five episode score categories (Exhibit 9.20). Assuming that the payment for each score category is set as the average cost of that category, we calculated the relative payment weight (defined as average cost in a specific category/average cost of all episodes).

Exhibit 9.20

Comparison of Average NRS Cost and Relative Payment Weight by NRS Score Categories (Pooled Model)

Score	N	Mean	Std Dev	Relative Payment Weight
0	326747	14.8	96	0.245
1 to 16	73142	62.8	209	1.045
17-34	72308	127.1	273	2.113
35-59	26776	239.6	520	3.984
60p	13334	434.0	671	7.217

Source: Abt Associates, Inc analysis of 2001 Home Health Datalink File

The performance of an ANOVA model with indicator variables derived from the five score categories was slightly less than that of the reduced model (0.1305 vs. 0.1452). This slight reduction was expected because we lost some of the details of variation within each by using score categories.

We further developed a two-level model for this version of the NRS model because data suggested that NRS cost differs systematically between early and later episodes. In this model, the coefficient of each explanatory variable was allowed to differ between early and later episodes. The R-squared for the two-level model was 0.1480. A comparison of scores derived from the pooled and two-level model is shown in Exhibit 9.21. For most of the variables, the scores were similar in early and later episodes. A few variables had a much higher scores in the later episodes than in early episodes (e.g., ostomy_1 [ostomy not related inpt stay/no regimen change], M0450e_34 [3 or more stage 4 pressure ulcers], and pskin [primary skin cancer]), and a few items had lower scores in the later episodes (mainly skin-related secondary diagnoses).

Exhibit 9.21

Comparison of NRS Score From Pooled and Two-Level Models

Variable	Label	Pooled Model	Two-Level Model	
			Early episodes	Later episodes
pgi_wound	Primary diagnosis = Anal fissure, fistula and abscess	19	20	20
Pcell	Primary diagnosis = Cellulitis and abscess	13	12	17
pgangrene	Primary diagnosis = Gangrene	10	14	0
pca_skin	Primary diagnosis = Malignant neoplasms of skin	16	16	16
Pulcer	Primary diagnosis = Non-pressure and non-stasis ulcers	10	12	7
Pskin	Primary diagnosis = Other infections of skin and subcutaneous tissue	19	10	45
ppostop_1	Primary diagnosis = Post-operative Complications 1	32	34	20
ppostop_2	Primary diagnosis = Post-operative Complications 2	23	22	22
ptrauma_1	Primary diagnosis = Traumatic Wounds and Burns	16	17	13
sgi_wound	Other diagnosis = Anal fissure, fistula and abscess	8	4	23
Scell	Other diagnosis = Cellulitis and abscess	6	6	6
sgangrene	Other diagnosis = Gangrene	11	13	5
Sulcer	Other diagnosis = Non-pressure and non-stasis ulcers	8	10	5
Sskin	Other diagnosis = Other infections of skin and subcutaneous tissue	7	10	3
spostop_1	Other diagnosis = Post-operative Complications 1	15	18	0
spostop_2	Other diagnosis = Post-operative Complications 2	15	13	22
strauma_1	Other diagnosis = Traumatic Wounds and Burns	7	8	4
pu12cnt_1	M0450 = 1 pressure ulcer, stage 1 or 2	12	12	13
pu12cnt_23	M0450 = 2 or 3 pressure ulcers, stage 1 or 2	20	20	20
pu12cnt_4p	M0450 = 4+ pressure ulcers, stage 1 or 2	30	31	31
M0450d_1	M0450= 1 pressure ulcer, stage 3	31	28	33
M0450d_2	M0450= 2 pressure ulcers, stage 3	41	35	47
M0450d_34	M0450= 3 or 4 pressure ulcers, stage 3	57	50	62
M0450e_1	M0450= 1 pressure ulcer, stage 4	52	50	50
M0450e_2	M0450= 2 pressure ulcers, stage 4	80	61	87
M0450e_34	M0450= 3 or 4 pressure ulcers, stage 4	104	63	123
PUunobs	M0450e = 1(unobserved pressure ulcer(s))	16	17	17
stasis2	M0476 = 2 (status of most problematic stasis ulcer: early/partial granulation)	18	16	22
stasis3	M0476 = 3 (status of most problematic stasis ulcer: not healing)	28	25	32
surg3	M0488 = 3 (status of most problematic surgical wound: not healing)	18	18	18
surg2	M0488 = 2 (status of most problematic surgical wound: early/partial granulation)	5	4	10
ostomy_1	M0550=1(ostomy not related to inpt stay/no regimen change)	21	13	32
ostomy_2	M0550=2 (ostomy related to inpt stay/regimen change)	35	36	36

