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Assistant Secretary for Planning and Evaluation
Office of Disability, Aging and Long-Term Care Policy



ALTERNATIVE RISK- ADJUSTMENT APPROACHES TO ASSESSING THE QUALITY OF HOME HEALTH CARE: FINAL REPORT

July 2006

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TABLE OF CONTENTS

ABSTRACT	v
EXECUTIVE SUMMARY	vii
INTRODUCTION	1
RISK-ADJUSTMENT OF HEALTH CARE QUALITY MEASURES	3
Theoretical and Conceptual Models.....	3
Current Approach to Risk-Adjustment of OBQI Quality Indicators	4
Other Empirical Research on Home Health Outcomes Using OASIS.....	4
Empirical Research on Nursing Home Outcomes.....	5
Reliability of OASIS Data	6
Project Framework.....	6
METHODS	8
Source of Data	8
Analytic Methods.....	9
DEVELOPMENT OF ALTERNATIVE MODELS AND RESULTS OF ANALYSES	15
Preliminary Analyses	15
Technical Advisory Group (TAG) Meeting	18
Final Data Analyses: Risk-Adjustment Models	20
Final Data Analyses: Agency Impacts.....	24
CONCLUSIONS AND IMPLICATIONS	26
REFERENCES	29
FIGURES	31
TABLES	41

LIST OF FIGURES AND TABLES

FIGURE 1:	Performance of Alternative and Current Risk-Adjustment Models for Improvement in ADL Outcomes.....	31
FIGURE 2:	Performance of Alternative and Current Risk-Adjustment Models for Improvement in IADL Outcomes.....	32
FIGURE 3:	Performance of Alternative and Current Risk-Adjustment Models for Improvement in Physiologic and Cognitive Outcomes.....	33
FIGURE 4:	Performance of Alternative and Current Risk-Adjustment Models for Utilization Outcomes.....	34
FIGURE 5:	Inclusion of OASIS-B1 Items in Risk-Adjustment Models	35
FIGURE 6:	Inclusion of OASIS-B1 Elements in Risk-Adjustment Models	36
FIGURE 7:	Mean Percentage Point Difference in Agency Performance Using Current versus Full Alternative Models	37
FIGURE 8:	Spearman’s Rank Correlation Coefficient for Agency Outcomes Using Current versus Full Alternative Models	38
FIGURE 9:	Mean Percentage Point Difference in Agency Performance Using Current versus Core Alternative Models	39
FIGURE 10:	Spearman’s Rank Correlation Coefficient for Agency Outcomes Using Current versus Core Alternative Models	40
TABLE 1:	Outcome Measures Used in OBQI	41
TABLE 2:	Preliminary Set of Core Risk Factors Used in Initial Analyses	42
TABLE 3:	Final Set of Core Items Included as Risk-Adjusters in All Alternative Models	44
TABLE 4a:	Risk-Adjusters Specific to ADL Outcome Models	46
TABLE 4b:	Risk-Adjusters Specific to IADL Outcome Models	46
TABLE 4c:	Risk-Adjusters Specific to Physiologic Outcome Models	47
TABLE 4d:	Risk-Adjusters Specific to Cognitive and Utilization Outcomes.....	48

TABLE 5a:	“Prior” Risk-Adjusters Specific to ADL Outcomes	49
TABLE 5b:	“Prior” Risk-Adjusters Specific to IADL Outcomes	50
TABLE 5c:	“Prior” Risk-Adjusters Specific to Physiologic Outcomes	51
TABLE 5d:	“Prior” Risk-Adjusters Specific to Emotional/Behavioral/Cognitive Outcomes	51
TABLE 6a:	Summary of Regression Models: Activities of Daily Living.....	52
TABLE 6b:	Final Alternative Risk-Adjustment Models for Activities of Daily Living Outcomes	55
TABLE 7a:	Summary of Regression Models: Instruments Activities of Daily Living	63
TABLE 7b:	Final Alternative Risk-Adjustment Models for Instrumental Activities of Daily Living Outcomes	66
TABLE 8a:	Summary of Regression Models: Physiologic Measures	72
TABLE 8b:	Final Alternative Risk-Adjustment Models for Physiologic Outcomes	75
TABLE 9a:	Summary of Regression Models: Emotional/Behavioral Measures	81
TABLE 9b:	Final Alternative Risk-Adjustment Models for Emotional/ Behavioral Outcomes.....	82
TABLE 10a:	Summary of Regression Models: Cognitive Measures	84
TABLE 10b:	Final Alternative Risk-Adjustment Models for Cognitive Outcomes	85
TABLE 11a:	Summary of Regression Models: Utilization Measures.....	87
TABLE 11b:	Final Alternative Risk-Adjustment Models for Utilization Outcomes.....	88
TABLE 12:	Summary of Agency-Level Analyses: Activities of Daily Living	90
TABLE 13:	Summary of Agency-Level Analyses: Instrumental Activities of Daily Living	93
TABLE 14:	Summary of Agency-Level Analyses: Physiologic Measures.....	96

TABLE 15: Summary of Agency-Level Analyses: Cognitive Measures..... 97

TABLE 16: Summary of Agency-Level Analyses: Utilization Measures 98

ABSTRACT

Background and Purpose. The Outcome-Based Quality Improvement (OBQI) program provides reports to all Medicare-certified home health agencies so that they can identify potential quality problems and devise appropriate strategies to address them. There are 41 OBQI quality measures. A data-driven “stepwise” approach currently is used to risk adjust the OBQI indicators with a separate set of risk factors included in the risk-adjustment model for each outcome. The purpose of this project was to use a theory and evidence-based approach to develop and test alternative risk-adjustment models for the OBQI quality indicators within the frame of the existing Outcome and Assessment Information Set (OASIS) instrument.

Methods. The data analyzed in this project were obtained from the Centers for Medicare and Medicaid Services’ (CMS) contractor at the University of Colorado. They drew the data from the OASIS National Repository at CMS to create discrete episodes of home health care during calendar year 2001. In this project, alternative models were estimated sequentially after replicating the current risk-adjustment models. The first model was limited to the admission (or baseline) value of the outcome indicator and a core set of risk-adjusters. Subsequent models included a small number of outcome-specific risk-adjusters. Following development of a final set of alternative risk-adjustment models, an agency-level analysis was conducted to determine the impact on agencies’ quality ratings.

Results. The alternative models that include outcome-specific risk-adjusters typically have *slightly lower explanatory power* than the current models. This finding is not surprising since the “stepwise” approach used to develop current models is likely to result in models with close to the best explanatory power possible for the data set analyzed. The number of OASIS data items required to risk-adjust all outcomes, on the other hand, is considerably higher for the current compared with the alternative models. The agency-level analysis examined how the alternative approaches to risk-adjustment of the OBQI indicators affect an agency’s quality ratings as calculated by CMS for public reporting. For most agencies and most outcomes, the adjusted proportion of patients with an outcome and the agency’s ranking relative to other agencies is similar regardless of whether the current or alternative model is used to risk-adjust outcomes.

Conclusions. The results suggest that the relatively small reduction in explanatory power of most of the alternative risk-adjustment models for the OBQI indicators is unlikely to have a substantial effect on the quality ratings of the majority of agencies. A theory and evidence-based modeling approach, then, has the potential to simplify risk-adjustment and provide a consistent and stable basis for risk-adjustment relative to the current approach. This should make it more understandable to providers and encourage individual agencies to risk-adjust their own outcomes. The reliance on a

smaller number of OASIS data elements, in addition, would contribute to the Department's efforts to streamline the OASIS instrument and potentially facilitate the identification of a parsimonious set of clinical measures appropriate for data exchange in an electronic health record environment.

EXECUTIVE SUMMARY

Background and Purpose

One of the central goals of the U.S. Department of Health and Human Services is to improve the quality of health care received by all Americans. In the home health care area, the Department has two key initiatives developed and implemented by the Centers for Medicare and Medicaid Services (CMS) to assess, improve, and report quality. The Outcome-Based Quality Improvement (OBQI) program provides reports to all Medicare-certified home health agencies so that they can identify potential quality problems and devise appropriate strategies to address them. The Home Health Quality Initiative (HHQI) uses a subset of the OBQI quality measures for public reporting.

There are 41 home health quality measures in the context of the OBQI framework including functional, physiologic, emotional/behavioral, cognitive, and health care utilization outcomes. The source of the data used in OBQI and HHQI is the Outcome and Assessment Information Set (OASIS). Since July 1999, home health agencies participating in the Medicare or Medicaid programs have been required to collect OASIS on all patients age 18 or older admitted to Certified Home Health Agencies. The two exceptions are persons receiving pre or postpartum maternity services and those receiving only personal care, chore or housekeeping services.

Thirty of the 41 OBQI quality indicators now are risk-adjusted when comparing outcomes for patients from one agency with outcomes for patients from all agencies in OBQI reports. An additional OBQI patient outcome indicator (Improvement in Pain Interfering with Activity) is risk-adjusted for public reporting in HHQI but not in OBQI reports sent to agencies. A data-driven “stepwise” approach currently is used to risk-adjust the OBQI indicators with a separate set of risk factors included in the risk-adjustment model for each outcome.

The purpose of this project was to use a theory and evidence-based approach to develop and test alternative risk-adjustment models for the OBQI quality indicators within the frame of the existing OASIS instrument. Specifically, instead of using a separate set of risk-adjusters for each OBQI quality indicator where risk-adjusters are primarily determined based on their statistical fit to the model, this project used a core set of risk-adjusters in all models that theory and prior research suggest are important determinants of home health quality. Advantages of a theory and evidence-based approach include simplicity, understandability, stability of the risk-adjustment models over time, conceptual meaningfulness, and the potential for greater parsimony in data elements when a large number of outcome indicators are being risk-adjusted, as is the case in the OBQI program. Findings from the project will contribute to CMS’s future plans for continued refinement of risk-adjustment and outcome measures, and support the Department’s efforts to reduce regulatory burden by streamlining OASIS.

Methods

Analyses were conducted in two major phases: preliminary data analyses and final data analyses. Preliminary data analyses included replication of the CMS risk-adjustment models for the first set of 11 outcomes reported in HHQI, and development of alternative models for these outcomes. A Technical Advisory Group (TAG) meeting then was conducted with experts in home health care and risk-adjustment as well as policymakers and provider representatives. Based on the results of the preliminary data analyses, the TAG provided input on our initial approach. After the TAG meeting, final data analyses were conducted. The project team replicated the current models for the remaining 20 quality measures that are currently risk-adjusted in OBQI or HHQI. A final set of alternative risk-adjustment models then was developed for all 31 OBQI quality indicators, followed by an examination of the impact of alternative risk-adjustment models on agency quality ratings.

The data analyzed in this project were obtained from the CMS contractor at the University of Colorado. They drew the data from the OASIS National Repository at CMS to create discrete episodes of home health care during calendar year 2001. The file includes episodes of care beginning *and* ending within the calendar year. Approximately 1,500,000 OASIS episodes are present in the overall data set. The University of Colorado randomly assigned about a third of the episodes to the developmental sample for initial estimation of risk-adjustment models for most outcomes. The remaining 1,000,000 were used to validate the final models derived from analysis of the developmental sample.

In the *preliminary data analyses*, six alternative models were estimated for each of the 11 initial HHQI outcomes. We began with a model limited to the core set of clinical, demographic and payment risk-adjusters, including the *baseline* value of the outcome measure if it was not already among the core variables. Outcome-specific risk-adjusters were added at subsequent steps: Model 2 included other clinical characteristics at baseline that might plausibly affect the outcome, and Model 3 included measures of clinical status *prior to* home health admission. Four clinical therapies at baseline (i.e., oxygen therapy, IV/infusion therapy, enteral/parenteral nutrition, and ventilator) then were added to the risk-adjustment models of the 11 HHQI outcomes. Living arrangements and social support indicators were added next. Finally, home health episode length of stay (LOS) was added solely to allow comparison of current and alternative model statistics and parameter estimates.

Only three alternative models were estimated for each of the 31 outcome indicators in the *final data analyses*.

- Model 1 was limited to the admission (or baseline) value of the outcome indicator and a core set of primarily clinical risk-adjusters drawn from the domains covered by the OASIS start of care instrument.

- Model 2 added to Model 1 other clinically relevant admission characteristics plausibly influencing the specific outcome.
- Model 3 added to Model 2 indicators of patient functioning *prior to home health admission*.

The rationale for examining prior health status variables separately from clinical measures on admission is because of questions regarding the reliability of the former and possible elimination from the OASIS instrument.

The decision to estimate only three sequential models, as opposed to the six estimated in the preliminary analyses, was based on the advice of the TAG and further analysis of the living situation and informal support/assistance measures following the TAG meeting. The analysis confirmed that these factors contributed relatively little to the explanatory power of risk-adjustment models with the exception that they very modestly improved the explanatory power of the Improvement in Medication Management risk-adjustment model. Following this analysis, the living situation and informal support/assistance measures were excluded from all alternative models.

Four sets of statistics were estimated for each current and alternative risk-adjustment model:

- Number of OASIS items included in the risk-adjustment model.
- Number of OASIS elements (some OASIS items have multiple elements) included in the risk-adjustment model.
- R-squared statistic (technically, a pseudo R-squared statistic that measures the extent of the agreement between observed and predicted values).
- c statistic (a measure of how well the risk-adjusters in the model correctly classify whether an episode will result in the outcome being examined).

The total number of OASIS items and elements used to risk-adjust all OBQI quality indicators also was compared.

An agency-level analysis was conducted following development of a final set of alternative risk-adjustment models. The purpose was to determine how the different approaches to risk-adjustment affect an agency's quality ratings. Approximately 5,000 agencies were included on the calendar year 2001 files provided to the project team by the University of Colorado. Two "adjusted" agency outcome rates were calculated for each of the 31 outcomes currently risk-adjusted in OBQI or HHQI. One of the adjusted rates was estimated using the current risk-adjustment model and the other was estimated using the "full" alternative model (i.e., Model 3 which includes outcome-specific and "prior" OASIS items, or Model 2 where there were no relevant prior items).

Development of Alternative Models and Results of Analyses

The preliminary set of theory and evidence-based core risk-adjusters in the first phase of the project, where we focused on the original 11 HHQI outcomes, was drawn from a number of domains covered by the OASIS instrument. The selection of the final set of core risk-adjusters was based on findings from the preliminary analyses, comments of TAG members, and examination of a small number of additional OASIS items provided by the University of Colorado following the TAG meeting. In addition to the core, approximately 2-3 outcome-specific risk-adjusters were included in the final, “full” risk-adjustment model developed for each of the 31 OBQI outcomes currently risk-adjusted by CMS. In addition, 1-3 directly related, conceptually important “prior” health status measures were included in the full risk-adjustment models of most of the health status outcomes. The great majority of core as well as supplemental risk factors are clinical measures at baseline suitable for inclusion in electronic health records. All risk-adjusters were constructed from routinely collected OASIS data elements.

Comparison of Current and Alternative Models

Overall results from the comparison of the current and alternative risk-adjustment models are described first, followed by results for specific domains (e.g., Activity of Daily Living (ADL) measures, physiologic indicators). In general, the “full” alternative models typically have *slightly lower explanatory power* than the current risk-adjustment models. Specifically, the R-squared statistic for the full model tends to be within 1-2 percentage points of the R-squared statistic for the model developed by the University of Colorado. There is a similar pattern for the c statistic. While the number of OASIS items and elements used to risk-adjust a given outcome is sometimes larger and sometimes smaller the alternative model compared with the respective current model, the overall number of OASIS items and elements employed when risk-adjusting all 31 OBQI outcome indicators is considerably smaller for the full alternative models (64 versus 88 OASIS items, and 93 versus 135 OASIS elements).

The *ADL and IADL outcomes* represent 23 of the 41 OBQI quality indicators and over two-thirds of the 31 outcome indicators currently risk-adjusted by the University of Colorado.

- Most of the full alternative risk-adjustment models for the ADL and Instrumental Activity of Daily Living (IADL) outcomes have slightly lower explanatory power than the current models; an exception is the risk-adjustment model for Improvement in Ambulation where the alternative model performs significantly better than the current risk-adjustment model.
- “Prior” OASIS items contribute substantially to the explanatory power (roughly two percentage points to the R-squared statistic) of almost all of the risk-adjustment models of *improvement* in ADLs and IADLs, but not *stabilization* in ADLs and IADLs.

- The ADL and IADL stabilization outcomes all are skewed (i.e., a very large share of those potentially able to stabilize do stabilize) which may explain the relatively low R-squared and relatively high c statistics for the stabilization risk-adjustment models.

“Prior” OASIS items contribute little to the explanatory power of the risk-adjustment models for the remaining health status outcomes. The one exception is risk-adjustment model for Improvement in Urinary Incontinence, a physiologic outcome in the OBQI framework. Among *physiologic outcomes*, the alternative risk-adjustment model for Improvement in Urinary Tract Infection (UTI) performs considerably worse than the current UTI risk-adjustment model. The R-squared statistic for the full model is 5.9% compared to 12.1% for the current model, and corresponding c statistics are 0.665 and 0.740. The main reason for this difference is the exclusion of home health episode LOS from the alternative model.

No “prior” OASIS items were included in the alternative models for the *utilization outcomes* (i.e., Acute Care Hospitalization, Discharged to the Community, and Emergent Care). As was the case with the UTI risk-adjustment model, the exclusion of LOS reduces the explanatory power of the alternative models for the three utilization outcomes relative to current models.

Agency Analyses

Regardless of whether the current or “full” alternative model was used to risk-adjust outcomes, the quality ratings for most agencies on most outcomes are similar. In particular, the difference between the current and alternative risk-adjusted percent of an agency’s patients with each outcome is within one to two percentage points for most agencies on most outcomes. It is the ranking of each agency relative to others, however, that is likely to be of greatest concern to providers. Our analysis found that the ranking of agencies using current risk-adjustment models and the ranking using the full alternative risk-adjustment models are in close agreement for most outcomes.

The agency-level analyses then were repeated using only the core risk-adjusters in the alternative risk-adjustment models. This was done in order to better understand the contribution of the outcome-specific and OASIS “prior” items to the finding of similar quality ratings regardless of risk-adjustment approach. The basic results hold. However, as would be expected, the quality ratings are not as close when outcome-specific and OASIS prior items are dropped from the alternative risk-adjustment models of the OBQI indicators.

Conclusions and Implications

There are important tradeoffs and differences between the current and alternative approaches to risk-adjusting OBQI quality indicators. The first is the generally higher

explanatory power of the current models versus the simplicity of the alternative models and their overall reliance on a smaller number of OASIS items and elements. That current models generally have slightly better explanatory power than the alternative models is not surprising since the “stepwise” approach is likely to result in models with close to the best explanatory power possible for the data set analyzed. At the same time, however, it leads to the selection of a large number of risk factors when all outcome measures are considered. In addition, because the stepwise approach “fits” models to the data on which they are developed, the explanatory power of these models is likely to decline when they are applied to new data sets.

A second tradeoff is between the full alternative models that include the outcome-specific risk-adjusters and alternative models with only the core set of risk-adjusters. The latter tend not to predict outcomes as well as the full models. Measures of physical functioning *prior to home health admission* are particularly significant in the risk-adjustment models of ADL and IADL improvement. The “prior” OASIS items, however, are more difficult than many other items for home health agencies to collect and are thought to be less reliable than other clinical measures. Should they be dropped from the OASIS instrument, the explanatory power of the risk-adjustment models for most ADL and IADL improvement models would be reduced roughly two percentage points.

The decision to exclude home health LOS from the alternative models, in addition, has a significant impact on a small but important subset of risk-adjustment models (i.e., the utilization outcomes). LOS was excluded because it can be affected by problems in the care process that also affect outcomes (i.e., low quality care can cause a longer stay as well as worse outcomes). If LOS is included in risk-adjustment models, conclusions about the quality of agency care could be erroneous due to quality problems being risk-adjusted away. The TAG convened to review preliminary models developed by the project team strongly supported the decision to exclude LOS from risk-adjustment models. The consequence, however, is reduced explanatory power for some outcomes. A possible methodological solution, which has data burden and simplicity implications, is to collect information on the timing of all of the utilization outcomes (e.g., hospitalization) and estimate hazard models which take into account the time to the outcome of interest.

An agency-level analysis was conducted to examine how alternative approaches to risk-adjustment of the OBQI indicators affect an agency’s quality ratings, with two main findings. First, for most agencies and most outcomes, the adjusted proportion of patients with an outcome is similar regardless of whether the current or the full alternative model is used to risk-adjust outcomes. Second, the relative ranking of agencies using current risk-adjustment models and the ranking using the “full” alternative risk-adjustment models are in close agreement for most outcomes. One limitation of the agency analysis is that for some outcomes a relatively large number of agencies were excluded because too few patients at each of these agencies had the potential to have the outcome (i.e., less than 20 in the study sample).