Exhibit 9.21

Comparison of NRS Score From Pooled and Two-Level Models

Variable	Label	Pooled Model	Two-Level Model	
			Early episodes	Later episodes
nskin_ostomy1	Any "Selected Skin Conditions" AND M0550=1(ostomy not related to inpt stay/no regimen change)	22	20	20
nskin_ostomy2	Any "Selected Skin Conditions" AND M0550=2 (ostomy related to inpt stay/regimen change)	7	8	8
ther_l	M0250 (Therapy at home) =1 (IV/Infusion)	11	10	13
stasiscnt_23	M0470 = 2 or 3 (2 or 3 stasis ulcers)	17	13	23
stasiscnt_4	M0470 = 4 (4 stasis ulcers)	34	29	41
ucont2	M0520 = 2 (patient requires urinary catheter)	17	13	20

Source: Abt Associates Inc analysis of 2001 Home Health Datalink file

The pooled and two-level models have an indicator variable for later episodes, and the regression coefficients for this variable were significant and positive. However, no NRS scores were assigned to the variable, because of the concern that additional scores give HHAs an incentive to provide unnecessary episodes of care.

In Exhibit 9.22, we show the relative payment weights from the pooled and two-level models. The relative payment weight was defined as the ratio of the score-group average cost (derived from the new models) to the sample mean.

Exhibit 9.22

Comparison of Average NRS Cost and Relative Payment Weight by NRS Score Categories

Score	N	Mean NRS Cost	(Std Dev)	Relative Payment Weight
Pooled Model				
0	326747	14.8	(96)	0.245
1 to 16	73142	62.8	(209)	1.045
17-34	72308	127.1	(273)	2.113
35-59	26776	239.6	(520)	3.984
60p	13334	434.0	(671)	7.217
2-Level Model				
Early Episodes				
0	236047	10.8	(86.5)	0.180
1 to 16	69488	53.4	(174.2)	0.888
17-34	33644	135.2	(311.0)	2.248
35-59	16575	224.3	(562.1)	3.729
60p	5159	384.6	(640.9)	6.396
Later Episodes				
0	90747	25.0	(115.2)	0.415
1 to 16	11534	100.9	(284.1)	1.678
17-34	31136	141.5	(261.5)	2.353
35-59	9815	258.4	(411.3)	4.296
60p	8162	480.1	(718.5)	7.983

Source: Abt Associates Inc analysis of 2001 Home Health Datalink file

To further compare the performance of the two types of payment model, we further fit ANOVA models by including the indicator variables of payment groups. The R-squared of the ANOVA model derived

from the two-level model was slightly higher than that derived from the pooled model (0.1373 vs. 0.1304).

In Exhibit A.3 in the Appendix, we display the difference between payment and cost for conditions scored in the underlying regression model, assuming that payment rates per NRS score category equals the average NRS cost of the category. For all the conditions in Exhibit 9.21, the payment was more similar to cost under the pooled or two-level models than under the bundled payment rate; for most of the conditions, the payment was more similar to cost under the two-level model than under the pooled model.

9.9. Updating the NRS Model for the Final Payment Rule

Sample

After reviewing the results above, we decided to use a trimmed sample to develop the refined NRS model.

a. We used episodes from 2004 and 2005 in the analytical file. The data from 2004 and 2005 were the most recent data available, and were more likely to reflect agencies' current coding and caring practice. The results from 2004 and 2005 were similar, thus, we decided to refine the NRS model on the combined 2004 and 2005 data.

b. We excluded episodes with NRS cost>3500 (the 99.9th percentile of NRS cost in CY 2005) from the model development. Inclusion of the outliers would tilt the regression lines and could give unstable estimated regression coefficients.

Refining the NRS model presented in NPRM

To refine the NRS model, we tested a few alternative definitions of skin conditions in the NRS model and tested a few additional conditions that might be related to NRS cost.

- The NPRM model has OASIS-derived variables on pressure ulcer, stasis ulcer, and surgical wounds. Some counts and stages were combined in NPRM model. Some insignificant ones (e.g., counts of surgical wounds and stage 1 surgical wounds) were excluded. To test alternative cuts and variable selection, we included indicator variables for each possible value of relevant variables (M0450, M0470, M0474, M0476, M0484, M0486, and M0488). Based on the results, we combined a few pressure ulcer variables because they had similar regression coefficients.

- We added indicator variables derived from M0540 (bowel incontinence). Cases with frequent bowel incontinence incurred a much higher NRS cost than cases without bowel incontinence. A variable on daily or more than daily bowel incontinence was added to the refined model.

- We tested ADL variables by including indicator variables on ability to dress upper and lower body, dependence on toileting and bathing, and status of locomotion. Patients' ADL were significantly associated with the NRS cost. However, due to CMS concerns that it was unclear what supply needs the ADL variables were proxying, they were dropped from the model.

- We added a subset of V codes to the model. V44.0 to V44.9 (artificial opening) and V55.0 to V55.9 (attention to artificial opening) in primary and secondary diagnostic fields were tested

separately. The NRS use was similar between artificial opening and the care of the opening; and the NRS use was also similar regardless of whether the V code was coded as the primary or secondary diagnoses. Thus, we created a combined variable for cystostomy care (V44.5 and V55.5), tracheostomy care (V44.0 and V55.0), and urostomy care (V44.6 and V55.6), respectively, and added them to the NRS model. Other V codes had weak association with the NRS cost and, therefore, were not included in the NRS model.