The results suggest that the relatively small reduction in explanatory power of most of the alternative risk-adjustment models for the OBQI indicators is unlikely to have a substantial effect on the quality ratings of the majority of agencies. A theory and evidence-based modeling approach, then, has the potential to simplify risk-adjustment and provide a consistent and stable basis for risk-adjustment relative to the current approach. This should make it more understandable to providers and encourage individual agencies to risk-adjust their own outcomes. The reliance on a smaller number of OASIS data elements, in addition, would contribute to the Department's efforts to streamline the OASIS instrument and potentially facilitate the identification of a parsimonious set of clinical measures appropriate for data exchange in an electronic health record environment.

INTRODUCTION

One of the central goals of the U.S. Department of Health and Human Services is to improve the quality of health care received by all Americans. In the home health care area, the Department has two key initiatives developed and implemented by the Centers for Medicare and Medicaid Services (CMS) to assess, improve, and report quality. The Outcome-Based Quality Improvement (OBQI) program provides reports to all Medicare-certified home health agencies so that they can identify potential quality problems and devise appropriate strategies to address them. The Home Health Quality Initiative (HHQI) uses a subset of the OBQI quality measures for public reporting. The purpose of HHQI is to provide useful information for potential home health consumers to make informed decisions when choosing a home health agency, and to provide an incentive for home health providers to improve the quality of care they provide.

The source of the data used in OBQI and HHQI is the Outcome and Assessment Information Set (OASIS). Since July 1999, home health agencies participating in the Medicare or Medicaid programs have been required to collect OASIS on all patients age 18 or older admitted to Certified Home Health Agencies. The two exceptions are persons receiving pre or postpartum maternity services and those receiving only personal care, chore or housekeeping services. OASIS data subsequently are submitted to State Survey Agencies which in turn send the data to CMS where they become part of a National Repository. The Medicare Prescription Drug, Improvement and Modernization Act of 2003 suspended OASIS requirements, beginning December 2003, for patients who are *not* covered by Medicare or Medicaid.

There are 41 home health quality measures in the context of the OBQI framework. They include functional, physiologic, emotional/behavioral, cognitive, and health care utilization (e.g., hospitalization) outcomes (Table 1). Currently, 30 of the 41 OBQI quality indicators are risk-adjusted when comparing outcomes for patients from one agency with outcomes for patients from all agencies in OBQI reports.¹ One of the OBQI patient outcome indicators (Improvement in Pain Interfering with Activity) is risk-adjusted for public reporting in HHQI but not in OBQI reports sent to agencies.

The quality indicators are risk-adjusted so that agencies serving different types of patients can be compared. The statistical modeling approach currently used to risk-adjust these measures is a data-driven “stepwise” approach with a separate set of risk factors used for each OBQI measure. One potential drawback of using a stepwise approach to risk-adjustment is finding a set of adjusters that are specific to the particular data set being modeled. Since the decision to retain a variable as a predictor in a given model is driven by the data being analyzed, there is a risk of an “overfit” of the data. The resulting model may predict the analytic data set well, but be a poor fit when

¹ Because of data constraints and methodological issues, 11 outcomes are not risk-adjusted. CMS is planning to address these constraints and issues so that these outcomes will be either risk-adjusted or modified so risk-adjustment is possible.

applied to future data. To at least partially address this problem, the risk-adjustment models developed by the CMS contractor at the University of Colorado were estimated on a randomly selected subsample of the overall dataset, referred to as the “developmental sample.” The developmental sample models then were validated by applying them to data that were set aside for this purpose. In those cases where there was a substantial discrepancy in the explanatory power of the model between the developmental and validation samples, the model was re-estimated using the developmental sample.

The purpose of this project was to develop and test alternative risk-adjustment approaches to assessing the quality of home health care. A theory and evidence-based approach was used to develop risk-adjustment models for the OBQI quality indicators. Specifically, instead of using a separate set of risk-adjusters for each OBQI quality indicator where risk-adjusters are primarily determined based on their statistical fit to the model, this project used a core set of risk-adjusters in all models that theory and prior research suggest are important determinants of home health quality. Advantages of a theory and evidence-based approach include simplicity, understandability, stability of the risk-adjustment models over time, conceptual meaningfulness, and the potential for greater parsimony in data elements when a large number of outcome indicators are being risk-adjusted, as is the case in the OBQI program.

The alternative models were developed within the framework of the uniform data collection system (OASIS) at the time of the study. A project goal was to develop alternative models that could be implemented using existing data sources and project resources limited analyses to OASIS data elements. Within this framework, clinically relevant measures that may be included in future electronic record systems were distinguished from other measures in the model-building process. We identified the relative contribution of OASIS items supplementing the core set of risk-adjusters to inform efforts to determine whether OASIS items can be excluded from the instrument without jeopardizing the explanatory power of the risk-adjustment models.

Findings from this project will contribute to CMS’s future plans for continued refinement of risk-adjustment and outcome measures. They also will provide home health care providers with a better understanding of current and alternative modeling approaches for risk-adjustment of home health quality indicators. Finally, the results will support the Department’s efforts to reduce regulatory burden by streamlining OASIS.

RISK-ADJUSTMENT OF HEALTH CARE QUALITY MEASURES

Risk-adjustment is a critical tool in the evaluation of health care quality. Its aim is to “level the playing field” so that providers serving different patients can be meaningfully compared (Johnson, 2003). Many of the risk-adjustment methods developed and implemented to date are designed to account for differences in patients’ health status when determining payment rates in public programs. The limited diffusion of risk-adjustment methods for assessing the quality of health care may be due to the multiple dimensions of quality, cost of appropriate data, and technical complexity of risk-adjustment methods. Blumenthal and colleagues (2005) argue that greater attention needs to be paid to simplicity, practicality and the intuitive appeal of risk-adjustment methods to increase diffusion and the effective use of this tool.

Theoretical and Conceptual Models

The most widely employed theoretical model in health services research is Andersen and Newman’s conceptual framework (1973) for examining the determinants of medical care utilization. It describes the use of individual health services as a function of societal determinants (technology, norms), health system determinants (resources, organization) and individual determinants (predisposing, enabling and health status). The development of theoretical models of patient health *outcomes* has lagged behind although the Anderson and Newman framework can serve as a starting point for thinking about the contributors to patient outcomes.

Iezzoni (2003) recently outlined the concepts underpinning the risk-adjustment of health care outcomes, highlighting the importance of the “medical meaningfulness” of risk-adjusters. She lists 26 potential risk factors in the following five broad categories (page 35):

- Demographic characteristics;
- Clinical factors;
- Socioeconomic factors;
- Health-related behaviors and activities;
- Attitudes and perceptions.

Iezzoni points out that data limitations will constrain the range of potential risk-adjusters and that an “*a priori* conceptual model of which risk factors should be in a risk-adjustment method for a given outcome...” is necessary to evaluate the credibility of risk-adjusted findings (page 33).

Current Approach to Risk-Adjustment of OBQI Quality Indicators

There is relatively little empirical research on the quality of home health care (Institute of Medicine, 2001). Important exceptions include the work of the team at the University of Colorado responsible for developing OBQI under contract to CMS. The method used by CMS to risk-adjust patient outcomes is logistic regression.² The initial modeling approach involved conceptually and clinically specifying all possible risk factors that might influence the OBQI outcome from a large number of candidate risk factors derived from the OASIS instrument. The grouping of the potential risk-adjusters by OASIS content area represents a framework for thinking about contributors to patient outcomes. All but the “length of stay” (LOS) category fit within the five broad categories identified by Iezzoni.

A “stepwise” logistic regression approach is used to assess the relationship between each candidate risk factor and the outcome measure under consideration. Separate logistic regression models are used for each outcome measure and, in some cases, “submodels” are estimated for patients with different *baseline* values of the outcome indicator. For example, three sub-models are estimated when assessing Improvement in Transferring: one for patients who can transfer with minimal human assistance; one for patients who are unable to transfer by themselves but able to bear weight and pivot during the transfer process; and one for patients with higher levels of disability in transferring. Details of the risk-adjustment methodology are provided in Shaughnessy and Hittle (2002) “Overview of Risk Adjustment and Outcome Measures for Home Health Agency OBQI Reports” available for direct download at <http://www.cms.hhs.gov/apps/hha/RiskAdj1.pdf> with the risk-adjustment models for the 30 outcomes risk-adjusted in OBQI at <http://www.cms.hhs.gov/apps/hha/riskadj1appa.pdf>. The risk-adjustment model for “Improvement in Pain Interfering with Activity” (risk-adjusted in HHQI but not in OBQI reports) is at <http://www.cms.hhs.gov/apps/hha/RiskModels.pdf>. Risk-adjusted outcomes are reported in a recent analysis of whether home health quality changed following the introduction of the Medicare prospective payment system (Schlenker, Powell and Goodrich, 2005).

Other Empirical Research on Home Health Outcomes Using OASIS

Mathematica Policy Research (Cheh and Black, 2002), as part of Laguna Research Associates’ analysis of the impact of the Medicare home health interim payment system, also has analyzed home health outcomes using OASIS (or slightly modified OASIS) data. The investigators grouped OASIS items in their risk-adjusted models into the following broad categories:

² CMS has tested several other risk-adjustment methods (e.g., multivariate standardization, discriminant function analysis, the classification and regression tree methodology). Logistic regression was determined to have several advantages over these methods, and thus, adopted for use.

- Demographic measures;
- Availability of informal care at home health admission;
- Medical conditions, symptoms and needs at home health admission;
- Prognosis at home health admission.

They also included in their models “Measures of Patient’s Prior Service Use Before Home Health Admission” derived from Medicare claims data.

Fortinsky and Madigan (1997) analyzed home health outcomes using standardized items from the “transition” and “full” OASIS data system. They used Andersen and Newman’s conceptual framework for organizing their explanatory variables although only bivariate analyses were conducted.

Prior work by the project team at the Center for Home Care Policy and Research at the Visiting Nurse Service of New York includes a study conducted by Peng, Navaie-Waliser and Feldman (2003) that examined physical functioning (activities of daily living (ADLs) and instrumental activities of daily living (IADLs)), psychological functioning (anxiety and depression) and discharge outcomes among home health care patients using OASIS data. They used a subset of OASIS items as case-mix adjusters, based on Andersen and Newman’s conceptual framework, with a focus on differences among patients across OASIS-derived race and ethnic categories.

Other prior work at the Center for Home Care Policy and Research has focused on the outcomes of heart failure patients. We relied on OASIS data for baseline patient measures and survey data at a uniform point in time after home health admission for outcome measures (Murtaugh et al., 2005; Feldman et al., 2005). In these studies, OASIS data at baseline were grouped into broad domains similar to those described above with key variables from each domain included as risk-adjusters in our models.

Empirical Research on Nursing Home Outcomes

There is a growing literature on risk-adjustment of nursing home quality measures. Mukamel and colleagues (2003), for example, used Minimum Data Set (MDS) information on over 45,000 residents in 671 nursing homes in New York State to develop a risk-adjusted urinary incontinence outcome measure. A large number of potential risk-adjusters was examined and goodness of fit statistics improved substantially when separate models were estimated for each of three age categories (i.e., 65-74, 75-84, and 85 and older). In earlier work, Mukamel and Brower (1998) examined the influence of three different risk-adjustment methods on conclusions about nursing home quality of care. The three methods examined were: (1) no risk-adjustment; (2) risk-adjustment using only items needed to determine nursing home payment (Resource Utilization Group, or RUGs, items); and (3) “comprehensive” adjustment based on patient-level risk factors. The investigators found substantial disagreement in quality ratings depending on the risk-adjustment method employed.

Reliability of OASIS Data

Item reliability is an important issue when selecting risk-adjusters. The testing of OASIS items by the team that developed OBQI at the University of Colorado is an important source of information on reliability. In addition, inter-rater reliability of the full range of OASIS items has been examined by the Center for Home Care Policy and Research of the Visiting Nurse Service of New York (Kinatukara, Rosati and Huang, 2005), and selected items have been examined by Madigan and Fortinsky (2000).

There is considerable variation among OASIS items in their inter-rater reliability as measured by the percent agreement and Cohen's kappa (a measure of agreement that adjusts for the extent to which the observed agreement is due to chance). This is particularly true when reliability statistics are reported for specific categories of multi-category items rather than the average over all categories. The results from these analyses can be used to identify potential risk-adjusters that are more (or less) reliable than others as well as content areas within domains that more (or less) reliable than others.

Project Framework

The framework for selecting the core set of risk-adjusters is based on an integration of lezzoni's conceptual model, prior empirical research, and the input of a Technical Advisory Group (TAG) (see below). It is limited to patient measures although the context in which care is provided theoretically may influence patient outcomes. The specific domains and sub-domains of potential risk-adjusters are listed below and refer to patient status at the time of home health admission (or at the time of a subsequent baseline assessment) unless otherwise indicated:

- Demographic characteristics.
- Socioeconomic factors:
 - Health insurance coverage;
 - Housing and neighborhood characteristics;
 - Familial characteristics, household composition and support/assistance in the home;
 - Educational attainment and health literacy;
 - Economic resources;
 - Employment and occupation;
 - Cultural beliefs and behaviors.

- Clinical factors:
 - Clinical status before and leading up to home care admission:
 - *Historical* use of health services,
 - *Prior* medical conditions,
 - *Prior* physical functioning;
 - Clinical status at home care admission:
 - Physiologic measures,
 - Primary diagnosis and comorbidities,
 - Physical functioning,
 - Cognitive status,
 - Mental health;
 - Clinical therapies at home care admission.
- Health-related behaviors and activities.
- Attitudes and perceptions.

METHODS

Source of Data

OASIS, as noted above, is the source of the data used in OBQI. Agencies are required to collect OASIS at different points in time over a patient's stay. The reason for an assessment is recorded on the OASIS instrument from among the following categories:

- 01 = Start of Care (SOC)--further visits planned
- 02 = Start of Care (SOC)--no further visits planned
(discontinued 12/2002)
- 03 = Resumption of Care (ROC) (after inpatient stay)
- 04 = Recertification (Follow-Up) assessment (every 60 days)
- 05 = Other Follow-Up (when there is a significant change in patient condition)
- 06 = Transferred to an Inpatient Provider--patient not discharged from agency
- 07 = Transferred to an Inpatient Provider--patient discharged from agency
- 08 = Death at Home
- 09 = Discharged from Agency to the Community
- 10 = Discharged from Agency--no visits completed after SOC/ROC assessment (discontinued 12/2002)

There is some variation in the data items collected depending on the reason for the assessment. *Baseline* data for risk-adjustment and the health status quality indicators are from SOC, ROC and Other Follow-Up assessments. Data from assessment types 06-09 are used to determine changes in health status as well as utilization outcomes. OASIS is described in detail at <http://www.cms.hhs.gov/oasis>.

The data analyzed in this project were obtained from the CMS contractor at the University of Colorado. They drew the data from the OASIS National Repository at CMS to create discrete episodes of home health care during calendar year 2001. The file includes all episodes of care beginning *and* ending within the calendar year. Approximately 1,500,000 OASIS episodes are present in the overall data set. The University of Colorado randomly assigned about a third of the episodes to the developmental sample for initial estimation of risk-adjustment models for most outcomes. The remaining 1,000,000 were used to validate the final models derived from analysis of the developmental sample.

The data set contains the OBQI outcome indicators and 143 potential risk-adjusters derived from OASIS. The University of Colorado replaced any missing values for the risk-adjusters with mean values from the sample used to develop their risk-adjustment models. A technical memo documenting the creation and coding of risk

factors in the current models has been written by staff at the University of Colorado and can be downloaded from <http://www.cms.hhs.gov/apps/hha/riskadjappb.pdf>. All of the data needed to replicate the risk-adjustment models employed in OBQI and HHQI at the time of the study were included on the files.

The project estimated preliminary models using the 143 candidate risk-adjusters developed by the University of Colorado. Following the TAG meeting (see below), a small number of potentially important risk-adjusters available on raw data files edited by the CMS contractor were requested by the project team and provided by the University of Colorado.

Analytic Methods

Analyses were conducted in two major phases (i.e., preliminary data analyses and final data analyses). Preliminary data analyses included replication of the CMS risk-adjustment models for the first set of 11 outcomes reported in HHQI and development of alternative models for these outcomes. A TAG meeting then was conducted with experts in home health care and risk-adjustment as well as policymakers and provider representatives. The TAG provided input on our initial approach based on the results of the preliminary data analyses. Following the TAG, a final set of alternative risk-adjustment models was developed for all 41 OBQI quality indicators and the impact of alternative risk-adjustment models on agency quality ratings was examined.

Logistic regression is the statistical method currently used to risk-adjust OBQI outcomes. We also used logistic regression when estimating risk-adjustment models since the purpose of the project was to replicate the existing approach and compare it with a theory and evidence-based approach to selecting risk-adjusters. An R-squared statistic and c statistic were estimated to assess the explanatory power and fit of current and alternative models.

The R-squared statistic is the squared correlation between the observed and predicted value of the dependent variable. This pseudo R-squared measure is the one estimated by the CMS contractor at the University of Colorado and included in publicly released reports describing current risk-adjustment models. While it is not equivalent to the R-squared statistic estimated in ordinary least squares regression, throughout this report we refer to increases and decreases in the R-squared statistics as changes in the “explanatory power” of a model. The change technically represents an increase or decrease in the extent of the agreement between observed and predicted values.

Preliminary Data Analyses

Preliminary analyses were conducted on the first set of OBQI outcomes publicly reported as part of HHQI.³ The 11 measures are:

- Improvement in ambulation/locomotion;
- Improvement in transferring;
- Improvement in toileting;
- Improvement in pain interfering with activity;
- Improvement in bathing;
- Improvement in management of oral medications;
- Improvement in upper body dressing;
- Improvement in confusion frequency;
- Stabilization in bathing;
- Admitted to an acute care hospital;
- Any emergent care provided.

Current risk-adjustment models first were replicated to ensure that the samples for each model and specifications for independent and dependent variables in initial models exactly corresponded to those used by CMS when reporting the first set of HHQI outcomes. After replicating the risk-adjustment models for the 11 outcomes (a total of 15 models since three sub-models are estimated to risk-adjust Improvement in Transferring and Improvement in Pain Interfering with Activity) a theory and evidence-based approach was used to estimate alternative models for these outcomes.

Estimation of the theory and evidence-based models proceeded sequentially. A total of six models was estimated for each outcome. We began with a model limited to a core set of *clinically relevant* risk-adjusters, which included the *baseline* value of the outcome measure if it was not already among the core variables. We then added risk-adjusters at each subsequent step in the model building process.

- Model 1: Clinical Core. Clinically relevant core variables plus the baseline value of the outcome measure if it is not among the core variables.
- Model 2: Outcome Specific. Addition of other clinically relevant variables plausibly influencing the specific outcome except measures of health status prior to admission.
- Model 3: OASIS “Prior” Items. Addition of prior health status variables (e.g., physical functioning 14 days prior to admission). The rationale for examining

³ As of September 1, 2005, four of the initial 11 HHQI indicators were dropped from public reporting (i.e., Improvement in Toileting, Improvement in Upper Body Dressing, Improvement in Confusion Frequency, and Stabilization in Bathing). They were replaced by Improvement in Dyspnea, Improvement in Urinary Incontinence, and Discharge to the Community.

prior health status variables separately is because of questions regarding their reliability and possible elimination from the OASIS instrument.

- Model 4: Clinical Therapies. Addition of indicators of whether the patient was receiving specific therapies at baseline (i.e., oxygen therapy, IV/infusion therapy, enteral/parenteral nutrition, and ventilator). The rationale for examining therapies separately from other clinically relevant risk-adjusters is that they are qualitatively different from the demographic and clinical characteristics of individuals. In addition, these therapies are used to determine the case-mix adjusted Medicare home health payment rate and might seem to be subject to home health agency “gaming.” Clinical and industry experts agree, however, that these services are invasive and would not be initiated without very clear clinical indications and medical orders.
- Model 5: “Full Model” including Social Support. Addition of the living arrangement and social support indicators as risk-adjusters. We refer to this model as the “full model” since it includes all core variables available in the data set employed in the preliminary analyses, as well as risk-adjusters specific to the individual outcomes.
- Model 6: Length of Stay (LOS). We added to the full models a home care episode LOS measure grouped into the categories employed by the University of Colorado. The sole purpose for including the LOS categories was to allow comparison of model statistics and parameter estimates with the University of Colorado risk-adjustment models.

The statistics below were estimated for the current and each of the alternative risk-adjustment models:

- Number of OASIS items (i.e., the number of OASIS items that are the basis for the risk-adjusters included in the model).
- Number of OASIS elements (some OASIS items include multiple elements with each element separately assessed and marked; e.g., M0290, “High Risk Factors,” for which smoking, obesity, alcohol, and drug dependency are all individual indicators--or elements--within the single OASIS item).
- R-squared statistic (technically, a pseudo R-squared statistic that measures the extent of the agreement between observed and predicted values).
- c statistic (a measure of how well the risk-adjusters in the model correctly classify the outcome examined; a completely inaccurate model would have a c statistic of 0.5, while a completely accurate model would have a c statistic of 1.0).

Technical Advisory Group Review of Preliminary Results

A one-day TAG meeting was convened with members, including industry representatives, having expertise in home health care quality, risk-adjustment, and home health care policy. The methodology and results of the preliminary analyses were summarized and provided to the TAG in a technical memorandum prior to the meeting. TAG members also received a technical memo reviewing the current CMS method for risk-adjusting OBQI outcome measures and other relevant literature on risk-adjustment of home health care outcomes. These documents served as the starting point for discussions at the TAG meeting.

The role of the TAG was to advise the project team on the development of the alternative risk-adjustment models, in particular, to provide advice on:

- The selection of clinically and statistically sound variables from OASIS for the core set of risk factors;
- The selection of risk-adjusters specific to an outcome indicator;
- The sequential approach to model building employed in preliminary analyses;
- OASIS items to eliminate as potential risk-adjusters.

Final Data Analyses: Risk-Adjustment Models

The analytic methods for estimating a final set of alternative risk-adjustment models were very similar to those used to estimate preliminary models. First, the remaining outcomes of the current risk-adjustment models were replicated. Following refinement of the core and supplementary risk-adjusters, three sequential models were estimated for all 31 home health quality indicators currently risk-adjusted in OBQI or HHQI.

- Model 1: Clinical Core. Clinically relevant core variables plus the baseline value of the outcome measure if it is not among the core variables.
- Model 2: Outcome Specific. Addition of other clinically relevant variables plausibly influencing the specific outcome except measures of health status prior to admission.
- Model 3: OASIS “Prior” Items. Addition of prior health status variables (e.g., physical functioning 14 days prior to admission). The rationale for examining prior health status variables separately is because of questions regarding their reliability and possible elimination from the OASIS instrument.

The decision to estimate only three sequential models (as opposed to the six estimated in the preliminary analyses) was based on the advice of the TAG and further analysis of the social support risk-adjusters following the TAG meeting. The analysis confirmed that these factors contributed relatively little to the explanatory power of risk-adjustment models (see below).

Ten of the 41 OBQI quality indicators are not currently risk-adjusted. Only a model with the “clinical core” (i.e., Model 1) was estimated for each of these outcomes. The model statistics listed above in the Preliminary Data Analyses section were estimated for all risk-adjustment models developed in the Final Data Analyses.

Final Data Analyses: Agency Impacts

An agency-level analysis was conducted to examine how alternative approaches to risk-adjustment of the OBQI quality indicators affect an agency’s quality ratings. The agency-level analysis employed the validation data set provided by the University of Colorado with approximately 5,000 agencies included on the calendar year 2001 files. Two “adjusted” agency outcome rates were calculated for each of the 31 outcomes currently risk-adjusted in OBQI or HHQI. For example, an agency’s adjusted rate for Improvement in Bathing (see formula below) first was estimated using the current CMS risk-adjustment model. The adjusted rate then was re-estimated using the full alternative model developed to risk-adjust Improvement in Bathing in this project (i.e., the final version of Model 3). Not all agencies have estimates for all outcomes. If an agency has fewer than 20 patients with the potential to have an outcome, that outcome is not included in agency OBQI reports or in HHQI. We followed this approach and did not estimate the adjusted outcome for an agency when there were fewer than 20 patients with the potential to have the outcome.

There were five steps in the calculation of the adjusted agency outcome rate:

1. Identify the patients at an agency with the potential to have an outcome.
2. Determine the *observed percent* with the outcome at each agency where at least 20 patients have the potential to have the outcome.
3. Estimate the predicted probability of the outcome at the individual level using: (1) the current risk-adjustment model, and (2) the final alternative model.
4. Calculate the *average* predicted probability of the outcome at each agency when the current risk-adjustment model is used, and then when the alternative model is used.
5. Adjust the agency mean so that agencies can be compared to the national average for an outcome using the formula published by the University of Colorado:

$$\text{Adjusted Agency Outcome Rate} = \text{Observed Agency Outcome Rate} + (\text{Observed National Outcome Rate} - \text{Agency Predicted Outcome Rate})$$

The following statistics then were estimated for each of the 31 outcomes:

- Number and percent of agencies with the outcome (i.e., agencies with 20 or more episodes where the patient had the potential to have an outcome).
- Mean and standard deviation of the absolute difference in the adjusted percent of patients at each agency with the outcome.
- Percentage point difference at the 5th percentile of the distribution of differences in the adjusted percent of patients at each agency with the outcome.
- Percentage point difference at the 95th percentile of the distribution of differences in the adjusted percent of patients at each agency with the outcome.
- Rank of an agency based on the current risk-adjustment model (an integer number with 1 representing the best rank among all agencies).
- Rank of an agency based on the alternative risk-adjustment model.
- Percent of agencies with rankings that differ by two or more deciles (e.g., an agency is in the eighth decile using the current risk-adjustment method and in the sixth decile using the alternative model).
- Simple t-test of the statistical significance of the absolute difference in the adjusted proportion of patients with the outcome.
- Spearman's rank correlation test of the association between the two rankings of agency performance as calculated using the current versus alternative risk-adjustment models.

A sensitivity analysis subsequently was conducted to better understand the impact on agency quality ratings of the inclusion of outcome-specific and OASIS "prior" items in the alternative risk-adjustment models of the OBQI quality indicators. Specifically, the agency-level analysis was repeated with only the core risk-adjusters included in the alternative risk-adjustment model for each of the 31 OBQI outcomes (i.e., the final version of Model 1). The results with and without the outcome-specific and OASIS "prior" items as risk-adjusters then were compared.

DEVELOPMENT OF ALTERNATIVE MODELS AND RESULTS OF ANALYSES

The *preliminary* set of theory and evidence-based core risk-adjusters in the first phase of the project, where we focused on the original 11 HHQI outcomes, was drawn from a number of domains covered by the OASIS instrument. In selecting the core set as well as supplemental risk factors, special attention was paid to variables that are clinically relevant and suitable for inclusion in electronic health records. The preliminary set of core risk-adjusters is listed in Table 2. The only risk-adjusters that are not clinical or patient characteristics likely to be included in an electronic health record in this preliminary set are those under the Informal Support/Assistance and Living Situation sub-domains.

Preliminary Analyses

Currently, different subsets of home care patients are assessed when determining an agency's performance on each OBQI quality indicator. The three utilization outcomes are computed for all episodes except those ending in death (i.e., approximately 98% of episodes are included). For all other outcomes, two additional criteria are used to determine whether or not a given episode will be included. First, the episode must end in discharge to the community (approximately 70% of episodes), because the endpoint measures used to calculate improvement or stabilization on the non-utilization outcomes are collected only on the more comprehensive assessment made for those patients discharged to the community. Second, the start of care (SOC) assessment item for the outcome must permit the patient to have the potential to have the outcome. OBQI health status *improvement* measures are binary indicators of whether the patient's status at discharge is better than at baseline. Individuals who cannot improve because they do not have any deficit in the quality indicator at baseline are excluded from estimates of improvement. OBQI health status *stabilization* measures are binary indicators of whether the patient's status at discharge is *the same or better* than at baseline. Individuals who cannot deteriorate because they are in the worst category of the quality indicator at baseline are excluded from stabilization estimates.

The initial developmental sample from which the University of Colorado identified individuals with the potential to have an outcome is 125,000 episodes. However, the developmental sample was supplemented by the University of Colorado for four of the 11 HHQI outcomes due to low numbers of episodes where patients had the potential to have the outcome. The developmental sample was 250,000 episodes for Improvement in Upper Body Dressing, Improvement in Transferring, and Improvement in Oral Medications, and approximately 350,000 episodes for Improvement in Confusion.

Respecification of Core Risk-Adjustors

After replicating the risk-adjustment models developed by the University of Colorado, alternative models were estimated using exactly the same coding of risk-adjustors as in current models with two exceptions where theory or prior evidence suggested other codings were likely to be more meaningful. Instead of a continuous measure of the age of the home care patient, four categories were specified: <65; 65 to <75 (reference category); 75 to < 85; 85 or older. The other change was the creation of a single numeric scale from the individual OASIS ADL and IADL measures at baseline. Spector and Fleishman (1998) examined the psychometric properties of ADLs and IADLs and concluded that they represent a single construct. We approximated the scale developed by Spector and Fleishman by classifying persons as either independent or dependent on human help to complete each ADL and IADL. The scale is a simple count of the number of ADLs and IADLs that the patient needs human help to complete. It ranges from 0 to 14.

After initial models were estimated, we examined the direction and consistency of the effect of the core risk-adjustors across the 11 HHQI quality indicator outcome models. A number of the original risk-adjustors were integer scales that did not appear to be linearly related to the HHQI quality indicators and/or the effect on the outcome measures was the opposite of what would be expected.

- Hearing impairment was dropped from the core set of measures because of inconsistent effects and limited conceptual importance.
- Vision impairment was respecified into two dummy variables with a reference category of no impairment.
- Speech impairment was grouped into four categories with no speech impairment as the reference category and a top category that combined levels 3, 4 and 5.
- The original depression measure is a count of depressive symptoms, ranging from 0 to 5, which is highly skewed toward no symptoms; it was respecified as two dummy variables (i.e., 1 symptom only, 2 or more symptoms) with a reference category of no symptoms.
- A set of mutually exclusive indicators was created to measure frequency of urinary incontinence (“during the night,” “during the day,” “night and day,” and “urinary catheter present”) with a reference category of no incontinence.
- A set of mutually exclusive categorical variables was created for bowel incontinence similar to those created for urinary incontinence.
- A set of mutually exclusive categorical variables was created to indicate the type of help provided by the primary caregiver (i.e., the primary caregiver provides “help with ADLs (with or without providing help with IADLs),” “help with IADLs

only,” or “some other type of help”) with a reference category of no primary caregiver.

We also categorized dyspnea which was included in the risk-adjustment models of the ADL outcomes. The original integer scale was not linearly related to these outcomes. In some models of ADL outcomes, the direction of the effect of dyspnea was positive, suggesting improvement in ADL outcomes as the level of impairment increased (although generally decreasing in magnitude as impairment level increased). In other models the effect of higher levels of impairment on ADL outcomes was negative although never statistically significant. Despite its unexpected and inconsistent effects, we left dyspnea in the *preliminary* alternative risk-adjustment models for ADLs because of its conceptual importance. Dyspnea did have the expected effect on the utilization outcomes, with the probability of Emergent Care and Acute Care Hospitalization rising as the severity of dyspnea increased.

Respecification of Baseline and Prior Values of Outcome Indicators

The baseline and “prior” values of the outcome indicators were treated as continuous variables, following the approach of the University of Colorado, in our initial analyses. Higher values always represent a “sicker” state. Subsequently, these indicators were respecified as categorical variables to test the assumption that baseline and prior variables are linearly related to the outcome indicators. The respecification improved the explanatory power of the risk-adjustment models--in a few cases, substantially.

Summary of Preliminary Modeling Results

Six models were estimated for each outcome. We began with a model limited to the core set of clinical, demographic and payment risk-adjusters, including the *baseline* value of the outcome measure if it was not already among the core variables. Outcome-specific risk-adjusters were added at subsequent steps: Model 2 included other clinical characteristics at baseline that might plausibly affect the outcome, and Model 3 included measures of clinical status *prior to* home health admission. Four clinical therapies at baseline (i.e., oxygen therapy, IV/infusion therapy, enteral/parenteral nutrition, and ventilator) then were added to the risk-adjustment models for all 11 outcomes (Model 4). The living arrangements and social support indicators subsequently were added to all models (Model 5). Finally, LOS was added solely to allow comparison of current and alternative model statistics and parameter estimates.

By Model 3 (i.e., after the addition of the *prior* health status measures) the risk-adjustment models developed in the preliminary analyses generally approached but did not exceed the explanatory power of the HHQI risk-adjustment models developed by the University of Colorado. The effect of the measures of health status prior to admission on the explanatory power of the risk-adjustment models varied depending on the outcome indicator. They had a modest effect in the *improvement* in ADL models as

well as the one improvement in an IADL model (i.e., Improvement in Management of Oral Medication). Prior health status risk-adjusters had virtually no effect in the remaining models of health status outcomes and were not included in the risk-adjustment models of the two utilization outcomes.

The social support indicators, while conceptually important, added almost nothing to the explanatory power of risk-adjustment models that already included clinically relevant variables. The one exception was the Improvement in Oral Medication risk-adjustment model where there was a one percentage point increase in the R-squared statistic after the addition of the core social support measures and a statistically significant improvement in the fit of the model ($p < 0.001$).

The generally lower explanatory power of the *preliminary* alternative models is not surprising since the “stepwise” logistic regression technique used to develop the current models is likely to result in models with close to the best explanatory power possible for the data set analyzed. In addition, the exclusion of LOS from the alternative models, because it can be affected by the quality of care provided and therefore is not an appropriate risk-adjuster, results in a reduced R-squared value for the alternative utilization outcome models relative to the current models.

Whether the alternative models are more parsimonious than the University of Colorado models depends on whether the models are considered individually or *all* 11 are considered together. Only two of the preliminary risk-adjustment models were more parsimonious than the corresponding models developed by the University of Colorado to risk-adjust the 11 initial HHQI outcome indicators. The total number of OASIS items and elements used to risk-adjust all 11 HHQI outcome indicators, however, was smaller.

Technical Advisory Group (TAG) Meeting

A TAG meeting was conducted in Washington, DC, on August 20, 2004. Members of the TAG, which included industry representatives, were experts in home health care quality, risk-adjustment, and home health policy. The TAG made a number of comments and recommendations based on a review of preliminary analysis results and other background documents.

Strong support was expressed for identifying a core set of risk-adjusters (for statistical reasons as well as for face validity and interpretation of risk-adjustment models). TAG members agreed that the original file of risk-adjusters obtained from the University of Colorado had some limitations and that additional OASIS data should be requested to allow further development of three types of risk-adjusters: diagnoses, social support, and payer. Diagnoses were aggregated into broad body system categories on the original file. With the specific diagnosis information collected on OASIS, it will be possible to specify diagnoses that occur frequently in the home care population (e.g., diabetes) as well as conceptually important medical conditions. It was pointed out that some important diagnoses typically are recorded as secondary, not

primary, diagnoses (e.g., multiple sclerosis) and that diagnosis risk-adjusters should take OASIS secondary diagnoses into account.

The TAG also recommended further examination of living arrangement and social support risk-adjusters after the original OASIS variables are obtained because of their high face validity for clinicians. There was a discussion about more detailed living arrangement data and whether knowing that the patient lives with his or her spouse, as opposed to other family members, is likely to perform better as a risk-adjuster. TAG members pointed out that it is possible that too much assistance could delay improvement in some activities. Also, it was suggested that the project team think about whether it is possible to identify spouses who can help with care versus those who cannot or who may require their own care.

There was a discussion of the original payer data (M0150) as well. Medicaid as a payer is to some extent an indicator of economic status. It also is likely to be an indicator of more permanent disability and/or chronic disease. One of the industry experts also suggested that agency staff completing OASIS assessments tend to check Medicare as a payer if there is any chance that the episode might be billed to Medicare. A very large share of episodes (greater than 94%) on the file obtained from the University of Colorado report Medicare as a payer. In addition to home health agency coding practices, this is partly due to the way episodes of home health care are selected for OBQI outcome analysis. All episodes must start *and* finish in the calendar year. This eliminates many long episodes that are more likely to have Medicaid as the payer including episodes where home health was provided the entire year but admission and discharge are outside the calendar year.

The rationale for examining the baseline therapy measures (i.e., oxygen therapy, IV/infusion therapy, enteral/parenteral nutrition, and ventilator) separately from other clinically relevant risk-adjusters was discussed by the TAG. The risk-adjustment experts agreed that it generally is a bad idea to include actual services in payment or outcome risk-adjustment models since it may encourage inappropriate use of the services. The clinical and industry experts, however, pointed out that these services were invasive and would not be initiated without very clear clinical indications and medical orders. These measures generally had little impact on the explanatory power of the 11 HHQI risk-adjustment models but may be appropriate as outcome-specific risk-adjusters in some cases.

One TAG member indicated that sensory measures (e.g., vision, speech) tend to vary in their relationship with outcomes and that the project team may want to consider dropping them from the core set of risk-adjusters and including them as outcome-specific risk-adjusters when appropriate. It also was suggested that “Life Expectancy” be dropped from consideration since agencies questioned its reliability and it is unclear whether it will be included in future versions of OASIS.

Overall, there was agreement that the sequential model building approach used by the project team was logical. There also was agreement that LOS should not be

included as a risk-adjuster. Members of the TAG also agreed that agency-level analyses are an important part of the assessment of differences between current and alternative risk-adjustment models.

Final Data Analyses: Risk-Adjustment Models

Development of Final Set of Core and Supplemental Risk-Adjusters

The selection of the final set of core risk-adjusters was based on findings from the preliminary analyses, comments of TAG members, and examination of a small number of additional OASIS items provided by the University of Colorado following the TAG meeting. The analyses conducted after receipt of additional OASIS data included respecification of the Living Situation and Informal Support/Assistance risk-adjusters. Specifically, alternative specifications were explored utilizing the more detailed data on living arrangements (with the “lives with spouse/family” category in initial models separated into two categories) and the person providing assistance.

The additional data and respecification, however, did not substantially affect the contribution of the living situation and informal support/assistance measures to the explanatory power of the HHQI risk-adjustment models that already included demographic, payer and clinical measures. The one exception is the risk-adjustment model for Improvement in Medication Management. When the living arrangement and social support measures were added to a model with demographic, payer and clinical measures (i.e., added to Model 3), the R-squared statistic increased from 15.7% to 16.7%. These conceptually important measures were excluded from the alternative models because of the limited contribution to the explanatory power of the risk-adjustment models.

Table 3 lists the final set of core risk-adjusters in the alternative models along with their specification. A total of 43 OASIS items were used to construct the core risk-adjusters. The demographic and insurance measures clearly are likely to be included in electronic health records and the remaining items are all clinically relevant. The one core risk-adjuster that varies from model to model is the baseline value of the outcome indicator. The baseline value, specified as a categorical variable, tends to make a relatively large contribution to the explanatory power of risk-adjustment models. It appears to be adjusting for differences in the probability of improving (or stabilizing) related to the number of levels of the OASIS item.

Risk-adjusters specific to each outcome, other than measures of health status *prior* to admission, are listed in Tables 4a-4d. They are reported by domain of the outcome indicator (e.g., Table 4a lists the risk-adjusters specific to ADL outcome models). Some items are common to all risk-adjustment models within a domain. For example, obesity is included in the risk-adjustment models of all ADL outcomes. Other items are specific to a single outcome. For example, whether a patient smokes is specific to the

Improvement in Dyspnea risk-adjustment model. Generally, 2-3 outcome-specific items were added to each risk-adjustment model. All of these items are clinical factors.

Tables 5a-5d list the measures of clinical status *prior* to home health admission that were added to the risk-adjustment models of selected OBQI outcomes. As noted above, these OASIS items were examined separately from other outcome-specific risk-adjusters because of questions about their reliability and possible elimination from the OASIS instrument. There were no directly related, conceptually important prior health status risk-adjusters used for four OBQI outcomes (i.e., Improvement in Dyspnea and the three utilization outcomes).

Comparison of Current and Alternative Models

The OBQI quality indicators are grouped into six broad domains by the University of Colorado: (1) ADLs, (2) IADLs, (3) Physiologic indicators, (4) Emotional/Behavioral measures, (5) Cognitive measures, and (6) Utilization Outcomes (see Table 1). We first present results from all models and then by domain. The models developed by the University of Colorado are referred to as the “current” models; the two final alternative models are referred to as the “core” alternative model (which includes only core risk-adjusters) and the “full” alternative model (i.e., Model 3 which includes outcome specific and prior OASIS items, or Model 2 where there are no relevant prior items).

The “full” alternative models typically have *slightly lower explanatory power* than the current risk-adjustment models. Specifically, the R-squared statistic for the full model tends to be within 1-2 percentage points of the R-squared statistic for the model developed by the University of Colorado. There is a similar pattern for the c statistic. While the number of OASIS items and elements is sometimes larger and sometimes smaller for the alternative models compared with current models, the overall number of OASIS items and elements employed when risk-adjusting all 31 OBQI outcome indicators is considerably smaller for the full alternative models (64 versus 88 OASIS items, and 93 versus 135 OASIS elements).