- We also re-tested a few variables that were included in previous NRS analyses, but were dropped from the NPRM model. They were:
  - Diabetic ulcer (ICD-9-CM codes 250.8 and 707). An indicator variable was defined as 1 if the primary diagnosis was 250.8 and the first secondary diagnosis was 707, or if the primary diagnosis was 707 and the first secondary diagnosis was 250.8.
  - Ulcers (ICD-9-CM codes 454.0 454.2 707.0). Ulcers captured by 454.0 454.2 and 707.0 were dropped due to the small impact on the model (a very small number of episodes has the code and the coefficients were small).

We found that the two-level model has a slightly better model fit than the pooled model. From the two-level model, the majority of the conditions had similar weights for early and later episodes. A few conditions had a much higher weight in later episodes, like the stage 4 pressure ulcers, primary diagnosis of skin cancer, and ostomy. One condition, primary diagnosis of gangrene, had a much lower weight in later episodes. Because the two approaches differed little in their overall model fit, CMS decided to proceed with the pooled model. This decision would also address concerns that having a two-level model will give incentives to agencies to provide unnecessary service. In the pooled model, the same clinical condition in early and later episodes receives the same NRS score.

While estimating the pooled NRS model, we included an indicator variable on whether the episode was an early or later episode. The purpose of including the variable in the NRS model was to obtain more-accurate estimates of the impact of clinical conditions on NRS cost, rather than to give additional NRS scores for later episodes. The regression coefficient of the early/later episode indicator was about 29, suggesting that on average later episodes had a higher NRS cost than early episodes by $29. However, to limit the incentive effects from the early/later episode indicator, a score was not assigned for it.

In Exhibit 9.23, we present the results of updated NRS model fit on a trimmed sample of home health episodes in 2003 and 2004.

Exhibit 9.23

NRS Case-Mix Adjustment Variables and Scores

Item	Description	Score
	SELECTED SKIN CONDITIONS:	
1	Primary diagnosis = Anal fissure, fistula and abscess	15
2	Other diagnosis = Anal fissure, fistula and abscess	13
3	Primary diagnosis = Cellulitis and abscess	14
4	Other diagnosis = Cellulitis and abscess	8
5	Primary diagnosis = Diabetic ulcers	20
6	Primary diagnosis = Gangrene	11
7	Other diagnosis = Gangrene	8
8	Primary diagnosis = Malignant neoplasms of skin	15
9	Other diagnosis = Malignant neoplasms of skin	4
10	Primary or Other diagnosis = Non-pressure and non-stasis ulcers	13

Exhibit 9.23

NRS Case-Mix Adjustment Variables and Scores

11	Primary diagnosis = Other infections of skin and subcutaneous tissue	16
12	Other diagnosis = Other infections of skin and subcutaneous tissue	7
13	Primary diagnosis = Post-operative Complications	23
14	Other diagnosis = Post-operative Complications	15
15	Primary diagnosis = Traumatic Wounds and Burns	19
16	Other diagnosis = Traumatic Wounds and Burns	8
17	Primary or other diagnosis = V code, Cystostomy care	16
18	Primary or other diagnosis = V code, Tracheostomy care	23
19	Primary or other diagnosis = V code, Urostomy care	24
20	OASIS M0450 = 1 or 2 pressure ulcers, stage 1	4
21	OASIS M0450 = 3+ pressure ulcers, stage 1	6
22	OASIS M0450 = 1 pressure ulcer, stage 2	14
23	OASIS M0450 = 2 pressure ulcers, stage 2	22
24	OASIS M0450 = 3 pressure ulcers, stage 2	29
25	OASIS M0450 = 4+ pressure ulcers, stage 2	35
26	OASIS M0450 = 1 pressure ulcer, stage 3	29
27	OASIS M0450 = 2 pressure ulcers, stage 3	41
28	OASIS M0450 = 3 pressure ulcers, stage 3	46
29	OASIS M0450 = 4+ pressure ulcers, stage 3	58
30	OASIS M0450 = 1 pressure ulcer, stage 4	48
31	OASIS M0450 = 2 pressure ulcers, stage 4	67
32	OASIS M0450 = 3+ pressure ulcers, stage 4	75
33	OASIS M0450e = 1(unobserved pressure ulcer(s))	17
34	OASIS M0470 = 2 (2 stasis ulcers)	6
35	OASIS M0470 = 3 (3 stasis ulcers)	12
36	OASIS M0470 = 4 (4+ stasis ulcers)	21
37	OASIS M0474 = 1 (unobservable stasis ulcers)	9
38	OASIS M0476 = 1 (status of most problematic stasis ulcer: fully granulating)	6
39	OASIS M0476 = 2 (status of most problematic stasis ulcer: early/partial granulation)	25
40	OASIS M0476 = 3 (status of most problematic stasis ulcer: not healing)	36
41	OASIS M0488 = 2 (status of most problematic surgical wound: early/partial granulation)	4
42	OASIS M0488 = 3 (status of most problematic surgical wound: not healing)	14
	OTHER CLINICAL FACTORS:	
43	OASIS M0550=1(ostomy not related to inpt stay/no regimen change)	27
44	OASIS M0550=2 (ostomy related to inpt stay/regimen change)	45
45	Any `Selected Skin Conditions` (rows 1-42 above) AND M0550=1(ostomy not related to inpt stay/no regimen change)	14
46	Any `Selected Skin Conditions` (rows 1-42 above) AND M0550=2(ostomy related to inpt stay/ regimen change)	11
47	OASIS M0250 (Therapy at home) =1 (IV/Infusion)	5
48	OASIS M0520 = 2 (patient requires urinary catheter)	9
49	OASIS M0540 = 4 or 5 (bowel incontinence, daily or >daily)	10
Sample = episodes with NRS cost <= $3500 in 2003 and 2004.		