ADL and IADL Outcomes. The ADL and IADL outcomes represent 23 of the 41 OBQI quality indicators and over two-thirds of the 31 outcome indicators currently risk-adjusted by the University of Colorado. The performance (i.e., explanatory power as measured by the R-squared statistic) of the alternative and current risk-adjustment models for ADL and IADL outcomes is presented graphically in Figure 1 and Figure 2. Table 6a and Table 7a summarize the model statistics for all ADL and IADL outcome models, respectively, and Table 6b and Table 7b present the detailed regression results for the full alternative models estimated for the 23 ADL and IADL outcomes.⁴

As previously discussed, most of the full alternative ADL and IADL models have slightly lower explanatory power than the current models. This is not surprising since a “stepwise” approach was used to develop the current models. An exception is the alternative risk-adjustment model for the Improvement in Ambulation outcome where

⁴ Regression results for the core model (Model 1) and Model 2 are available from the project team upon request.

the R-squared statistic is more than six percentage points greater than the R-squared statistic for the current model. The ADL and IADL *stabilization* outcomes, it should be noted, are highly skewed (i.e., a very high proportion of those potentially able to stabilize do stabilize). This may explain the relatively low R-squared and relatively high c statistics for both current and alternative models.

The outcome-specific risk-adjusters generally contribute very little to the explanatory power of the ADL and IADL risk-adjustment models that already include the core risk-adjusters. In contrast, the *prior* OASIS items contribute substantially to the explanatory power (roughly two percentage points to the R-squared statistic) of almost all of the risk-adjustment models of *improvement* in ADLs and IADLs, but not *stabilization* in ADLs and IADLs. There is a similar pattern for c statistics.

Physiologic Outcomes. Figure 3 graphically presents the performance of the alternative and current risk-adjustment models for the five physiologic outcomes currently risk-adjusted in OBQI. Table 8a summarizes the model statistics for all physiologic outcome models and Table 8b presents the detailed regression results for the full alternative models estimated for the five physiologic outcomes that are currently risk-adjusted, and the alternative models with only core risk-adjusters for the four that are not currently risk-adjusted in OBQI.

The outcome-specific risk-adjusters tend to make a slightly greater contribution to the explanatory power of the physiologic outcome models compared to ADL and IADL outcome models. The effect of the prior OASIS items, on the other hand, is modest. Among the physiologic outcomes, the full alternative risk-adjustment model for Improvement in UTI performs considerably worse than the current UTI risk-adjustment model. The R-squared statistic for Model 3 is 5.9% compared to 12.1% for the current model, and corresponding c statistics are 0.665 and 0.740 (see Table 8a). The main reason for this difference is the exclusion of home health episode LOS from the alternative model.

Emotional/Behavioral Outcomes. None of the emotional/behavioral outcomes currently is risk-adjusted in OBQI. Only Model 1 (i.e., the model including only the core risk-adjusters) was estimated for outcomes that are not currently risk-adjusted. The model statistics for the alternative models for the three emotional/behavioral outcomes are reported in Table 9a. The detailed regression results for the final alternative models estimated for the emotional/behavioral outcomes are presented in Table 9b. The R-squared and c statistics for all three models are low.

Cognitive Outcomes. There are three cognitive outcomes in OBQI but currently only Improvement in Confusion Frequency is risk-adjusted. The right-most bar in Figure 3 graphically presents the performance of the alternative and current risk-adjustment models for Improvement in Confusion Frequency. Neither the outcome-specific nor the prior OASIS items contribute substantially to the explanatory power of the Improvement in Confusion Frequency model that already includes the core risk-adjusters. Table 10a summarizes the model statistics for all cognitive outcome models. Table 10b presents

the detailed regression results for the full alternative model estimated for Improvement in Confusion Frequency as well as the alternative models with only core risk-adjusters for the two cognitive outcomes that are not currently risk-adjusted in OBQI. The R-squared and c statistics for all models are relatively low although the c statistic for the Stabilization in Cognitive Functioning risk-adjustment model that includes only the core risk-adjusters is 0.738 indicating adequate ability to predict what is a highly skewed outcome (i.e., over 90% of individuals who could stabilize did stabilize).

Utilization Outcomes. Figure 4 graphically presents the performance of the alternative and current risk-adjustment models for the three utilization outcomes (all three are risk-adjusted in OBQI). Table 11a summarizes the model statistics for all current and alternative utilization outcome models and Table 11b presents the detailed regression results for the full alternative models estimated for the utilization outcomes.

Two of the three outcome-specific variables at baseline (Dyspnea and IV/Infusion therapy) are highly statistically significant in the final, full risk-adjustment models for all three utilization outcomes ($p < 0.001$). Nevertheless, the outcome-specific variables as a group have only a very small effect on the explanatory power of the risk-adjustment models for the utilization outcomes. When added to models already including the core risk-adjusters, the R-squared and c statistics increase by at most roughly half a percentage point or 0.005, respectively. No prior OASIS items were included in the alternative models for these outcomes. As noted previously, the exclusion of LOS reduces the explanatory power of the alternative models for the utilization outcomes.

Comparison of Overall Number of OASIS Items and Elements Used in Risk-Adjustment

The overall number of OASIS *items* used in current and alternative risk-adjustment models (out of a total of 95 “M0” items) is graphically presented in Figure 5. The core OASIS items in the alternative models are in the lower left-hand corner shaded in the darkest color. On the diagonal (in the next darkest shade) are the OASIS outcome specific and “prior” items included in the full alternative models (i.e., Model 3 for the outcomes with “prior” OASIS items and Model 2 where there are no relevant “prior” items). The OASIS items for the additional variables used in one or more of the current risk-adjustment models but not in the alternative models are in the next darkest shade. Sixty-four OASIS items were used to construct the risk-adjusters included in one or more of the full alternative models, compared to 88 for the current models developed by the University of Colorado. There are seven OASIS items that are not used in either the current or alternative models (unshaded in the upper-right-hand corner of Figure 5). The “M0” items used for case-mix classification in the Medicare prospective payment system are in bold with an asterisk.

Some OASIS *items* include multiple *elements* with each element separately assessed and marked (i.e., the OASIS items with instructions to mark all categories that apply). The OASIS *elements* used in current and alternative risk-adjustment models are graphically presented in Figure 6 in the same manner as the OASIS *items* in Figure 5.

There are a total of 180 OASIS *elements* with 93 used to construct the risk-adjusters in the full alternative models compared to 135 in the models developed by the University of Colorado. All OASIS *elements* in the alternative risk-adjustment models also are used in current models with two exceptions: the Current Payer elements “Medicaid traditional fee-for-service” (M0150_3) and “Medicaid HMO/managed care” (M0150_4), both of which are highlighted on the left side of Figure 6. The “M0” elements used for case-mix classification in the Medicare prospective payment system are in bold with an asterisk.

Final Data Analyses: Agency Impacts

The results of the agency analyses are reported by outcome domain in Tables 12-16. Overall, the results suggest that the quality ratings for most agencies and most outcomes are similar regardless of whether the current or alternative “full” model is used to risk-adjust outcomes. The difference tends to be minimal (no more than one to two percentage points) between the current and alternative risk-adjusted percent of an agency’s patients with each outcome (see Figure 7). For a small share of agencies (i.e., those below the 5th or above the 95th percentile of the distribution), however, differences exceed four percentage points for Improvement in Ambulation, Improvement in Light Meal Preparation, Improvement in UTI, Acute Care Hospitalization, and Discharge to the Community (see columns 3 and 4 of Tables 12-16).

The average of the differences at each agency is greatest for Discharge to the Community (0.374 percentage points) followed by Improvement in UTI (0.287 percentage points). In the case of the UTI outcome, the average percent of patients improving at each agency was 83.7% when estimated using the current risk-adjustment model and 83.9% when estimated using the alternative full model. Despite the very small size of average differences, they often are statistically significant because sample sizes tend to be large, ranging from a low of 771 agencies when comparing the risk-adjusted Improvement in UTI outcomes, to 4,798 agencies in analyses of the percent of patients with an Acute Care Hospitalization.

While the magnitude of the difference between outcome estimates using the two risk-adjustment approaches is important, it is the ranking of each agency relative to others that is likely to be of most concern to providers. The next-to-the-last column in Tables 12-16 reports estimates of Spearman’s rank correlation coefficient. These correlation coefficients are presented graphically in Figure 8. A value of one would indicate that rankings are exactly the same. For most outcomes, in fact, the correlation coefficient is close to one (i.e., it is above 0.950). The two lowest correlation coefficients are 0.912 for Improvement in UTI and 0.925 for Improvement in Ambulation.

The final column of each of the agency-level analysis tables reports the number and percent of agencies that change two or more deciles in rank when the risk-adjustment method is changed. (An agency, for example, would have to decline from the top decile--or top 10% in ranking--to the third decile or lower to be identified as

changing two or more deciles.) The outcomes with the greatest number of agencies shifting at least two deciles in rank, not surprisingly, are those with the lowest Spearman's rank correlation coefficient. Among the agencies analyzed, 20.1% shifted two or more deciles in their Improvement in UTI ranking while 17.3% changed two or more deciles in their Improvement in Ambulation ranking.

Agency quality rankings differ the most where the difference in the explanatory power of the current and alternative risk-adjustment models is substantial. In the case of Improvement in Ambulation, the alternative risk-adjustment model explains considerably more of the variation in the outcome than the current model. It is the reverse for the Improvement in UTI outcome where the current model includes LOS among the risk-adjusters. Agency quality rankings for the utilization outcomes do not differ as much as might be expected given the exclusion of LOS from the alternative models and, as a result, the lower explanatory power of alternative versus current risk-adjustment models.

A sensitivity analysis then was conducted to better understand the impact on agency quality ratings of the inclusion of outcome-specific and OASIS "prior" items in the alternative risk-adjustment models of the OBQI quality indicators. Specifically, agency-level analyses were repeated with only the core risk-adjusters included in the alternative risk-adjustment models (i.e., the final version of Model 1 for each of the 31 currently risk-adjusted OBQI outcomes). The results of the sensitivity analysis are presented graphically in Figure 9 and Figure 10. The basic pattern of impacts is the same but, as expected, the difference in risk-adjusted outcomes using the current and alternative approaches increases (to between one and three percentage points for most agencies on almost all outcomes). For almost a third of the outcomes the Spearman rank correlation coefficient now is in the 0.900-0.950 range with the correlation coefficient for Improvement in Ambulation falling slightly below 0.900.

Finally, it is important to note that for many OBQI outcomes a relatively large number of agencies had fewer than 20 patients in the analytic sample with the potential to have the outcome. These agencies, therefore, were excluded when examining the impact of the alternative approaches to risk-adjustment on the percent of patients with the outcome. The number of agencies excluded is particularly large for two outcomes. All but 14.7% of agencies were excluded when examining the impact of alternative risk-adjustment approaches on estimates of Improvement in UTI and all but 19.5% were excluded when examining the impact on estimates of Improvement in Bowel Incontinence.

CONCLUSIONS AND IMPLICATIONS

The purpose of this project was to develop and test alternative risk-adjustment approaches to assessing the quality of home health care. A data-driven “stepwise” approach currently is used to risk-adjust OBQI quality indicators with a separate set of risk-adjusters in each outcome model. In this project, a theory and evidence-based approach was used to develop alternative risk-adjustment models for the OBQI quality indicators. Advantages of a theory and evidence-based approach include simplicity, understandability, stability of the risk-adjustment models over time, conceptual meaningfulness, and the potential for greater parsimony in data elements when a large number of outcome indicators are being risk-adjusted as is the case in the OBQI program.

The alternative models were developed within the framework of the uniform data collection system (OASIS) in place at the time of the study. A project goal was to develop alternative models that could be implemented using existing data sources and project resources limited analyses to OASIS data elements. The examination of alternative risk-adjusters developed from other data sources (e.g., Medicare claims) is an important area of future research.

Based on theory and prior empirical research, a core set of risk-adjusters was identified from among the content areas covered by OASIS. These core items were included in the risk-adjustment models for all outcomes. A small number of outcome-specific risk-adjusters then was added to each model. The outcome-specific risk-adjusters are OASIS measures of patient status on admission, as well as status *prior to admission*, plausibly related to a specific outcome or outcome domain.

At the time of this study, 31 of the 41 OBQI quality indicators were risk-adjusted in either OBQI or HHQI. The analysis focused on a comparison of the current and alternative models for these 31 outcomes. In particular, it focused on statistics that measure how well a model predicts an outcome, as well as the number of OASIS items and elements needed to construct the risk-adjusters. While the OBQI quality indicators represent six broad health and functional domains, 22 of the 31 risk-adjusted outcomes (over 70%) are ADL or IADL outcomes.

There are important tradeoffs and differences between the current and alternative approaches to risk-adjusting OBQI quality indicators. The first is the generally higher explanatory power of the current models versus the simplicity of the alternative models and their overall reliance on a smaller number of OASIS items and elements. That current models generally have marginally better explanatory power than the alternative models is not surprising since the “stepwise” approach is likely to result in models with close to the best explanatory power possible for the data set analyzed. At the same time, however, it leads to the selection of a large number of risk factors when all outcome measures are considered. In addition, because the stepwise approach “fits”

models to the data on which they are developed, the explanatory power of these models is likely to decline when they are applied to new data sets.

A second tradeoff is between the “full” alternative models that include the outcome-specific risk-adjusters and alternative models with only the core set of risk-adjusters. The latter tend not to predict outcomes as well as the full models. Measures of physical functioning *prior to home health admission* are particularly significant in the risk-adjustment models of ADL and IADL improvement. The “prior” OASIS items, however, are more difficult than many other items for home health agencies to collect and are thought to be less reliable than other clinical measures. Should they be dropped from the OASIS instrument, the explanatory power of the risk-adjustment models for most ADL and IADL improvement models would be reduced roughly two percentage points.

The decision to exclude home health LOS from the alternative models, in addition, has a significant impact on the risk-adjustment models for the small but important subset of utilization outcomes. LOS was excluded because it can be affected by problems in the care process that also affect outcomes (i.e., low quality care can cause a longer stay as well as worse outcomes). If LOS is included in risk-adjustment models, conclusions about the quality of agency care could be erroneous due to quality problems being risk-adjusted away. The TAG convened to review preliminary models developed by the project team strongly supported the decision to exclude LOS from risk-adjustment models. The consequence, however, is reduced explanatory power for a small number of outcomes. A possible methodological solution, which has data burden and simplicity implications, is to collect information on the timing of all of the utilization outcomes (e.g., hospitalization) and estimate hazard models that take into account the time to the outcome of interest.

Our agency-level analysis examined how the alternative approaches to risk-adjustment of the OBQI indicators affect an agency’s quality ratings as currently calculated by CMS. For most agencies and most outcomes the adjusted proportion of patients with an outcome is similar regardless of whether the current or the “full” alternative model is used to risk-adjust outcomes. Of greater potential concern to providers, however, is the ranking of each agency relative to others, irrespective of the size of the difference in risk-adjusted outcomes. Our analysis found that the ranking of agencies using current risk-adjustment models and the ranking using the “full” alternative risk-adjustment models are in close agreement for most outcomes.

The agency-level analyses were repeated using only the “core” risk-adjusters in the alternative risk-adjustment models. This was done in order to better understand the contribution of the outcome-specific and OASIS “prior” items to the finding of similar quality ratings regardless of risk-adjustment approach. The basic results hold. However, as would be expected, the quality ratings are not as close when outcome-specific and OASIS “prior” items are dropped from the alternative risk-adjustment models of the OBQI indicators.

One limitation of the agency analysis is that for some outcomes a relatively large share of agencies was excluded because they had too few patients with the potential to have the outcome (i.e., less than 20). Nevertheless, the results suggest that the relatively small reduction in explanatory power of most of the alternative risk-adjustment models is unlikely to have an effect on the ranking of the majority of agencies on OBQI quality indicators.

Overall, a theory and evidence-based modeling approach has the potential to simplify risk-adjustment and provide a consistent and stable basis for risk-adjustment relative to the current approach. This should make it more understandable to providers and encourage individual agencies to risk-adjust their own outcomes. The reliance on a smaller number of OASIS data elements, in addition, would contribute to the Department's efforts to streamline the OASIS instrument and potentially facilitate the identification of a parsimonious set of clinical measures appropriate for data exchange in an electronic health record environment.

REFERENCES

- Andersen, R. & Newman, J.F. (1973). Societal and individual determinants of medical care utilization in the United States. *The Milbank Quarterly*, 51, 95-124.
- Blumenthal, D., Weissman, J.S., Wachterman, M., Weil, E., Stafford, R.S., Perrin, J.M., Ferris, T.G., Kuhlthau, K., Kaushal, R., & Iezzoni, L.I. (2005). The who, what, and why of risk adjustment: A technology on the cusp of adoption. *Journal of Health Politics, Policy and Law*, 30(3), 453-473.
- Cheh, V., & Black, W. (2002). *Did the balanced budget agreement of 1997 affect the quality of Medicare home health services? Final report (MPR Reference No. 8635-500)*. Princeton, NJ: Mathematica Policy Research, Inc.
- Feldman, P.H., Murtaugh, C.M., Pezzin, L.E., McDonald, M.V., & Peng, T.R. (2005). Just-in-time evidence-based e-mail "reminders" in home health care: Impact on patient outcomes. *Health Services Research*, 40(3), 865-885.
- Fortinsky, R.H., & Madigan, E.A. (1997). Home care resource consumption and patient outcomes: What are the relationships? *Home Health Care Services Quarterly*, 16(3), 55-73.
- Iezzoni, L.I. (Ed.). (2003). *Risk adjustment for measuring health care outcomes (3rd ed.)*. Chicago, IL: Health Administration Press.
- Institute of Medicine. (2001). *Improving the quality of long-term care* (G.S. Wunderlich, & P. Kohler, Eds.). Washington, DC: National Academy Press.
- Johnson, M.L. (2003). Risk assessment and adjustment: Adjustment for sick patients or a sick system? *Medical Care*, 41(1), 4-7.
- Kinatukara, S., Rosati, R.J., & Huang, L. (2005). Assessment of OASIS reliability and validity using several methodological approaches. *Home Health Care Services Quarterly*, 24(3), 23-38.
- Kramer, A.M., Shaughnessy, P.W., Bauman, M.K., & Crisler, K.S. (1990). Assessing and assuring the quality of home health care: A conceptual framework. *The Milbank Quarterly*, 68(3), 413-443.
- Madigan, E.A., & Fortinsky, R.H. (2000). Additional psychometric evaluation of the outcomes and assessment information set (OASIS). *Home Health Care Services Quarterly*, 18(4), 49-62.

Mukamel, D.B., & Brower, C.A. (1998). The influence of risk adjustment methods on conclusions about quality of care in nursing homes based on outcome measures. *The Gerontologist*, 38(6), 695-703.

Mukamel, D.B., Watson, N.M., Meng, H., & Spector, W.D. (2003). Development of a risk-adjusted urinary incontinence outcome measure of quality for nursing homes. *Medical Care*, 41(4), 467-478.

Murtaugh, C.M., Pezzin, L.E., McDonald, M.V., Feldman, P.H., & Peng, T.R. (2005). Just-in-time evidence-based e-mail "reminders" in home health care: Impact on nurse practices. *Health Services Research*, 40(3), 849-864.

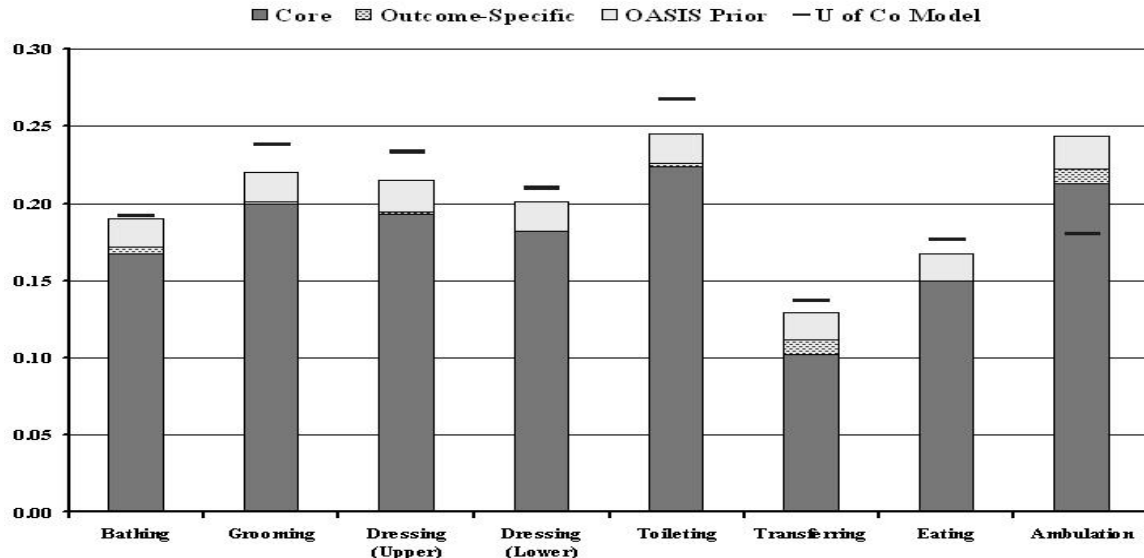
Peng, T.R., Navaie-Waliser, M., & Feldman, P.H. (2003). Social support, home health service use, and outcomes among four racial/ethnic groups. *The Gerontologist*, 43(4), 503-513.