NRS score per episode

From the pooled model, we estimated the episode NRS scores. The episode score was estimated as the sum of the scores of all of an episode's scoring conditions. An exception was that, if the same scoring condition was listed in both primary and secondary diagnoses, only the primary diagnosis received points. For example, we found that 1,299 episodes had gangrene listed as both primary and secondary diagnoses. Those episodes were assigned points for gangrene as the primary diagnosis (11 points) but not as secondary diagnosis.

The episode NRS scores ranged from 0 to 268. About two-thirds of the episodes had a score equal to zero.

Exhibit 9.24

Percentiles of NRS Scores

	All episodes	Episodes w/ score>0
Minimum	0	4
1st Pctile	0	4
10th Pctile	0	4
25th Pctile	0	4
50th Pctile	0	14
75th Pctile	8	27
90th Pctile	27	48
99th Pctile	75	98
Maximum	268	268

Sample = episodes with NRS cost <= $3500 in 2003 and 2004.

Categorizing the episodes based on the NRS use

We then divided the episodes into NRS use categories based on the episode NRS scores. The purpose was to develop a payment system in which episodes in the same NRS use category would receive the same amount of payment. Such a system accounts for the variation in the NRS while give less incentive to HHAs to incur unnecessary NRS cost compared to a cost-based payment method.

In the NPRM payment proposal, episodes were divided into five NRS use categories. We noted that there was a substantial variation in the NRS cost in the fifth category. A few episodes with extremely high NRS cost tilted average cost upwards. If the payment rate was determined based on the average cost per episode group, then a majority of the episodes in the fifth category would be over-paid whereas a small number of episodes with very high NRS cost are severely under-paid; HHAs would lose money in taking in such patients that may incur very high NRS cost. CMS received public comments in response to the NPRM, recommending that the NRS payments better accommodate the very highest-cost NRS needs. Thus, we were asked to create a separate NRS use category for episodes with very high NRS cost, which accounted for <0.5% of all episodes.

We divided the episodes into six NRS use categories based on their NRS scores. The cut-offs for the scoring categories were selected based on the percentiles of scores of episodes with score>0. The selected cut-offs presented in this section differed slightly from the ones presented in the NPRM due to the difference in the analytical sample and modifications that we made to the NRS model, both of which led to a shift in the distribution of episode NRS scores. The six categories were:

1. Category 1: NRS score = 0
2. Category 2: 1 <= NRS score <= 14
3. Category 3: 15 <= NRS score <= 27
4. Category 4: 28 <= NRS score <= 48
5. Category 5: 49 <= NRS <= 98
6. Category 6: NRS score > 98

Episodes in the same score categories would be paid by the same rate.

Comparison of five-group and six-group methods

We compared the performance of two payment methods: the five-group (last two categories combined) and six-group payment methods. We examined the distribution of NRS cost and relative payment weight by score categories, fit ANOVA models by including the five or six payment groups separately, and compared the payment-cost differences for groups of episodes. We restricted our analysis to episodes with NRS cost <= $3500.

Of the episodes with NRS score equal to 0, a portion had some NRS cost (Exhibit 9.25). The average NRS cost of episodes with an NRS score of 0 was $15. Across the five or six NRS score categories, the proportion of episodes with zero NRS cost decreased gradually, whereas the average NRS cost increased. This suggests that our NRS model is in general valid, but somewhat limited in explaining the variation in NRS cost. There are substantial variations in the cost of wound care procedures and supplies. Some of the advanced procedures and supplies are costly, but the inclusion of indicators on the skin conditions cannot fully explain such variation. For example, the average NRS cost per episodes was $200 for patients with one stage 3 pressure ulcer and no other scoring conditions, and the cost ranged from $0 to $3496 per episode in the restricted sample, and $86,914 in the entire sample. At the extremes, a few of the episodes with NRS score equal to 0 had NRS costs of several thousand dollars, while some episodes in the highest NRS score category had no NRS cost.

About 1% of episodes have an NRS cost >$1000, and 0.1% of the episodes had an NRS cost > $3000. Only 10,602 episodes belonged to the sixth score category, and the average cost for this category is $573.

Exhibit 9.25

Distribution of NRS Cost by NRS Score Categories

	# of episodes	%	Distribution of NRS Cost							Relative weight
			Mean	Std Dev	Minimum	25th percentile	Median	75th percentile	Maximum	
a. Five Score Categories										
0	1,893,205	63.7	15	80	0	0	0	0	3499	0.270
1 to 14	613,539	20.6	53	168	0	0	0	33	3498	0.974
15 to 27	198,669	6.7	145	291	0	0	39	161	3482	2.671
28 to 48	159,971	5.4	216	372	0	0	80	257	3497	3.969
gt 48	106,641	3.6	356	513	0	25	164	461	3499	6.545
b. Six Score Categories										
0	1,893,205	63.7	15	80	0	0	0	0	3499	0.270
1 to 14	613,539	20.6	53	168	0	0	0	33	3498	0.974
15 to 27	198,669	6.7	145	291	0	0	39	161	3482	2.671
28 to 48	159,971	5.4	216	372	0	0	80	257	3497	3.969
49 to 98	96,339	3.2	333	487	0	22	153	429	3499	6.120
> 98	10,302	0.3	573	676	0	74	336	808	3498	10.525

Sample = episodes in 2003 and 2004.

Next, we fit ANOVA models with five or six score categories being the only explanatory variables and NRS cost being the outcome. We studied the model fit of the ANOVA models, which is the proportion of variation in NRS cost explained by the scoring categories.(Exhibit 9.26) The interpretation of model fit of the ANOVA model is similar to that of the NRS model that we discussed in prior sections. The difference is that we used the NRS use categories instead of the 40-plus clinical conditions to explain the variations in the NRS cost. The ANOVA model always had a slightly worse fit than the NRS model, but its R-squared statistic more accurately represents the fit of the payment groups to the data.

In addition to fitting the ANOVA model on episodes with cost <= 3,500, we also fit the model on samples with NRS cost outliers. The model fit decreased as we included more NRS cost outliers in the sample.

Exhibit 9.26

Performance of NRS ANOVA Models

Sample	Number of episodes	Average NRS cost	Score Groups	R-Square
NRS<=3500	2972025	54.4	5 categories	0.1609
			6 categories	0.1656
All episodes	2974678	61.4	5 categories	0.0030
			6 categories	0.0033

Evaluating the Performance of Alternative Payment Methods

We evaluated the performance of three NRS payment approaches by estimating the difference between NRS cost and NRS payment for various subgroups of episodes under each method. We evaluated three NRS payment options:

- Paying every episode an amount equal to the overall average estimated NRS cost per episode. (This method is labeled as "1-group" in the table.)

- Using the payment rates derived from the 5-group model (the NRS base payment adjusted by the weight for the episode's NRS group under this model).

and

- Using the payment rates derived from the 6-group model (the NRS base payment adjusted by the weight for the episode's NRS group under this model).

We estimated the average payment and cost differences and the percent of episodes with negative payment-cost differences using the three sets of rates. We repeated the analysis for different subgroups of episodes, e.g., episodes with or without scoring conditions, and episodes with or without NRS cost (Exhibit 9.27), episodes with NRS scoring diagnoses (Exhibit 9.28), and episodes with one of the scoring OASIS conditions (Exhibit 9.29).

Of the three payment methods, the 1-group model (paying all episodes the NRS average cost per episode) yielded the worst payment accuracy, while the methods based on five or six score groups showed similar performance. The average payment-cost differences deviated further from 0 for all the subgroups of episodes under the single rate than under group-specific pay rates. Still, methods based on the five or six score groups on average underpaid episodes with NRS cost by $76 and overpaid episodes without NRS cost by $37.

A majority of the episodes with clinical conditions included in the NRS models were overpaid under the 5 or 6 group payment approach.

Exhibit 9.27

Payment-Cost Differences under Three NRS Payment Methods - All Episodes

	All Episodes			Episodes with Payment<Cost			Episodes with Payment>=Cost		
Payment Rate	Number of Episodes	Mean P-C	SD	%	Mean P-C	SD	%	Mean P-C	SD
No scoring condition in NRS model									
1-group	1,893,205	40	80	6	-151	257	94	52	8
5-group	1,893,205	0	80	12	-108	207	88	14	2
6-group	1,893,205	0	80	12	-108	207	88	14	2
Any scoring condition in NRS model									
1-group	1,078,820	-70	296	35	-290	422	65	47	14
5-group	1,078,820	0	280	24	-300	436	76	94	79
6-group	1,078,820	0	279	24	-299	434	76	93	80
NRS cost>0									
1-group	966,505	-113	317	51	-257	394	49	36	15
5-group	966,505	-69	296	49	-212	363	51	69	80
6-group	966,505	-69	295	49	-211	361	51	68	81
NRS cost=0									
1-group	2,005,520	54	0	.	.	.	100	54	0
5-group	2,005,520	33	50	.	.	.	100	33	50
6-group	2,005,520	33	50	.	.	.	100	33	50

Sample = episodes with estimated NRS cost <=3500.