Schlenker, R.E., Powell, M.C., & Goodrich, G.K. (2005). Initial home health outcomes under prospective payment. *Health Services Research*, 40(1), 177-193.

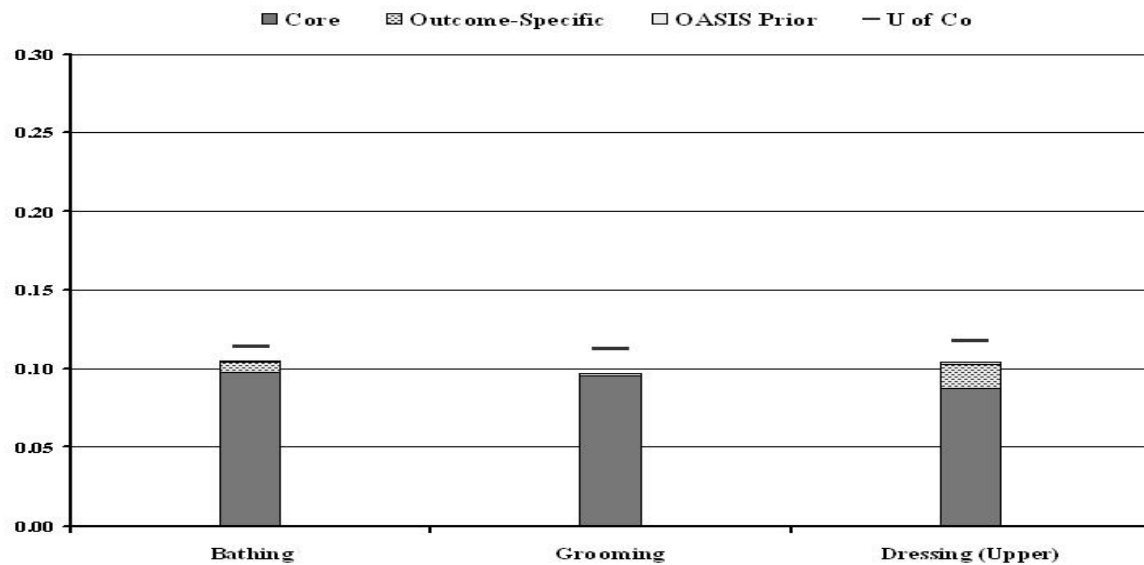
Spector, W.D., & Fleishman, J.A. (1998). Combining activities of daily living with instrumental activities of daily living to measure functional disability. *Journal of Gerontology: Social Sciences*, 53B(1), S46-S57.

FIGURES

FIGURE 1. Performance of Alternative and Current Risk-Adjustment Models for Improvement in ADL Outcomes

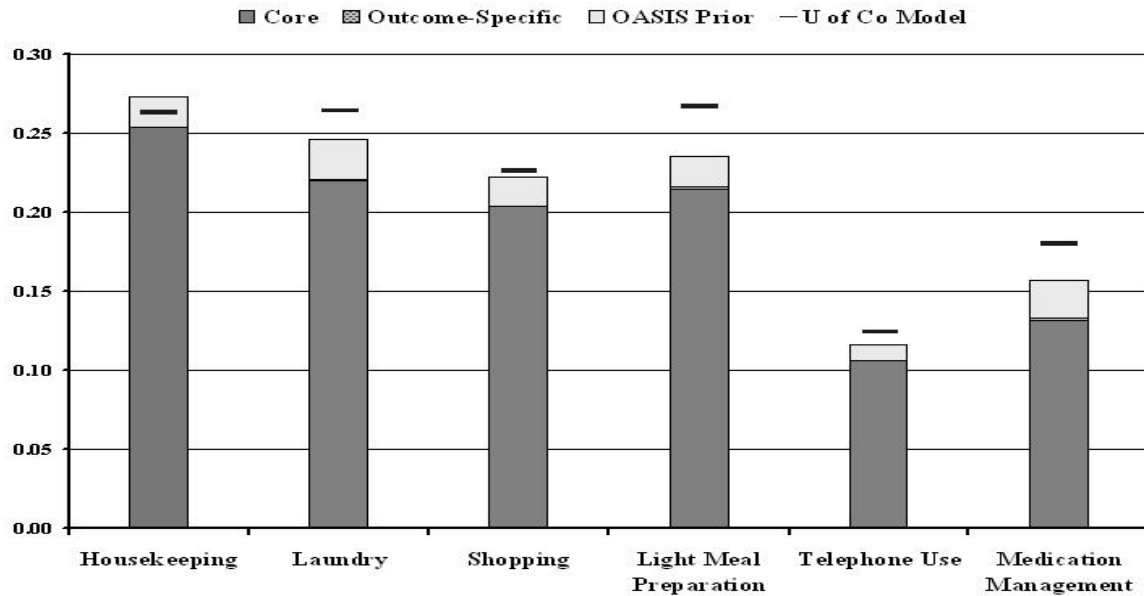


Performance of Alternative and Current Risk-Adjustment Models for Stabilization in ADL Outcomes

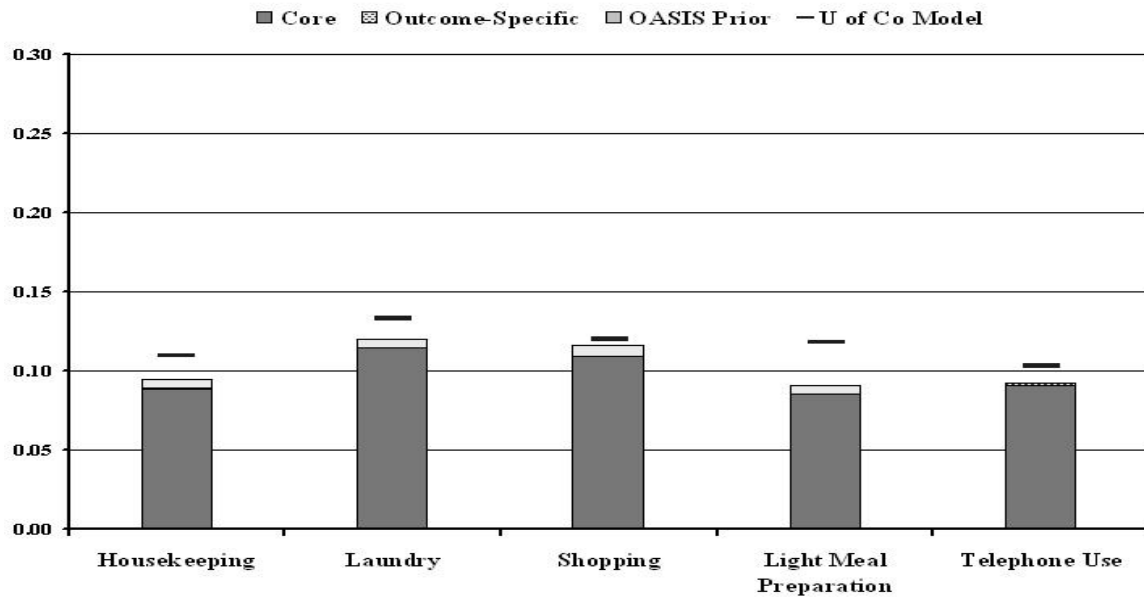


NOTE: Vertical height (the y-axis) indicates the explanatory power of the alternative risk-adjustment models with: (1) only the core risk factors (the dark shade at the bottom of the column), (2) the addition of the outcome specific risk-adjusters (the speckled section), and (3) the addition of relevant "prior" OASIS items (the light shade at the top of the column). The short, solid line above or within the column indicates the explanatory power of the current ("U of CO") risk-adjustment model. See methods section for the definition of the pseudo-R-squared measure of explanatory power.

FIGURE 2. Performance of Alternative and Current Risk-Adjustment Models for Improvement in IADL Outcomes

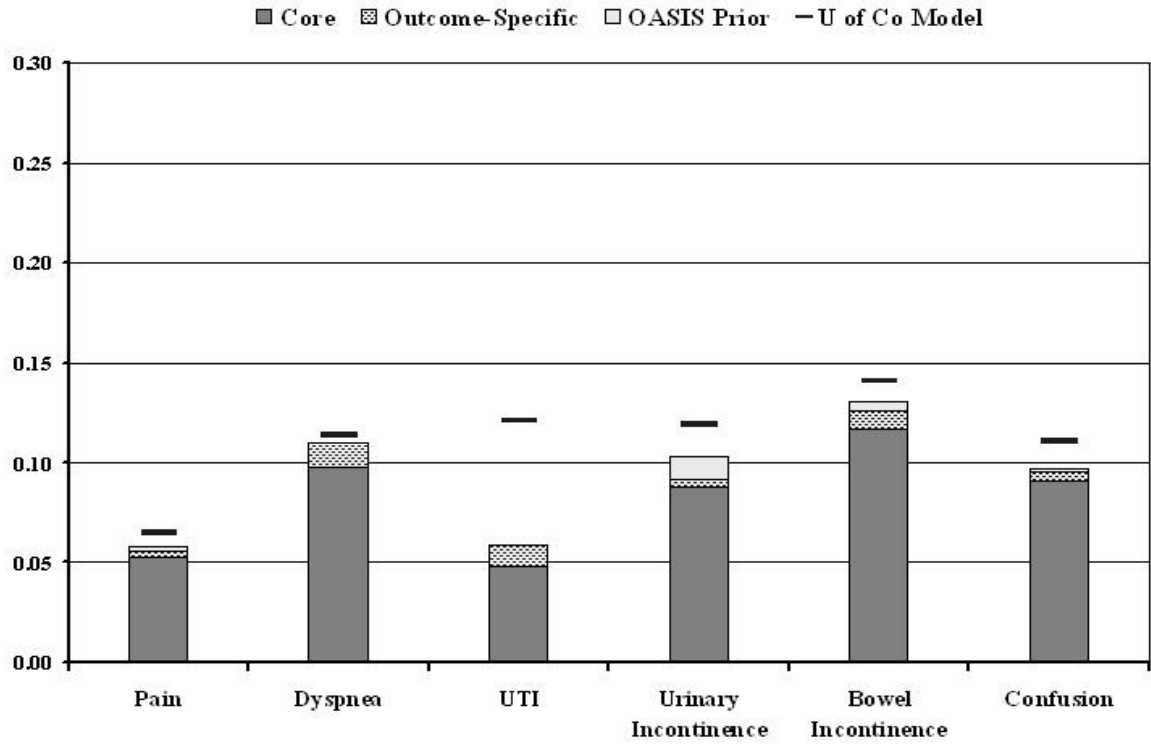


Performance of Alternative and Current Risk-Adjustment Models for Stabilization in IADL Outcomes



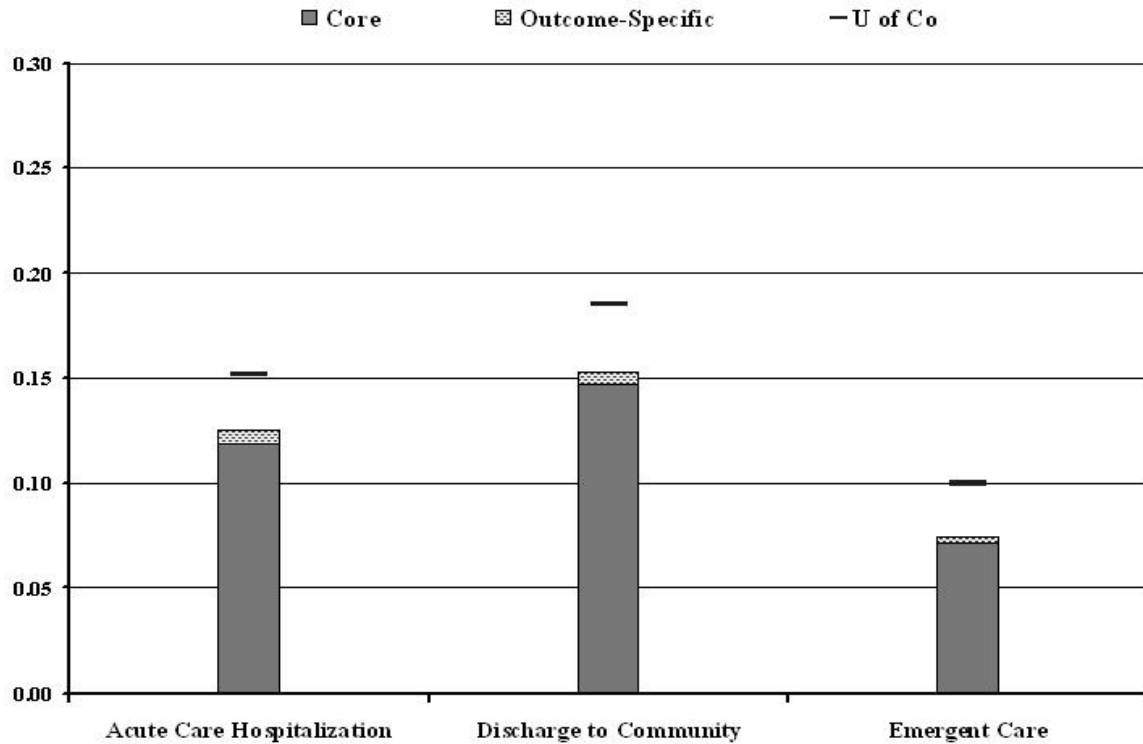
NOTE: Vertical height (the y-axis) indicates the explanatory power of the alternative risk-adjustment models with: (1) only the core risk factors (the dark shade at the bottom of the column), (2) the addition of the outcome specific risk-adjusters (the speckled section), and (3) the addition of relevant “prior” OASIS items (the light shade at the top of the column). The short, solid line above or within the column indicates the explanatory power of the current (“U of CO”) risk-adjustment model. See methods section for the definition of the pseudo-R-squared measure of explanatory power.

FIGURE 3. Performance of Alternative and Current Risk-Adjustment Models for Improvement in Physiologic and Cognitive Outcomes



NOTE: Vertical height (the y-axis) indicates the explanatory power of the alternative risk-adjustment models with: (1) only the core risk factors (the dark shade at the bottom of the column), (2) the addition of the outcome specific risk-adjusters (the speckled section), and (3) the addition of relevant “prior” OASIS items (the light shade at the top of the column). The short, solid line above or within the column indicates the explanatory power of the current (“U of CO”) risk-adjustment model. See methods section for the definition of the pseudo-R-squared measure of explanatory power.

FIGURE 4. Performance of Alternative and Current Risk-Adjustment Models for Utilization Outcomes



NOTE: Vertical height (the y-axis) indicates the explanatory power of the alternative risk-adjustment models with: (1) only the core risk factors (the dark shade at the bottom of the column), (2) the addition of the outcome specific risk-adjusters (the speckled section), and (3) the addition of relevant "prior" OASIS items (the light shade at the top of the column). The short, solid line above or within the column indicates the explanatory power of the current ("U of CO") risk-adjustment model. See methods section for the definition of the pseudo-R-squared measure of explanatory power.

FIGURE 5. Inclusion of OASIS-B1 Items in Risk-Adjustment Models

M0200	M0220	M0100	M0190	M0210	M0280				
M0066	M0250*	M0290	M0300	M0340	M0350	M0360	M0140	M0180	
M0069	M0150	M0430	M0500	M0370	M0380	M0400	M0450*	M0474	M0486
M0175*	M0230*	M0510	M0640P	M0650P	M0464	M0470	M0484	M0810	M0820
M0230S*	M0240*	M0240S*	M0260	M0660P	M0670P	M0488*	M0550*	M0620	M0825*
M0270	M0390*	M0410	M0420*	M0440*	M0680P	M0690P	M0630	M0730P	M0790
M0445	M0460*	M0468	M0476*	M0482	M0700P	M0710P	M0720P	M0790P	M0800
M0490*	M0520	M0530*	M0540*	M0560	M0570	M0580	M0740P	M0750P	M0800P
M0590	M0610*	M0640	M0650*	M0660*	M0670*	M0680*	M0690*	M0760P	M0770P
M0700*	M0710	M0720	M0730	M0740	M0750	M0760	M0770	M0780	M0780P
LEGEND									
Items used in:		Core (43)	Full (64)	U of Co Models (88)	Not Used (7)				
OASIS ITEM					X				
OASIS ITEM				X					
OASIS ITEM			X	X					
OASIS ITEM		X	X	X					

NOTE: There is a total of 95 OASIS items for risk-adjustment.

* Item used in home health resource group case-mix classification for Medicare payment.

FIGURE 6. Inclusion of OASIS-B1 Elements in Risk-Adjustment Models

M0175_NA*	M0100	M0150_1	M0190_A	M0140_1	M0140_2	M0140_3	M0140_4	M0140_5	M0140_6	M0140_UK		
M0200	M0220_1	M0190_B	M0210_A	M0210_B	M0150_0	M0150_5	M0150_6	M0150_7	M0150_8	M0150_9	M0150_10	M0150_11
M0220_2	M0220_3	M0220_4	M0210_C	M0210_D	M0220_UK	M0150_UK	M0175_5*	M0180	M0220_7	M0220_NA	M0250_3*	M0250_4*
M0066	M0220_5	M0220_6	M0250_1*	M0250_2*	M0280	M0290_4	M0290_3	M0340_4	M0340_5	M0340_6	M0825	M0350_3
M0069	M0150_2	M0290_1	M0290_2	M0290_3	M0300	M0340_1	M0340_2	M0380_3	M0380_4	M0380_5	M0380_6	M0380_7
M0150_3	M0150_4	M0175_1*	M0290_UK	M0430	M0340_3	M0350_1	M0350_2	M0350_4	M0380_UK	M0450_E*	M0474	M0486
M0175_2*	M0175_3*	M0175_4*	M0230_A*	M0300_2	M0510	M0350_UK	M0360	M0370	M0380_1	M0500_3	M0500_4	M0550*
M0230S_A*	M0240_B*	M0240_C*	M0240_D*	M0610_1*	M0610_2*	M0610_5*	M0380_2	M0400	M0450_A*	M0450_B*	M0610_7*	M0810
M0240_E*	M0240_F*	M0240S_B*	M0240S_C_D*	M0240S_D*	M0640P	M0650P	M0660P	M0450_C*	M0450_D*	M0464	M0470	M0820
M0240S_E*	M0240S_F*	M0260	M0270	M0390*	M0410	M0670P	M0680P	M0690P	M0484	M0488*	M0500_1	M0610_4*
M0420*	M0440*	M0445	M0460*	M0468	M0476*	M0482	M0700P	M0710P	M0720P	M0610_6*	M0620	M0630
M0490*	M0520	M0530*	M0540*	M0560	M0570	M0580	M0590_1	M0590_2	M0740P	M0750P	M0730P	M0790
M0590_3	M0590_4	M0590_5	M0590_6	M0610_3*	M0640	M0650*	M0660*	M0670*	M0680*	M0760P	M0790P	M0800
M0690*	M0700*	M0710	M0720	M0730	M0740	M0750	M0760	M0770	M0780	M0770P	M0780P	M0800P

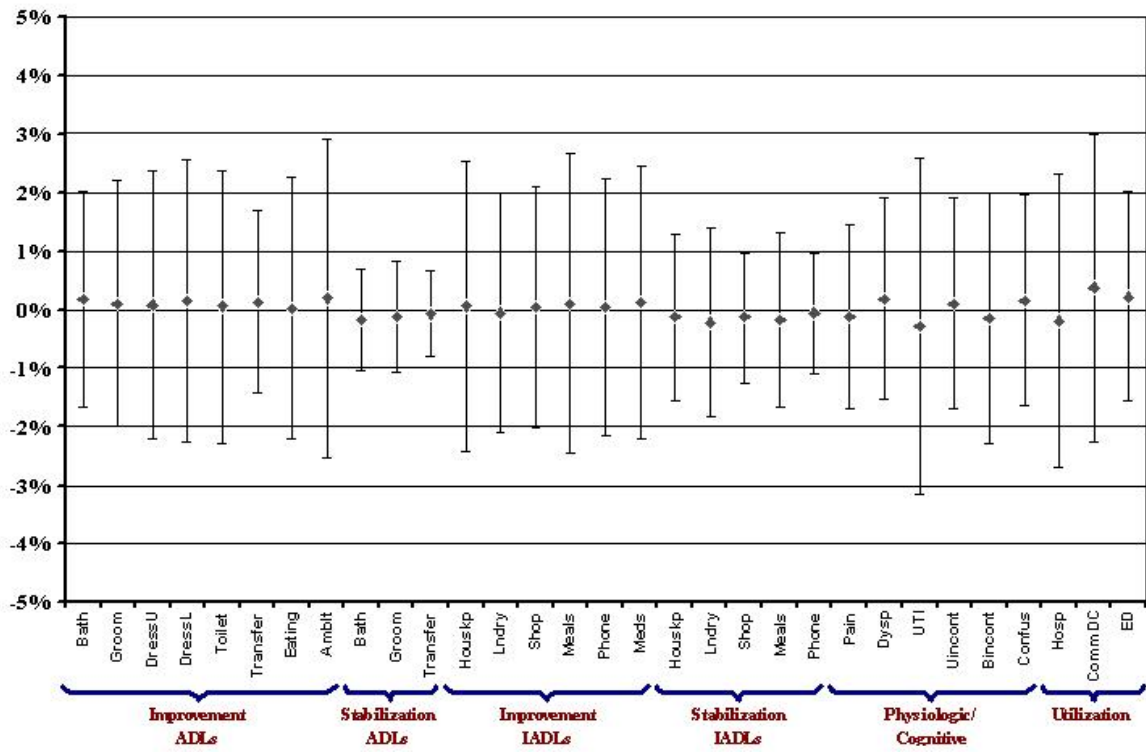
LEGEND

Elements Used In:	Core (61)	Full (93)	U of Co (135)	Not Used (43)
OASIS Element				X
OASIS Element			X	
OASIS Element		X	X	
OASIS Element	X	X	X	
OASIS Element	X	X		

NOTE: There is a total of 180 OASIS elements for risk-adjustment.