Exhibit 9.28

Payment-Cost Differences under Three NRS Payment Methods - Episodes by NRS Scoring Diagnosis

	All Episodes			Episodes with Payment<Cost			Episodes with Payment>=Cost		
Payment Rate	Number of Episodes	Mean P-C	SD	%	Mean P-C	SD	%	Mean P-C	SD
Primary diagnosis = Anal fissure, fistula and abscess									
1-group	825	-116	335	48	-288	419	52	43	16
5-group	825	32	323	23	-371	480	77	150	79
6-group	825	31	323	23	-369	484	77	148	77
Other diagnosis = Anal fissure, fistula and abscess									
1-group	881	-145	380	51	-330	465	49	44	16
5-group	881	-3	357	27	-377	507	73	136	94
6-group	881	-3	356	27	-380	506	73	135	94
Primary diagnosis = Cellulitis and abscess									
1-group	30,247	-84	303	41	-274	405	59	46	15
5-group	30,247	-1	304	27	-302	437	73	112	88
6-group	30,247	-3	303	28	-302	437	72	111	85
Other diagnosis = Cellulitis and abscess									
1-group	36,733	-98	323	42	-295	422	58	47	15
5-group	36,733	1	312	26	-332	456	74	115	90
6-group	36,733	0	311	26	-332	455	74	114	88
Primary diagnosis = Diabetic ulcers									
1-group	19,497	-144	343	57	-285	400	43	42	17
5-group	19,497	16	347	28	-357	459	72	162	94
6-group	19,497	12	346	28	-356	459	72	159	91
Primary diagnosis = Gangrene									
1-group	1,445	-112	303	51	-260	368	49	42	17
5-group	1,445	10	301	29	-294	400	71	134	93
6-group	1,445	10	300	29	-293	398	71	134	97

Exhibit 9.28

Payment-Cost Differences under Three NRS Payment Methods - Episodes by NRS Scoring Diagnosis

	All Episodes			Episodes with Payment<Cost			Episodes with Payment>=Cost		
Payment Rate	Number of Episodes	Mean P-C	SD	%	Mean P-C	SD	%	Mean P-C	SD
Other diagnosis = Gangrene									
1-group	2,723	-132	324	54	-282	382	46	44	16
5-group	2,723	-4	325	32	-313	408	68	143	100
6-group	2,723	-1	325	32	-312	405	68	145	109
Primary diagnosis = Malignant neoplasms of skin									
1-group	1,905	-68	331	32	-310	504	68	46	15
5-group	1,905	41	327	17	-429	592	83	137	51
6-group	1,905	40	327	17	-428	590	83	137	51
Other diagnosis = Malignant neoplasms of skin									
1-group	4,974	-37	229	30	-234	347	70	47	14
5-group	4,974	10	221	22	-243	355	78	80	63
6-group	4,974	9	220	22	-243	354	78	80	62
Primary or Other diagnosis = Non-pressure and non-stasis ulcers									
1-group	63,596	-168	388	56	-332	454	44	43	16
5-group	63,596	0	388	31	-383	497	69	173	107
6-group	63,596	-2	387	31	-381	495	69	170	107
Primary diagnosis = Other infections of skin and subcutaneous tissue									
1-group	1,893	-91	344	40	-292	474	60	45	15
5-group	1,893	34	334	20	-391	557	80	141	67
6-group	1,893	33	334	20	-387	557	80	140	65
Other diagnosis = Other infections of skin and subcutaneous tissue									
1-group	2,830	-84	317	39	-286	435	61	46	15
5-group	2,830	5	307	25	-308	475	75	109	84
6-group	2,830	4	307	25	-310	475	75	108	83
Primary diagnosis = Post-operative Complications									
1-group	33,835	-158	375	57	-310	441	43	41	17
5-group	33,835	-1	368	29	-385	501	71	153	78
6-group	33,835	-1	367	29	-385	500	71	152	78
Other diagnosis = Post-operative Complications									
1-group	14,747	-135	361	50	-313	442	50	44	16
5-group	14,747	20	350	25	-388	499	75	156	78
6-group	14,747	21	347	25	-383	492	75	157	81
Primary diagnosis = Traumatic Wounds and Burns									
1-group	51,724	-100	301	48	-256	376	52	44	16
5-group	51,724	24	299	25	-320	434	75	137	71
6-group	51,724	24	299	25	-320	433	75	137	73
Other diagnosis = Traumatic Wounds and Burns									
1-group	28,732	-72	290	37	-273	402	63	46	15
5-group	28,732	-2	279	26	-281	414	74	97	84
6-group	28,732	-2	278	26	-281	413	74	97	85
Primary or other diagnosis = V code, Cystostomy care									
1-group	6,039	-179	395	63	-309	452	37	39	18
5-group	6,039	-14	371	30	-374	503	70	142	87
6-group	6,039	-4	362	30	-361	488	70	147	100
Primary or other diagnosis = V code, Tracheostomy care									
1-group	5,058	-152	413	44	-408	521	56	47	14
5-group	5,058	-7	395	26	-470	547	74	154	71
6-group	5,058	-2	390	25	-465	541	75	156	79

Exhibit 9.28

Payment-Cost Differences under Three NRS Payment Methods - Episodes by NRS Scoring Diagnosis

	All Episodes			Episodes with Payment<Cost			Episodes with Payment>=Cost		
Payment Rate	Number of Episodes	Mean P-C	SD	%	Mean P-C	SD	%	Mean P-C	SD
Primary or other diagnosis = V code, Urostomy care									
1-group	6,485	-188	415	56	-368	481	44	44	16
5-group	6,485	-13	401	31	-418	517	69	167	88
6-group	6,485	-4	394	30	-411	507	70	171	101

Sample = episodes with estimated NRS cost <=3500.

Exhibit 9.29

Payment-Cost Differences under Three NRS Payment Methods - by Scoring OASIS Variables

	All Episodes			Episodes with Payment<Cost			Episodes with Payment>=Cost		
Payment Rate	Number of Episodes	Mean P-C	SD	%	Mean P-C	SD	%	Mean P-C	SD
OASIS M0450 = 1 or 2 pressure ulcers, stage 1									
1-group	62,773	-73	288	37	-275	396	63	47	14
5-group	62,773	4	271	25	-278	402	75	101	83
6-group	62,773	6	271	25	-276	399	75	102	90
OASIS M0450 = 3+ pressure ulcers, stage 1									
1-group	4,496	-145	383	47	-359	472	53	48	14
5-group	4,496	-14	360	29	-383	487	71	134	100
6-group	4,496	-4	358	28	-374	476	72	142	118
OASIS M0450 = 1 pressure ulcer, stage 2									
1-group	108,265	-112	320	48	-282	398	52	45	16
5-group	108,265	-13	310	33	-288	406	67	119	92
6-group	108,265	-12	308	33	-287	403	67	120	96
OASIS M0450 = 2 pressure ulcers, stage 2									
1-group	37,087	-160	377	56	-324	442	44	44	16
5-group	37,087	2	365	29	-377	485	71	158	86
6-group	37,087	5	362	29	-372	477	71	160	94
OASIS M0450 = 3 pressure ulcers, stage 2									
1-group	9,303	-213	427	61	-375	478	39	44	16
5-group	9,303	-5	417	31	-443	522	69	189	88
6-group	9,303	3	414	30	-437	516	70	194	102
OASIS M0450 = 4+ pressure ulcers, stage 2									
1-group	6,651	-265	492	65	-434	541	35	44	16
5-group	6,651	-39	482	34	-511	579	66	201	96
6-group	6,651	-23	479	33	-500	574	67	211	117
OASIS M0450 = 1 pressure ulcer, stage 3									
1-group	47,904	-224	437	63	-381	486	37	43	17
5-group	47,904	-7	431	31	-458	534	69	195	95
6-group	47,904	-1	428	31	-451	527	69	199	106
OASIS M0450 = 2 pressure ulcers, stage 3									
1-group	10,749	-315	531	70	-471	569	30	44	16
5-group	10,749	-51	527	35	-551	615	65	222	107
6-group	10,749	-30	524	34	-543	609	66	236	131
OASIS M0450 = 3 pressure ulcers, stage 3									
1-group	4,676	-346	563	72	-499	598	28	44	16
5-group	4,676	-77	558	37	-588	636	63	225	106
6-group	4,676	-50	554	36	-582	626	64	243	137

Exhibit 9.29

Payment-Cost Differences under Three NRS Payment Methods - by Scoring OASIS Variables