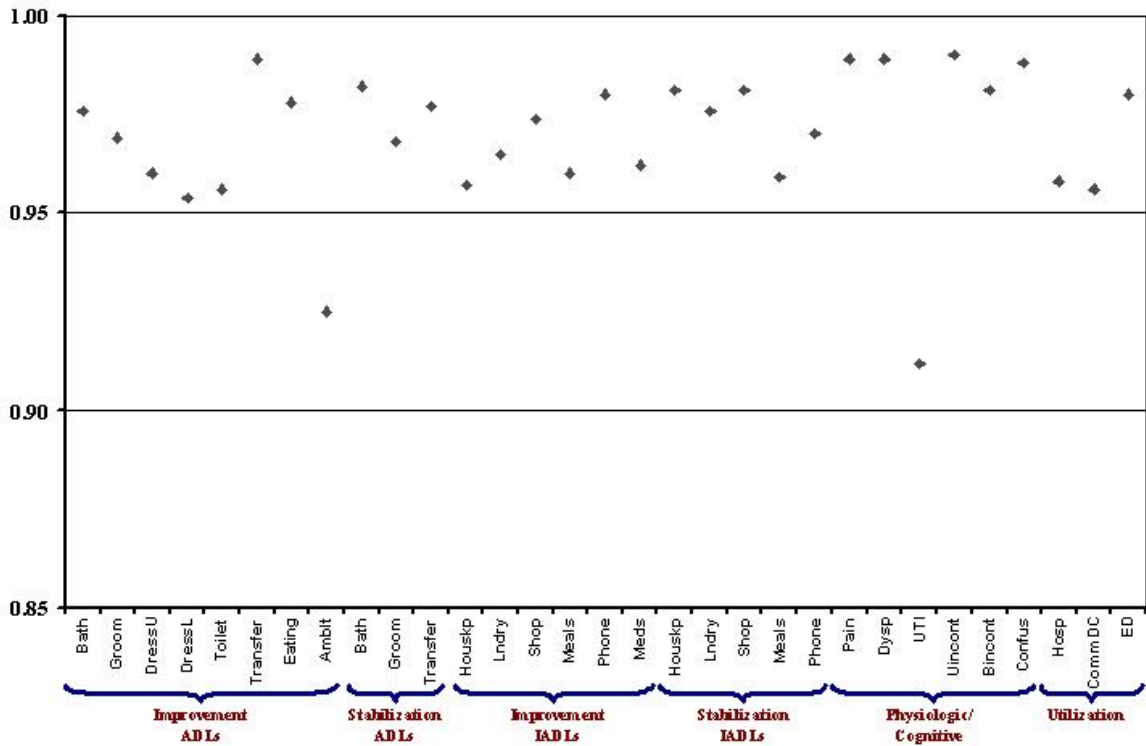
* Item used in home health resource group case-mix classification for Medicare payment.

FIGURE 7. Mean Percentage Point Difference in Agency Performance Using Current versus Full Alternative Models



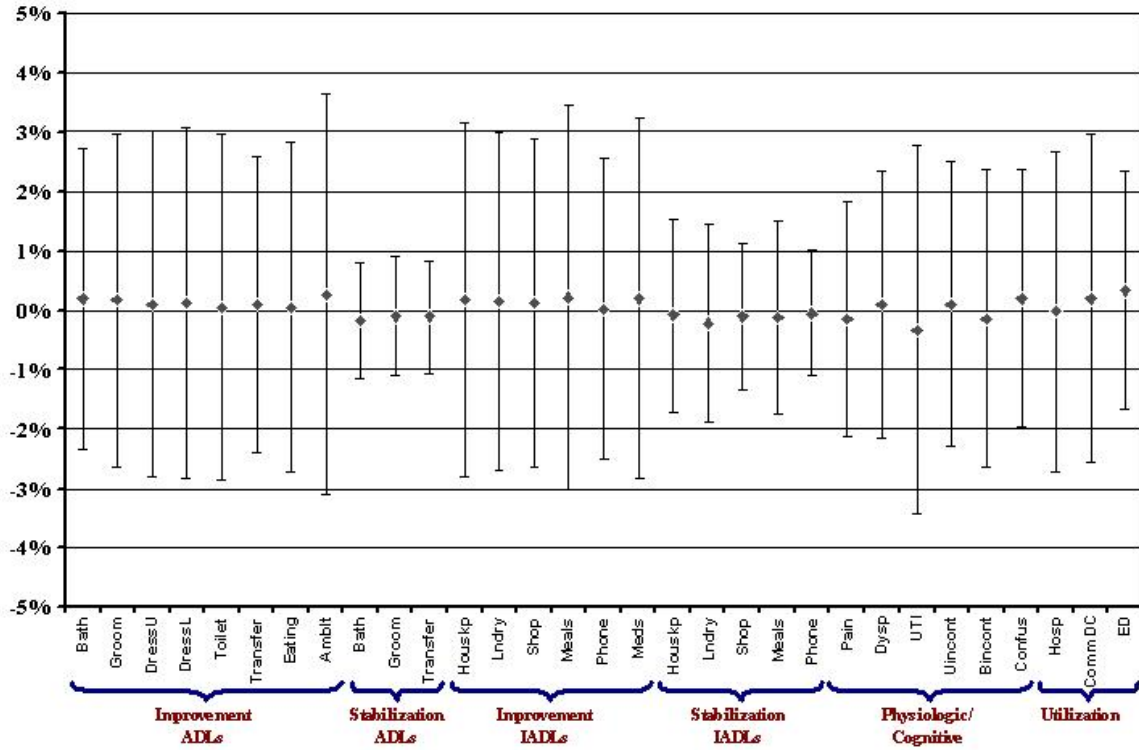
NOTE: Each point represents the average agency percentage point difference between patient outcomes predicted by the current model and the patient outcomes predicted by the full alternative model. Above and below each point is a set of bars representing a two standard deviation span for each outcome, centered on the mean.

FIGURE 8. Spearman's Rank Correlation Coefficient for Agency Outcomes Using Current versus Full Alternative Models



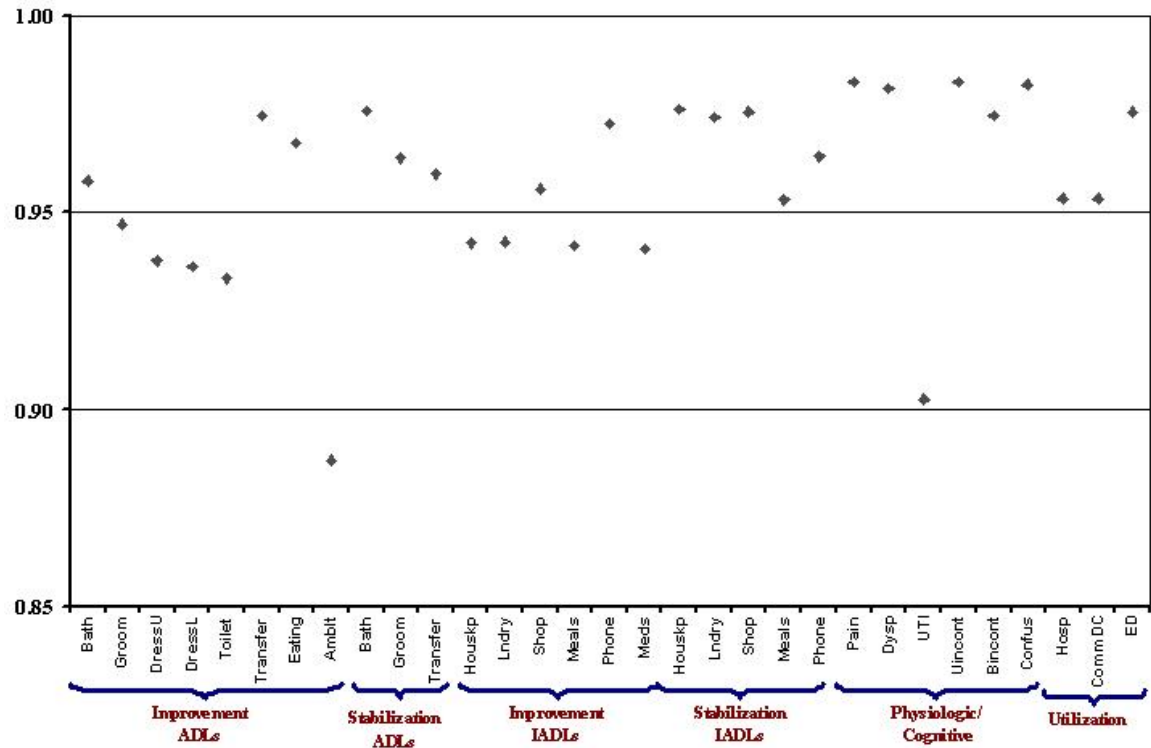
NOTE: Each point represents the value of Spearman's rank correlation coefficient for the ordinal ranking of agencies on their patient outcomes using the current model compared to rankings using the full alternative risk-adjustment model. It is a standard correlation coefficient, ranging from -1 to 1. In this figure, a value of 0 represents no relationship between the rankings, -1 represents perfectly opposite rankings, and 1 represents perfectly matching ranks produced by the models being compared. For purposes of presentation, only the range from 0.85 to 1 on the vertical (y) axis is shown in this figure.

FIGURE 9. Mean Percentage Point Difference in Agency Performance Using Current versus Core Alternative Models



NOTE: Each point represents the average agency percentage point difference between patient outcomes predicted by the current model and the patient outcomes predicted by the core alternative model. Above and below each point is a set of bars representing a two standard deviation span for each outcome, centered on the mean.

FIGURE 10. Spearman's Rank Correlation Coefficient for Agency Outcomes Using Current versus Core logic and Cognitive Outcomes



NOTE: Each point represents the value of Spearman's rank correlation coefficient for the ordinal ranking of agencies on their patient outcomes using the current model compared to rankings using the core alternative risk-adjustment model. It is a standard correlation coefficient, ranging from -1 to 1. In this figure, a value of 0 represents no relationship between the rankings, -1 represents perfectly opposite rankings, and 1 represents perfectly matching ranks produced by the models being compared. For purposes of presentation, only the range from 0.85 to 1 on the vertical (y) axis is shown in this figure.

TABLES

TABLE 1. Outcome Measures Used in OBQI	
HEALTH STATUS OUTCOME MEASURES	
<p>Functional: Activities of Daily Living</p> <p>Improved in:</p> <ul style="list-style-type: none"> Ambulation/locomotion Dressing upper body Dressing lower body Grooming Bathing Eating Toileting Transferring <p>Stabilized in:</p> <ul style="list-style-type: none"> Grooming Bathing Transferring <p>Physiologic</p> <p>Improved in:</p> <ul style="list-style-type: none"> Pain interfering with activity Number of surgical wounds Status of surgical wounds Dyspnea Urinary tract infection Urinary incontinence Bowel incontinence Speech or language <p>Stabilized in:</p> <ul style="list-style-type: none"> Speech or language 	<p>Functional: Instrumental Activities of Daily Living</p> <p>Improved in:</p> <ul style="list-style-type: none"> Management of oral medications Light meal preparation Laundry Housekeeping Shopping Telephone use <p>Stabilized in:</p> <ul style="list-style-type: none"> Management of oral medications Light meal preparation Laundry Housekeeping Shopping Telephone use <p>Emotional Behavioral</p> <p>Improved in:</p> <ul style="list-style-type: none"> Anxiety level Behavioral problem frequency <p>Stabilized in:</p> <ul style="list-style-type: none"> Anxiety level <p>Cognitive</p> <p>Improved in:</p> <ul style="list-style-type: none"> Confusion frequency Cognitive functioning <p>Stabilized in:</p> <ul style="list-style-type: none"> Cognitive functioning
UTILIZATION OUTCOME MEASURES	
<ul style="list-style-type: none"> Acute care hospitalization Discharge to community Emergent care 	
<p>NOTES: Adapted from Shaughnessy, P.W. and Hittle, D.F. 2002. "Overview of Risk Adjustment and Outcome Measures for Home Health Agency OBQI Reports" (available at http://www.cms.gov/providers/hha/RiskAdj1.pdf).</p> <p>Outcomes labeled as "Improved in" are binary indicators of whether status at discharge is better than at start of the episode on that outcome. Episodes that start at the ceiling of the outcome measure (i.e., those that could not improve because they are already at the top) are excluded from the denominator for "Improvement" outcomes.</p> <p>Outcomes labeled as "Stabilized in" are binary indicators of whether status at discharge is the same or better at discharge as compared to the start of the episode for that outcome. Episodes that start at the floor of the outcome measure (i.e., those that could not get worse because they start at the worst level), are excluded from the denominator for "Stabilization" outcomes.</p>	

TABLE 2. Preliminary Set of Core Risk Factors Used in Initial Analyses		
Preliminary Core Risk Factors	OASIS Items	Specification
DEMOGRAPHICS		
Age	M0066	<65 65-74 (reference category) 75-84 85+
Sex	M0069	Female Male (reference category)
SOCIOECONOMIC FACTORS		
Insurance/Payment:		
Any Medicare	M0150	Yes No (reference category)
Informal Support/Assistance:		
ADL assistance provided by caregiver	M0350, M0360, M0380	Yes No (reference category)
Frequency of assistance	M0350, M0360, M0370	Scale 0-6 (0 = no caregiver)
Living Situation:		
Lives alone	M0340	Yes No (reference category)
Lives with spouse/family	M0340	Yes No (reference category)
PRIOR SERVICE USE		
Discharge Past 14 Days:		
Discharge from hospital	M0175	Yes No (reference category)
Discharge from nursing home		
Discharge from rehabilitation facility		
CLINICAL FACTORS		
Prognoses:		
Overall prognosis	M0260	Poor (reference category) Good/fair
Rehab prognosis	M0270	Guarded (reference category) Good
Life expectancy	M0280	Greater than 6 mo. (reference category) Less than 6 months
Diagnoses:		
Infectious/parasitic diseases	M0190, M0210, M0230, M0240	For each major diagnosis category: Yes No (reference category) (Note: diagnoses are not mutually exclusive)
Neoplasms		
Endocrine/metabolic		
Blood diseases		
Mental diseases		
Nervous system		
Circulatory system		
Respiratory system		
Digestive system		
Genitourinary		
Skin/subcutaneous		
Musculoskeletal system		
Ill-defined conditions		
Fractures		
Other injury		
Iatrogenic conditions		
Diagnosis Severity:		
Number of severity ratings ≥ 2	M0230_S, M0240S	Integer count (range 0 to 6)

TABLE 2 (continued)		
Preliminary Core Risk Factors	OASIS Items	Specification
Sensory Status:		
Hearing impairment	M0400	No impairment (reference category) Minimal difficulty Moderate difficulty Severe difficulty (categories 3-4)
Vision impairment	M0390	Normal (reference category) Partially impaired Severely impaired
Speech/language impairment	M0410	No impairment (reference category) Minimal difficulty Moderate difficulty Severe difficulty (categories 3-5)
Integumentary Status:		
Surgical wound present	M0480	Yes No (reference category)
Stage of most problematic pressure ulcer	M0440, M0445, M0460	Scale 0-4 (0 = No pressure ulcer)
Status of most problematic stasis ulcer	M0440, M0468, M0476	Scale 0-3 (0 = No stasis ulcer)
Physical Functioning:		
ADL/IADL summary score	M0640 through M0780	Integer count 0-14 (0 = No dependencies)
Elimination Status:		
Urinary incontinence severity	M0520, M0530	No incontinence (reference category) Timed voiding deters incontinence Night only Day and Night
Urinary catheter	M0520	Yes No (reference category)
Bowel incontinence	M0540	Rarely or Never (reference category) Less than once weekly 1-3 times weekly 4-6 times weekly Daily or more often (categories 4-5)
Ostomy for bowel elimination	M0550	Yes (categories 1-2) No (reference category)
Neuro/Emotional/Behavioral Status:		
Cognitive functioning	M0560	No impairments (reference category) Requires prompting Requires assistance and some direction Requires considerable assistance Totally dependent
Confusion frequency	M0570	Never (reference category) New or complex situations only On awakening or at night Day and evening, not constantly Constantly
Anxiety frequency	M0580	None (reference category) Less often than daily Daily, but not constantly All of the time
Verbal disruption	M0610_3	Yes No (reference category)
Number of symptoms of depression	M0590	None (reference category) One symptom only More than one symptom

TABLE 3. Final Set of Core Items Included as Risk-Adjusters in All Alternative Models		
Core Variables	OASIS Items	Specification
DEMOGRAPHICS		
Age	M0066	<65 65-74 (reference category) 75-84 85+
Sex	M0069	Female Male (reference category)
SOCIOECONOMIC FACTORS		
Current payer	M0150	Any Medicaid Medicare HMO Medicare FFS and Other (reference category)
PRIOR SERVICE USE		
Discharge Past 14 Days:		
Discharge from hospital	M0175	Yes No (reference category)
Discharge from rehabilitation facility		
Discharge from nursing home		
CLINICAL FACTORS		
Baseline value of outcome indicator	Varies depending on outcome indicator	
Prognoses:		
Overall prognosis	M0260	Poor (reference category) Good/fair
Rehabilitation prognosis	M0270	Guarded (reference category) Good
Diagnoses:		
Diabetes (PPS group)	M0230, M0240	Yes No (reference category) (Note: diagnoses are not mutually exclusive)
Neurological (PPS group)		
Orthopedic (PPS group)		
Wound/Burn (PPS group)		
Dementia		
Hypertension		
Ischemia		
Arrhythmia		
Heart failure		
COPD		
Skin ulcer		
Orthopedic (other than PPS)		
Incontinence		
Cancer		
Mental condition		
Signs, symptoms, and Ill-defined conditions		
Diagnosis Severity:		
Number of severity ratings ≥ 2	M0230S, M0240S	Integer count (range 0 to 6)
Sensory Status:		
Vision	M0390	Normal (reference category) Partially impaired Severely impaired
Speech/language	M0410	No impairment (reference category) Minimal difficulty Moderate difficulty Severe difficulty (categories 3-5)

TABLE 3 (continued)		
Core Variables	OASIS Items	Specifications
Integumentary Status:		
Surgical wound present	M0482	Yes No (reference category)
Stage of most problematic pressure ulcer	M0440, M0445, M0460	Scale 0-4 (0 = No pressure ulcer)
Status of most problematic stasis ulcer	M0440, M0468, M0476	Scale 0-3 (0 = No stasis ulcer)
Physical Functioning:		
ADL/IADL summary score	M0640 through M0780	Integer count 0-14 (0 = No impairment)
Elimination Status:		
Urinary incontinence severity	M0520, M0530	No incontinence (reference category) Timed voiding deters incontinence Night only Day and Night
Urinary catheter	M0520	Yes No (reference category)
Bowel incontinence	M0540	Rarely or Never (reference category) Less than once weekly 1-3 times weekly 4-6 times weekly Daily or more often (categories 4-5)
Ostomy for bowel elimination	M0550	Yes (categories 1-2) No (reference category)
Neuro/Emotional/Behavioral Status:		
Cognitive functioning	M0560	No impairments (reference category) Requires prompting Requires assistance and some direction Requires considerable assistance Totally dependent
Confusion frequency	M0570	Never (reference category) New or complex situations only On awakening or at night Day and evening, not constantly Constantly
Anxiety frequency	M0580	None (reference category) Less often than daily Daily, but not constantly All of the time
Verbal disruption at least once weekly	M0610_3	Yes No (reference category)
Symptoms of depression	M0590	None (reference category) Depressed mood Any other symptoms

TABLE 4a. Risk-Adjusters Specific to ADL Outcome Models		
Variables	OASIS Items	Specification
ALL ACTIVITY OF DAILY LIVING OUTCOME MODELS¹		
Clinical Factors:		
Obesity	M0290_2	Yes No (reference category)
Frequency of pain interfering with activity	M0420	No pain, or does not interfere with activity (reference category) Less often than daily Daily but not constantly All of the time
ADDITIONAL ITEM IN TRANSFERRING MODELS²		
Clinical Factors:		
Current ambulation	M0700	Walks independently (reference category) Requires use of device Able to walk only with supervision Chairfast, able to wheel self Chairfast, unable to wheel self Bedfast, unable to ambulate
ADDITIONAL ITEM IN IMPROVEMENT IN AMBULATION MODEL		
Clinical Factors:		
Current transferring	M0700	Transfers independently (reference category) Transfers with minimal assistance or device Unable to transfer; can bear weight Unable to transfer; unable to bear weight Bedfast, able to turn and position self
<ol style="list-style-type: none"> 1. Improvement in Bathing, Grooming, Dressing (upper), Dressing (lower), Toileting, Transferring, Eating, and Ambulation; Stabilization in Bathing, Grooming, and Transferring. 2. Improvement in Transferring and Stabilization in Transferring. 		