	All Episodes			Episodes with Payment<Cost			Episodes with Payment>=Cost		
Payment Rate	Number of Episodes	Mean P-C	SD	%	Mean P-C	SD	%	Mean P-C	SD
OASIS M0450 = 4+ pressure ulcers, stage 3									
1-group	1,781	-447	633	77	-598	654	23	45	16
5-group	1,781	-145	633	42	-687	668	58	240	112
6-group	1,781	-80	629	39	-656	650	61	292	158
OASIS M0450 = 1 pressure ulcer, stage 4									
1-group	22,241	-347	559	71	-508	593	29	44	17
5-group	22,241	-77	556	37	-586	627	63	227	108
6-group	22,241	-52	554	36	-580	622	64	244	135
OASIS M0450 = 2 pressure ulcers, stage 4									
1-group	4,472	-480	663	76	-644	681	24	45	16
5-group	4,472	-178	663	45	-688	691	55	246	111
6-group	4,472	-87	662	40	-683	683	60	309	164
OASIS M0450 = 3+ pressure ulcers, stage 4									
1-group	2,836	-536	712	76	-718	725	24	45	16
5-group	2,836	-235	712	48	-763	716	52	248	112
6-group	2,836	-116	708	41	-758	699	59	328	173
OASIS M0450e = 1(unobserved pressure ulcer(s))									
1-group	21,675	-188	414	57	-363	478	43	45	16
5-group	21,675	-5	401	30	-427	520	70	172	93
6-group	21,675	4	398	29	-421	512	71	179	109
OASIS M0470 = 2 (2 stasis ulcers)									
1-group	9,765	-191	400	60	-344	453	40	44	17
5-group	9,765	19	402	28	-429	515	72	197	97
6-group	9,765	14	401	29	-427	514	71	192	95
OASIS M0470 = 3 (3 stasis ulcers)									
1-group	4,448	-229	446	64	-384	496	36	43	17
5-group	4,448	10	449	30	-478	559	70	217	100
6-group	4,448	1	448	30	-475	558	70	210	98
OASIS M0470 = 4 (4+ stasis ulcers)									
1-group	7,663	-276	489	67	-430	530	33	44	17
5-group	7,663	-1	488	31	-528	587	69	235	104
6-group	7,663	-11	488	32	-522	583	68	227	107
OASIS M0474 = 1 (unobservable stasis ulcers)									
1-group	3,186	-148	400	47	-370	498	53	48	14
5-group	3,186	7	401	28	-423	538	72	174	110
6-group	3,186	4	401	28	-422	538	72	171	109
OASIS M0476 = 1 (status of most problematic stasis ulcer: fully granulating)									
1-group	8,519	-88	319	39	-301	433	61	48	13
5-group	8,519	-1	316	27	-324	461	73	117	82
6-group	8,519	-1	315	27	-324	460	73	117	84
OASIS M0476 = 2 (status of most problematic stasis ulcer: early/partial granulation)									
1-group	49,161	-184	410	57	-355	474	43	44	16
5-group	49,161	-3	412	30	-435	530	70	182	92
6-group	49,161	-4	411	30	-432	528	70	180	94
OASIS M0476 = 3 (status of most problematic stasis ulcer: not healing)									
1-group	38,677	-244	454	66	-392	499	34	43	17
5-group	38,677	9	457	30	-490	560	70	223	103
6-group	38,677	3	455	31	-485	556	69	218	106

Exhibit 9.29

Payment-Cost Differences under Three NRS Payment Methods - by Scoring OASIS Variables

	All Episodes			Episodes with Payment<Cost			Episodes with Payment>=Cost		
Payment Rate	Number of Episodes	Mean P-C	SD	%	Mean P-C	SD	%	Mean P-C	SD
OASIS M0488 = 2 (status of most problematic surgical wound: early/partial granulation)									
1-group	367,905	-9	203	20	-237	371	80	49	12
5-group	367,905	20	190	16	-232	373	84	67	56
6-group	367,905	19	190	16	-232	372	84	66	55
OASIS M0488 = 3 (status of most problematic surgical wound: not healing)									
1-group	76,217	-110	338	45	-301	435	55	45	15
5-group	76,217	-9	326	28	-329	466	72	115	88
6-group	76,217	-9	325	28	-328	464	72	115	90
OASIS M0550=1(ostomy not related to inpt stay/no regimen change)									
1-group	41,232	-216	478	49	-487	562	51	49	12
5-group	41,232	-36	460	31	-512	572	69	181	92
6-group	41,232	-25	452	31	-502	562	69	186	104
OASIS M0550=2 (ostomy related to inpt stay/regimen change)									
1-group	18,631	-265	472	62	-453	513	38	47	14
5-group	18,631	-10	469	33	-486	542	67	229	102
6-group	18,631	-16	465	34	-483	535	66	224	103
Any `Selected Skin Conditions` (rows 1-42 above) AND M0550=1(ostomy not related to inpt stay/no regimen change)									
1-group	18,548	-349	575	65	-563	616	35	46	15
5-group	18,548	-68	570	37	-611	633	63	247	105
6-group	18,548	-44	557	35	-595	620	65	255	124
Any `Selected Skin Conditions` (rows 1-42 above) AND M0550=2(ostomy related to inpt stay/ regimen change)									
1-group	11,841	-311	502	68	-476	532	32	46	15
5-group	11,841	-9	502	34	-521	565	66	256	108
6-group	11,841	-18	497	35	-515	555	65	248	112
OASIS M0250 (Therapy at home) =1 (IV/Infusion)									
1-group	61,088	-51	289	28	-304	455	72	49	13
5-group	61,088	6	275	21	-313	465	79	89	74
6-group	61,088	7	274	21	-311	463	79	89	77
OASIS M0520 = 2 (patient requires urinary catheter)									
1-group	147,349	-93	326	39	-315	439	61	48	13
5-group	147,349	-14	301	27	-315	441	73	97	84
6-group	147,349	-12	300	27	-313	438	73	98	88
OASIS M0540 = 4 or 5 (bowel incontinence, daily or >daily)									
1-group	83,464	-85	314	40	-279	427	60	45	15
5-group	83,464	-9	290	29	-270	425	71	96	86
6-group	83,464	-6	288	28	-266	418	72	97	93

Sample = episodes with estimated NRS cost <=3500.