TABLE 4b. Risk-Adjusters Specific to IADL Outcome Models		
Variables	OASIS Items	Specification
ALL INSTRUMENTAL ACTIVITY OF DAILY LIVING OUTCOME MODELS¹		
Clinical Factors:		
Behaviors demonstrated at least once a week:		
Memory deficit	M0610_1	Yes No (reference category)
Impaired decision-making	M0610_2	Yes No (reference category)
ADDITIONAL ITEM IN HOUSEKEEPING, LAUNDRY, AND SHOPPING MODELS²		
Clinical Factors:		
Obesity	M0290_2	Yes No (reference category)
Pain frequency	M0420	No pain (reference category) Less than daily Daily, but not constantly All the time
<ol style="list-style-type: none"> 1. Improvement in Light Housekeeping, Laundry, Shopping, Light Meal Preparation, Telephone Use, Management of Medication; Stabilization in Housekeeping, Laundry, Shopping, Light Meal. 2. Improvement in Housekeeping, Laundry, Shopping; Stabilization in Housekeeping, Laundry, Shopping. 		

TABLE 4c. Risk-Adjusters Specific to Physiologic Outcome Models		
Variables	OASIS Items	Specification
ALL PSYCHOLOGIC OUTCOME MODELS EXCEPT PAIN¹		
Clinical Factors:		
Obesity	M0290_2	Yes No (reference category)
ADDITIONAL ITEMS IN DYSPNEA IMPROVEMENT MODEL		
Clinical Factors:		
Smoking	M0290_1	Yes No (reference category)
Respiratory treatments:		
Oxygen	M0500_1	Yes No (reference category)
Ventilator	M0500_2	Yes No (reference category)
ADDITIONAL ITEMS IN UTI IMPROVEMENT MODEL		
Clinical Factors:		
Current ambulation	M0700	Walks independently (reference category) Requires use of device Able to walk only with supervision Chairfast, able to wheel self Chairfast, unable to wheel self Bedfast, unable to ambulate
Therapy received in home:		
IV/Infusion	M0250_1	Yes No (reference category)
ADDITIONAL ITEM IN INCONTINENCE MODELS²		
Clinical Factors:		
Current toileting	M0680	Able to get to and from the toilet independently (reference category) Able to get to and from toilet when reminded, assisted, or supervised Unable to get to toilet, but can use bedside commode Unable to get to toilet or use bedside commode, but can use bedpan Totally dependent in toileting
Treated for UTI in past 14 days	M0510	Yes No (reference category)
ONLY OUTCOME-SPECIFIC ITEM IN IMPROVEMENT IN PAIN MODEL		
Clinical Factors:		
Intractable pain	M0430	Yes No (reference category)
1. Improvement in Number of Surgical Wounds, Status of Surgical Wounds, Dyspnea, Urinary Tract Infection, Urinary Incontinence, Bowel Incontinence, and Speech; Stabilization in Speech.		
2. Improvement in Urinary Incontinence, Bowel Incontinence.		

TABLE 4d. Risk-Adjusters Specific to Cognitive and Utilization Outcomes		
Variables	OASIS Items	Specification
ITEMS IN IMPROVEMENT IN CONFUSION FREQUENCY MODEL		
Clinical Factors:		
Behaviors demonstrated at least once a week:		
Memory deficit	M0610_1	Yes No (reference category)
Impaired decision-making	M0610_2	Yes No (reference category)
ITEMS IN ALL UTILIZATION OUTCOME MODELS¹		
Clinical Factors:		
Dyspnea	M0490	Never, patient is not short of breath (reference category) Walking more than 20 feet, or on stairs With moderate exertion With minimal exertion At rest
Therapy received in home:		
IV/Infusion	M0250_1	Yes No (reference category)
Respiratory treatments:		
Ventilator	M0500_2	Yes No (reference category)
1. Acute Care Hospitalization, Discharge to Community, Emergent Care.		

TABLE 5a. "Prior" Risk-Adjusters Specific to ADL Outcomes		
Variables	OASIS Items	Specification
ITEM USED IN BATHING MODELS¹		
Clinical Factors:		
Bathing prior to admission	M0670_P	Independent (reference category) Able with use of devices Able with partial assistance Requires assistance Unable, bathed in bed/chair Totally dependent
ITEM USED IN GROOMING MODELS²		
Clinical Factors:		
Grooming prior to admission	M0640_P	Independent (reference category) Able if utensils placed within reach Able with assistance Totally dependent
ITEM USED IN IMPROVEMENT IN UPPER BODY DRESSING MODEL		
Clinical Factors:		
Dressing upper body prior to admission	M0650_P	Independent (reference category) Able if clothing laid out or given Needs some help Totally dependent
ITEM USED IN IMPROVEMENT IN LOWER BODY DRESSING MODEL		
Clinical Factors:		
Dressing lower body prior to admission	M0660_P	Independent (reference category) Able if clothing laid out or given Needs some help Totally dependent
ITEM USED IN IMPROVEMENT IN TOILETING MODEL		
Clinical Factors:		
Toileting prior to admission	M0680_P	Independent (reference category) Able when assisted or supervised Uses bedside commode Uses bedpan independently Totally dependent
ITEM USED IN TRANSFERRING MODELS³		
Clinical Factors:		
Transferring prior to admission	M0690_P	Independent (reference category) Able with minimal assistance Unable but can pivot self Needs assistance Bedfast
ITEM USED IN IMPROVEMENT IN EATING MODEL		
Clinical Factors:		
Eating prior to admission	M0710_P	Independent (reference category) Able with intermittent assistance Needs mechanical/personal assistance (levels 2-5)
ITEM USED IN IMPROVEMENT IN AMBULATION MODEL		
Clinical Factors:		
Ambulation prior to admission	M0700_P	Independent (reference category) Needs device to walk Needs assistance to walk Chairfast, able to wheel self Chairfast, unable to wheel self Bedfast
<ol style="list-style-type: none"> 1. Improvement and Stabilization in bathing. 2. Improvement and Stabilization in grooming. 3. Improvement and Stabilization in transferring. 		

TABLE 5b. "Prior" Risk-Adjusters Specific to IADL Outcomes		
Variables	OASIS Items	Specification
ALL INSTRUMENTAL ACTIVITY OF DAILY LIVING OUTCOME MODELS¹		
Clinical Factors:		
Conditions Prior to Medical Regiment:		
Impaired decision-making	M0220_4	Yes No (reference category)
Memory loss requiring supervision	M0220_6	Yes No (reference category)
ADDITIONAL ITEM IN HOUSEKEEPING MODELS²		
Clinical Factors:		
Housekeeping prior to admission	M0750_P	Independent (reference category) Light tasks only Intermittent assistance Usually requires assistance Totally dependent
ADDITIONAL ITEM IN LAUNDRY MODELS³		
Clinical Factors:		
Laundry prior to admission	M0740_P	Independent (reference category) Light laundry only Totally dependent
ADDITIONAL ITEM IN SHOPPING MODELS⁴		
Clinical Factors:		
Shopping prior to admission	M0760_P	Independent (reference category) Needs some assistance Only if delivered Totally dependent
ADDITIONAL ITEM IN LIGHT MEAL PREPARATION MODELS⁵		
Clinical Factors:		
Meal preparation prior to admission	M0720_P	Independent (reference category) Able, but not regularly Totally dependent
ADDITIONAL ITEM IN TELEPHONE USE MODELS⁶		
Clinical Factors:		
Telephone use prior to admission	M0770_P	Independent (reference category) Able, with adapted phone Answers, but has trouble calling Sometimes answers, limited conversation Can listen with assistive device Totally dependent
ADDITIONAL ITEM IN MANAGEMENT OF MEDICATIONS MODELS⁷		
Clinical Factors:		
Medication management prior to admission	M0780_P	Independent (reference category) Able if prepared by another person Totally dependent
<ol style="list-style-type: none"> 1. Improvement in Housekeeping, Laundry, Shopping, Light Meal Preparation, Telephone Use, and Medication Management; Stabilization in Housekeeping, Laundry, Shopping, Light Meal Preparation, Telephone Use, and Medication Management. 2. Improvement and Stabilization in Housekeeping. 3. Improvement and Stabilization in Laundry. 4. Improvement and Stabilization in Shopping. 5. Improvement and Stabilization in Light Meal Preparation. 6. Improvement and Stabilization in Telephone Use. 7. Improvement and Stabilization in Management of Medications. 		

TABLE 5c. "Prior" Risk-Adjusters Specific to Physiologic Outcomes		
Variables	OASIS Items	Specification
ITEM USED IN IMPROVEMENT IN PLAN		
Clinical Factors:		
Conditions Prior to Medical Regimen Change or Inpatient Stay:		
Intractable pain	M0220_3	Yes No (reference category)
ITEMS USED IN IMPROVEMENT IN UTI, URINARY INCONTINENCE, AND BOWEL INCONTINENCE		
Clinical Factors:		
Conditions Prior to Medical Regimen Change or Inpatient Stay:		
Urinary incontinence	M0220_1	Yes No (reference category)
Intradwelling/suprapubic catheter	M0220_2	Yes No (reference category)
ADDITIONAL ITEMS IN INCONTINENCE MODELS¹		
Clinical Factors:		
Conditions Prior to Medical Regimen Change or Inpatient Stay:		
Impaired decision-making	M0220_4	Yes No (reference category)
Memory loss requiring supervision	M0220_6	Yes No (reference category)
Toileting	M0680_P	Independent (reference category) Able when supervised Uses bedside commode Uses bedpan independently/totally dependent (levels 3, 4)
1. Improvement in Urinary Incontinence and Improvement in Bowel Incontinence.		

TABLE 5d. "Prior" Risk-Adjusters Specific to Emotional/Behavioral/Cognitive Outcomes		
Variables	OASIS Items	Specification
ITEMS USED IN IMPROVEMENT IN CONFUSION FREQUENCY		
Clinical Factors:		
Conditions Prior to Medical Regimen Change or Inpatient Stay:		
Impaired decision-making	M0220_2	Yes No (reference category)
Disruptive or socially inappropriate behavior	M0220_5	Yes No (reference category)
Memory loss requiring supervision	M0220_6	Yes No (reference category)

TABLE 6a. Summary of Regression Models: Activities of Daily Living

	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 <i>Clinical Core (Baseline Model)</i>	Model 2 <i>Adds Outcome- Specific</i>	Model 3 <i>Adds OASIS "Prior" Items</i>
IMPROVEMENT IN BATHING	Yes				
Percent Who Could Improve: 62.2%					
Percent Improving Among Those Who Could: 57.0%					
Number of OASIS Items		52	41	43	44 ^a
Number of OASIS Elements		72	59	63	64
R ² statistic		0.192	0.167	0.172	0.190
c statistic		0.755	0.738	0.741	0.753
IMPROVEMENT IN GROOMING	Yes				
Percent Who Could Improve: 34.6%					
Percent Improving Among Those Who Could: 61.4%					
Number of OASIS Items		68	41	43	44 ^b
Number of OASIS Elements		95	59	63	64
R ² statistic		0.238	0.200	0.201	0.220
c statistic		0.784	0.760	0.761	0.774
IMPROVEMENT IN DRESSING UPPER BODY	Yes				
Percent Who Could Improve: 40.1%					
Percent Improving Among Those Who Could: 61.4%					
Number of OASIS Items		69	41	43	44 ^c
Number of OASIS Elements		98	59	63	64
R ² statistic		0.233	0.193	0.194	0.215
c statistic		0.780	0.755	0.756	0.770
IMPROVEMENT IN DRESSING LOWER BODY	Yes				
Percent Who Could Improve: 46.6%					
Percent Improving Among Those Who Could: 60.1%					
Number of OASIS Items		54	41	43	44 ^d
Number of OASIS Elements		71	59	63	64
R ² statistic		0.210	0.182	0.182	0.201
c statistic		0.763	0.744	0.745	0.758
IMPROVEMENT IN TOILETING	Yes				
Percent Who Could Improve: 24.5%					
Percent Improving Among Those Who Could: 59.7%					
Number of OASIS Items		43	41	43	44 ^e
Number of OASIS Elements		59	59	63	64
R ² statistic		0.267	0.224	0.226	0.245
c statistic		0.800	0.775	0.775	0.787

TABLE 6a (continued)

	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 <i>Clinical Core (Baseline Model)</i>	Model 2 <i>Adds Outcome- Specific</i>	Model 3 <i>Adds OASIS "Prior" Items</i>
IMPROVEMENT IN TRANSFERRING	Yes				
Percent Who Could Improve: 46.3%					
Percent Improving Among Those Who Could: 49.8%					
Number of OASIS Items		60	41	43	44 ^f
Number of OASIS Elements		87	59	63	64
R ² statistic		0.137	0.102	0.112	0.129
c statistic		0.711	0.681	0.690	0.705
IMPROVEMENT IN EATING	Yes				
Percent Who Could Improve: 21.6%					
Percent Improving Among Those Who Could: 53.3%					
Number of OASIS Items		42	41	43	44 ^g
Number of OASIS Elements		60	59	63	64
R ² statistic		0.176	0.150	0.150	0.167
c statistic		0.742	0.723	0.724	0.737
IMPROVEMENT IN AMBULATION	Yes				
Percent Who Could Improve: 59.9%					
Percent Improving Among Those Who Could: 34.1%					
Number of OASIS Items		38	41	43	44 ^h
Number of OASIS Elements		53	59	63	64
R ² statistic		0.180	0.213	0.222	0.244
c statistic		0.755	0.768	0.775	0.788
STABILIZATION IN BATHING	Yes				
Percent Who Could Stabilize: 66.4%					
Percent Stabilized Among Those Who Could: 90.4%					
Number of OASIS Items		42	41	43	44 ^a
Number of OASIS Elements		55	59	63	64
R ² statistic		0.114	0.098	0.104	0.105
c statistic		0.786	0.772	0.776	0.778
STABILIZATION IN GROOMING	Yes				
Percent Who Could Stabilize: 65.4%					
Percent Stabilized Among Those Who Could: 93.2%					
Number of OASIS Items		44	41	43	44 ^b
Number of OASIS Elements		64	59	63	64
R ² statistic		0.113	0.096	0.096	0.097
c statistic		0.804	0.784	0.784	0.786

TABLE 6a (continued)

	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 <i>Clinical Core (Baseline Model)</i>	Model 2 <i>Adds Outcome- Specific</i>	Model 3 <i>Adds OASIS "Prior" Items</i>
STABILIZATION IN TRANSFERRING	Yes				
Percent Who Could Stabilize: 69.2%					
Percent Stabilized Among Those Who Could: 93.7%					
Number of OASIS Items		48	41	43	44 [†]
Number of OASIS Elements		70	59	63	64
R ² statistic		0.118	0.088	0.103	0.104
c statistic		0.846	0.815	0.836	0.836

NOTES: "Percent Who Could Improve" calculated using all home health episodes, not just those discharged to the community. The smallest sample size for the ADL risk-adjustment models is 54,030. Shading indicates that U of CO model statistics are for multiple sub-models; we report the number of unique OASIS items and elements across all sub-models.

- a. Risk-adjustment model includes help required with bathing *prior to* home health admission.
- b. Risk-adjustment model includes help required with grooming *prior to* home health admission.
- c. Risk-adjustment model includes help required with dressing upper body *prior to* home health admission.
- d. Risk-adjustment model includes help required with dressing lower body *prior to* home health admission.
- e. Risk-adjustment model includes help required with using the toilet *prior to* home health admission.
- f. Risk-adjustment model includes help required with transferring *prior to* home health admission.
- g. Risk-adjustment model includes help required with eating *prior to* home health admission.
- h. Risk-adjustment model includes help required with ambulating *prior to* home health admission.

TABLE 6b. Final Alternative Risk-Adjustment Models for Activities of Daily Living Outcomes (Part I)

Risk Factor Measured at SOC/ROC	Improvement in:											
	Bathing		Grooming		Dressing Upper Body		Dressing Lower Body		Toileting		Transferring	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
DEMOGRAPHICS												
Age lt 65	-0.031	0.337	-0.117	0.000	-0.146	0.000	-0.051	0.170	-0.125	0.025	-0.026	0.310
Age 75-84	-0.062	0.004	0.014	0.516	0.008	0.695	0.047	0.063	0.059	0.118	-0.059	0.000
Age 85+	-0.302	0.000	-0.178	0.000	-0.161	0.000	-0.112	0.000	-0.110	0.008	-0.252	0.000
Gender: female	-0.116	0.000	-0.004	0.800	0.001	0.969	0.083	0.000	-0.106	0.000	-0.030	0.035
SOCIOECONOMIC FACTORS												
Any Medicaid	-0.170	0.000	-0.221	0.000	-0.173	0.000	-0.151	0.000	-0.220	0.000	-0.169	0.000
Medicare HMO	-0.110	0.000	-0.051	0.062	-0.072	0.004	-0.132	0.000	-0.072	0.107	-0.097	0.000
PRIOR SERVICE USE												
Discharged past 14 days:												
Discharge from hospital	0.348	0.000	0.419	0.000	0.436	0.000	0.391	0.000	0.444	0.000	0.310	0.000
Discharge from rehab facility	0.331	0.000	0.538	0.000	0.518	0.000	0.437	0.000	0.452	0.000	0.256	0.000
Discharge from nursing home	0.309	0.000	0.495	0.000	0.482	0.000	0.412	0.000	0.281	0.000	0.161	0.000
CLINICAL FACTORS												
Prognoses												
Overall prognosis good/fair	0.280	0.000	0.306	0.000	0.312	0.000	0.353	0.000	0.333	0.000	0.279	0.000
Rehabilitation prognosis good	0.313	0.000	0.330	0.000	0.334	0.000	0.296	0.000	0.307	0.000	0.261	0.000
Diagnoses												
Diabetes (PPS Group)	-0.069	0.001	-0.041	0.052	-0.052	0.008	-0.076	0.003	-0.048	0.187	-0.073	0.000
Orthopedic (PPS Group)	-0.003	0.865	0.210	0.000	0.140	0.000	0.070	0.001	0.135	0.000	0.077	0.000
Neurological (PPS Group)	-0.148	0.000	-0.142	0.000	-0.192	0.000	-0.187	0.000	-0.214	0.000	-0.096	0.000
Wound/Burn (PPS Group)	-0.133	0.001	-0.220	0.000	-0.172	0.000	-0.123	0.010	-0.200	0.004	-0.115	0.000
Cancer	-0.120	0.000	-0.201	0.000	-0.227	0.000	-0.123	0.001	-0.233	0.000	-0.076	0.005
Mental condition	0.006	0.888	0.011	0.778	0.039	0.316	0.080	0.122	-0.008	0.911	0.099	0.006
Dementia	-0.169	0.001	-0.126	0.002	-0.160	0.000	-0.126	0.018	-0.142	0.024	0.021	0.583
Hypertension	0.081	0.000	0.050	0.008	0.054	0.002	0.072	0.001	0.005	0.888	-0.029	0.052
Ischemia	0.127	0.000	0.162	0.000	0.182	0.000	0.142	0.000	0.108	0.032	0.167	0.000
Arrhythmia	0.068	0.022	0.079	0.008	0.049	0.072	0.047	0.194	0.035	0.505	-0.033	0.165
Heart failure	-0.092	0.000	-0.080	0.001	-0.037	0.104	-0.073	0.014	0.027	0.523	-0.090	0.000
COPD	-0.099	0.000	-0.016	0.548	-0.005	0.857	-0.017	0.606	0.081	0.101	0.031	0.172
Skin ulcer	-0.153	0.000	-0.172	0.000	-0.139	0.000	-0.120	0.011	-0.178	0.006	-0.192	0.000
Orthopedic (other than PPS)	0.043	0.042	0.194	0.000	0.214	0.000	0.024	0.336	0.178	0.000	-0.056	0.000
Incontinence	-0.279	0.000	-0.185	0.000	-0.168	0.000	-0.181	0.003	-0.171	0.016	-0.200	0.000
Symptoms, signs, & ill-defined conditions	-0.068	0.016	-0.024	0.357	0.003	0.896	-0.003	0.926	-0.153	0.000	-0.024	0.283
Diagnosis Severity												
Number of severity ratings ≥2	0.038	0.000	0.006	0.338	0.031	0.000	0.048	0.000	0.031	0.004	0.014	0.006
Sensory Status												
Partially vision impaired	-0.053	0.007	-0.135	0.000	-0.085	0.000	-0.056	0.012	-0.083	0.005	-0.102	0.000
Severely vision impaired	-0.140	0.008	-0.392	0.000	-0.307	0.000	-0.143	0.013	-0.166	0.019	-0.116	0.005
Speech: Minimum difficulty	-0.038	0.109	-0.110	0.000	-0.069	0.001	-0.035	0.203	-0.048	0.195	-0.064	0.001
Speech: Moderate difficulty	-0.093	0.025	-0.214	0.000	-0.170	0.000	-0.144	0.001	-0.079	0.143	-0.102	0.002
Speech: Severe difficulty	-0.381	0.000	-0.620	0.000	-0.539	0.000	-0.476	0.000	-0.373	0.000	-0.308	0.000

TABLE 6b (Part I) (continued)

Risk Factor Measured at SOC/ROC	Improvement in:											
	Bathing		Grooming		Dressing Upper Body		Dressing Lower Body		Toileting		Transferring	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Integumentary Status												
Surgical wound present	0.312	0.000	0.361	0.000	0.385	0.000	0.188	0.000	0.341	0.000	0.202	0.000
Stage of most problematic pressure ulcer	-0.141	0.000	-0.158	0.000	-0.162	0.000	-0.182	0.000	-0.159	0.000	-0.128	0.000
Status of most problematic stasis ulcer	-0.155	0.000	-0.066	0.007	-0.111	0.000	-0.170	0.000	-0.139	0.002	-0.077	0.000
Functional Status/Physical Functioning												
ADL/IADL index	-0.125	0.000	-0.236	0.000	-0.247	0.000	-0.239	0.000	-0.300	0.000	-0.090	0.000
Bath: Able 2/use of devices												
Bath: Able w/partial assistance	1.087	0.000										
Bath: Requires assistance	2.217	0.000										
Bath: Unable, Bathed in bed/chair	2.355	0.000										
Bath: Totally dependent	3.538	0.000										
Groom: Utensils within reach												
Groom: With assistance			1.111	0.000								
Groom: Totally dependent			2.105	0.000								
Dress UB: Needs some help					0.925	0.000						
Dress UB: Totally dependent					2.068	0.000						
Dress LB: Needs some help							0.644	0.000				
Dress LB: Totally dependent							1.979	0.000				
Toilet: Uses bedside commode									0.727	0.000		
Toilet: Uses bedpan independently									1.027	0.000		
Toilet: Totally dependent									1.260	0.000		
Transfer: Able w/minimal assistance	-0.030	0.180										
Transfer: Unable buy pivots	-0.309	0.000									2.208	0.000
Transfer: Needs assistance	-0.687	0.000									2.708	0.000
Transfer: Needs assistance/bedfast, able to turn self												
Transfer: Bedfact (Levels 4, 5)	-1.114	0.000									3.061	0.000
Eat: Unable to feed self												
Eat: Food tube/unable to take in nutrients (Levels 3-5)												
Amb: Needs device to walk											-0.691	0.000
Amb: Needs assistance to walk											-0.816	0.000
Amb: Chairfast, Able to wheel											-1.456	0.000
Amb: Chairfast, Unable to wheel											-1.717	0.000
Amb: Bedfast											-2.148	0.000
Elimination Status												
Urinary incontinence during the night	-0.097	0.002	-0.094	0.001	-0.108	0.000	-0.094	0.009	-0.127	0.009	-0.132	0.000
Urinary incontinence during the day	-0.152	0.006	-0.132	0.006	-0.169	0.000	-0.134	0.028	-0.208	0.006	-0.218	0.000
Urinary incontinence during the night & day	-0.212	0.000	-0.213	0.000	-0.216	0.000	-0.219	0.000	-0.224	0.000	-0.222	0.000
Urinary catheter present	-0.258	0.000	-0.441	0.000	-0.430	0.000	-0.479	0.000	-0.754	0.000	-0.386	0.000
Bowel incontinent less than weekly	-0.053	0.306	-0.060	0.164	-0.037	0.373	-0.115	0.042	-0.050	0.456	-0.123	0.002
Bowel incontinent 1-3 times/week	-0.175	0.000	-0.236	0.000	-0.210	0.000	-0.316	0.000	-0.279	0.000	-0.166	0.000

TABLE 6b (Part I) (continued)

Risk Factor Measured at SOC/ROC	Improvement in:											
	Bathing		Grooming		Dressing Upper Body		Dressing Lower Body		Toileting		Transferring	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Bowel incontinent 4-6 times/week	-0.266	0.000	-0.384	0.000	-0.350	0.000	-0.399	0.000	-0.462	0.000	-0.327	0.000
c statistic	-0.259	0.000	-0.487	0.000	-0.485	0.000	-0.514	0.000	-0.499	0.000	-0.234	0.000
Ostomy	0.015	0.809	-0.092	0.124	-0.025	0.651	0.048	0.501	-0.270	0.007	0.061	0.223
Neuro/Emotional/Behavioral Status												
Cog Func: Requires prompting	-0.080	0.002	-0.065	0.008	-0.067	0.003	-0.048	0.112	-0.096	0.021	-0.074	0.000
Cog Func: Requires assistance & some direction	-0.130	0.001	-0.161	0.000	-0.118	0.000	-0.096	0.032	-0.179	0.002	-0.082	0.011
Cog Func: Requires considerable assistance	-0.177	0.007	-0.215	0.000	-0.121	0.016	-0.164	0.019	-0.142	0.075	-0.083	0.097
Cog Func: Totally dependent	-0.572	0.000	-0.514	0.000	-0.497	0.000	-0.688	0.000	-0.360	0.014	-0.300	0.001
Conf Freq: In new situations	-0.035	0.122	-0.065	0.004	-0.038	0.062	-0.003	0.921	-0.024	0.525	-0.048	0.008
Conf Freq: Awakening at night	-0.077	0.225	-0.038	0.482	-0.103	0.041	-0.147	0.034	-0.004	0.960	-0.014	0.777
Conf Freq: Day/evenings, not constant	-0.127	0.001	-0.215	0.000	-0.180	0.000	-0.106	0.016	-0.054	0.331	-0.009	0.769
Conf Freq: Constantly	-0.178	0.018	-0.376	0.000	-0.350	0.000	-0.219	0.007	-0.119	0.185	0.051	0.369
Anx Freq: Less than daily	-0.016	0.437	-0.006	0.774	-0.005	0.803	-0.047	0.053	0.052	0.132	-0.005	0.750
Anx Freq: Daily but not constantly	0.018	0.466	0.022	0.344	0.031	0.152	0.034	0.244	0.130	0.001	0.029	0.139
Anx Freq: All the time	0.135	0.048	0.066	0.296	0.142	0.018	0.070	0.379	0.132	0.229	0.161	0.003
Verbal disruption	-0.232	0.003	-0.263	0.000	-0.255	0.000	-0.256	0.002	-0.215	0.019	-0.133	0.023
Depressive Feelings: Depressed mood	-0.062	0.004	-0.030	0.141	-0.026	0.168	-0.035	0.168	-0.101	0.003	-0.023	0.182
Depressive Feelings: Any other elements (2-6)	-0.037	0.493	0.018	0.691	0.003	0.937	-0.027	0.648	-0.097	0.204	-0.087	0.037
OUTCOME SPECIFIC RISK-ADJUSTERS												
Obesity	-0.082	0.001	0.004	0.865	-0.038	0.092	-0.166	0.000	-0.039	0.353	-0.133	0.000
Pain less often daily	-0.032	0.237	0.022	0.404	0.024	0.314	-0.014	0.673	-0.014	0.756	-0.009	0.665
Pain daily but not constantly	0.060	0.002	0.106	0.000	0.068	0.000	0.021	0.360	0.112	0.001	-0.013	0.393
Pain all the time	0.070	0.032	0.095	0.003	0.054	0.069	-0.013	0.740	0.229	0.000	0.010	0.698
Status Prior to Admission												
Bath: Able w/use of devices	-0.270	0.000										
Bath: Able w/partial assistance	-0.721	0.000										
Bath: Requires assistance	-0.861	0.000										
Bath: Unable, Bathed in bed/chair	-0.877	0.000										
Bath: Totally dependent	-0.925	0.000										
Groom: If utensils placed within reach			-0.688	0.000								
Groom: With assistance			-0.890	0.000								
Groom: Totally dependent			-1.086	0.000								
Dress UB: Able if clothing out					-0.667	0.000						
Dress UB: Needs some help					-0.897	0.000						
Dress UB: Totally dependent					-1.084	0.000						
Dress LB: Able if laid out or given							-0.501	0.000				
Dress LB: Needs some help							-0.793	0.000				
Dress LB: Totally dependent							-0.974	0.000				
Toilet: Able when supervised									-0.756	0.000		

TABLE 6b (Part I) (continued)

Risk Factor Measured at SOC/ROC	Improvement in:												
	Bathing		Grooming		Dressing Upper Body		Dressing Lower Body		Toileting		Transferring		
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model		
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
Toilet: Uses bedside commode										-0.818	0.000		
Toilet: Uses bedpan independently										-0.670	0.000		
Toilet: Totally dependent										-1.164	0.000		
Transfer: Able w/minimal assistance												-0.600	0.000
Transfer: Unable but pivots												-0.888	0.000
Transfer: Needs assistance												-1.056	0.000
Transfer: Needs assistance/bedfast (Levels 3,4)													
Transfer: Bedfast (Levels 4,5)												-0.946	0.000
Eat: Able with intermittent assistance													
Eat: Needs mechanical/personal assistance													
Amb: Needs device to walk													
Amb: Needs assistance to walk													
Amb: Chairfast, Able to wheel													
Amb: Chairfast, Unable wheel													
Amb: Bedfast													
Intercept	-0.414	0.000	1.839	0.000	1.746	0.000	1.387	0.000	3.079	0.000	1.189	0.000	
R ² statistic	0.190		0.220		0.215		0.201		0.245		0.129		
c statistic	0.753		0.774		0.770		0.758		0.787		0.705		

TABLE 6b. Final Alternative Risk-Adjustment Models for Activities of Daily Living Outcomes (Part II)

Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization in:						
	Eating		Ambulation		Bathing		Grooming		Transferring		
	Full Model		Full Model		Full Model		Full Model		Full Model		
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
DEMOGRAPHICS											
Age lt 65	0.038	0.469	-0.061	0.081	0.223	0.000	0.069	0.253	0.152	0.011	
Age 75-84	0.078	0.033	-0.101	0.000	-0.111	0.001	0.033	0.411	-0.045	0.261	
Age 85+	-0.097	0.018	-0.363	0.000	-0.306	0.000	-0.231	0.000	-0.206	0.000	
Gender: female	0.037	0.198	-0.127	0.000	-0.140	0.000	-0.029	0.360	-0.101	0.002	
SOCIOECONOMIC FACTORS											
Any Medicaid	-0.264	0.000	-0.040	0.231	0.038	0.417	-0.072	0.191	-0.038	0.485	
Medicare HMO	-0.055	0.235	-0.167	0.000	-0.127	0.001	-0.136	0.004	-0.110	0.024	
PRIOR SERVICE USE											
Discharged past 14 days:											
Discharge from hospital	0.365	0.000	0.249	0.000	0.094	0.002	0.220	0.000	0.174	0.000	
Discharge from rehab facility	0.522	0.000	-0.107	0.000	0.046	0.305	0.293	0.000	-0.072	0.182	
Discharge from nursing home	0.372	0.000	-0.103	0.003	0.060	0.235	0.303	0.000	0.169	0.007	
CLINICAL FACTORS											
Prognoses											
Overall prognosis good/fair	0.155	0.003	0.285	0.000	0.422	0.000	0.329	0.000	0.368	0.000	
Rehabilitation prognosis good	0.149	0.000	0.379	0.000	0.272	0.000	0.368	0.000	0.333	0.000	
Diagnoses											
Diabetes (PPS Group)	0.047	0.188	-0.118	0.000	-0.089	0.007	-0.084	0.032	-0.048	0.231	
Orthopedic (PPS Group)	0.227	0.000	-0.183	0.000	-0.008	0.794	0.134	0.000	0.083	0.023	
Neurological (PPS Group)	-0.099	0.004	-0.272	0.000	-0.082	0.021	-0.120	0.003	-0.051	0.237	
Wound/Burn (PPS Group)	-0.096	0.146	-0.021	0.630	-0.214	0.000	-0.233	0.001	-0.119	0.092	
Cancer	-0.295	0.000	0.144	0.000	-0.360	0.000	-0.512	0.000	-0.318	0.000	
Mental condition	-0.015	0.828	0.101	0.039	0.053	0.407	-0.095	0.189	0.157	0.043	
Dementia	-0.025	0.700	0.000	0.993	-0.089	0.198	-0.158	0.034	0.072	0.369	
Hypertension	-0.006	0.841	0.016	0.432	0.085	0.004	0.131	0.000	0.003	0.925	
Ischemia	0.034	0.463	0.294	0.000	0.121	0.004	0.251	0.000	0.219	0.000	
Arrhythmia	0.000	0.995	0.035	0.285	0.031	0.497	-0.006	0.918	0.039	0.476	
Heart failure	-0.047	0.256	-0.103	0.000	-0.129	0.001	-0.040	0.367	-0.046	0.318	
COPD	0.094	0.043	0.012	0.698	-0.081	0.053	-0.107	0.027	0.006	0.907	
Skin ulcer	-0.021	0.746	-0.170	0.000	-0.230	0.000	-0.165	0.015	-0.222	0.001	
Orthopedic (other than PPS)	0.067	0.065	-0.398	0.000	0.026	0.449	0.290	0.000	0.022	0.605	
Incontinence	-0.076	0.312	-0.154	0.017	-0.172	0.045	-0.149	0.107	-0.126	0.173	
Symptoms, signs, & ill-defined conditions	-0.026	0.568	-0.102	0.001	-0.010	0.827	0.032	0.521	-0.055	0.296	
Diagnosis Severity											
Number of severity ratings ≥ 2	0.004	0.731	0.084	0.000	0.009	0.360	-0.023	0.053	-0.010	0.395	
Sensory Status											
Partially vision impaired	-0.217	0.000	-0.063	0.005	0.059	0.052	-0.088	0.011	-0.084	0.021	
Severely vision impaired	-0.300	0.000	-0.285	0.000	-0.006	0.937	-0.452	0.000	-0.173	0.048	
Speech: Minimum difficulty	-0.173	0.000	-0.034	0.213	0.025	0.497	-0.085	0.042	-0.052	0.252	
Speech: Moderate difficulty	-0.261	0.000	-0.064	0.178	-0.131	0.036	-0.343	0.000	-0.276	0.000	
Speech: Severe difficulty	-0.572	0.000	-0.285	0.000	-0.365	0.000	-0.576	0.000	-0.229	0.011	

TABLE 6b (continued) (Part II)

Risk Factor Measured at SOC/ROC	Improvement in:									
	Eating		Ambulation		Bathing		Grooming		Transferring	
	Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Integumentary Status										
Surgical wound present	0.278	0.000	0.194	0.000	0.329	0.000	0.484	0.000	0.401	0.000
Stage of most problematic pressure ulcer	-0.127	0.000	-0.204	0.000	-0.151	0.000	-0.156	0.000	-0.178	0.000
Status of most problematic stasis ulcer	-0.035	0.400	-0.079	0.006	-0.094	0.004	-0.093	0.016	-0.081	0.040
Functional Status/Physical Functioning										
ADL/IADL index	-0.142	0.000	-0.093	0.000	-0.228	0.000	-0.349	0.000	-0.185	0.000
Bath: Able 2/use of devices					1.066	0.000				
Bath: Able w/partial assistance					2.328	0.000				
Bath: Requires assistance					3.595	0.000				
Bath: Unable, Bathed in bed/chair					4.679	0.000				
Bath: Totally dependent										
Groom: Utensils within reach							1.185	0.000		
Groom: With assistance							2.994	0.000		
Groom: Totally dependent										
Dress UB: Needs some help										
Dress UB: Totally dependent										
Dress LB: Needs some help										
Dress LB: Totally dependent										
Toilet: Uses bedside commode										
Toilet: Uses bedpan independently										
Toilet: Totally dependent										
Transfer: Able w/minimal assistance			-0.498	0.000	-0.085	0.014			3.513	0.000
Transfer: Unable buy pivots			-0.866	0.000	-0.619	0.000			4.090	0.000
Transfer: Needs assistance			-1.203	0.000	-1.078	0.000				
Transfer: Needs assistance/bedfast, able to turn self									4.337	0.000
Transfer: Bedfact (Levels 4, 5)			-1.654	0.000	-1.736	0.000				
Eat: Unable to feed self	1.392	0.000								
Eat: Food tube/unable to take in nutrients (Levels 3-5)	0.642	0.000								
Amb: Needs device to walk									-1.086	0.000
Amb: Needs assistance to walk			3.397	0.000					-1.463	0.000
Amb: Chairfast, Able to wheel			2.884	0.000					-2.074	0.000
Amb: Chairfast, Unable to wheel			4.133	0.000					-2.706	0.000
Amb: Bedfast			4.841	0.000					-2.681	0.000
Elimination Status										
Urinary incontinence during the night	0.034	0.495	-0.173	0.000	0.010	0.839	-0.092	0.088	-0.127	0.029
Urinary incontinence during the day	-0.176	0.029	-0.224	0.001	-0.009	0.918	-0.128	0.169	-0.060	0.579
Urinary incontinence during the night & day	-0.087	0.025	-0.235	0.000	-0.026	0.516	-0.159	0.000	-0.192	0.000
Urinary catheter present	-0.257	0.000	-0.380	0.000	-0.243	0.000	-0.366	0.000	-0.383	0.000
Bowel incontinent less than weekly	-0.201	0.006	-0.099	0.104	-0.204	0.008	-0.028	0.746	-0.210	0.022
Bowel incontinent 1-3 times/week	-0.198	0.001	-0.114	0.031	-0.148	0.046	-0.135	0.082	-0.194	0.016
Bowel incontinent 4-6 times/week	-0.385	0.000	-0.277	0.000	-0.392	0.000	-0.488	0.000	-0.184	0.095
c statistic	-0.267	0.000	-0.324	0.000	-0.446	0.000	-0.535	0.000	-0.200	0.018

TABLE 6b (continued) (Part II)

Risk Factor Measured at SOC/ROC	Improvement in:									
	Eating		Ambulation		Bathing		Grooming		Transferring	
	Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Ostomy	0.043	0.675	0.323	0.000	-0.234	0.008	-0.118	0.261	0.038	0.729
Neuro/Emotional/Behavioral Status										
Cog Func: Requires prompting	-0.080	0.053	-0.056	0.062	0.019	0.634	-0.077	0.089	0.031	0.540
Cog Func: Requires assistance & some direction	-0.121	0.035	-0.068	0.151	0.057	0.365	-0.168	0.012	0.045	0.542
Cog Func: Requires considerable assistance	-0.146	0.077	-0.103	0.164	0.114	0.259	-0.140	0.198	0.001	0.995
Cog Func: Totally dependent	-0.395	0.007	-0.298	0.028	-0.404	0.051	-0.818	0.003	-0.240	0.191
Conf Freq: In new situations	-0.007	0.846	0.018	0.488	-0.108	0.002	-0.076	0.062	0.028	0.526
Conf Freq: Awakening at night	-0.065	0.467	0.036	0.627	-0.273	0.005	-0.201	0.056	0.003	0.980
Conf Freq: Day/evenings, not constant	-0.074	0.199	-0.014	0.766	-0.233	0.000	-0.336	0.000	0.019	0.793
Conf Freq: Constantly	-0.211	0.024	0.034	0.690	-0.332	0.003	-0.525	0.000	0.186	0.132
Anx Freq: Less than daily	-0.019	0.580	0.011	0.648	0.007	0.817	0.025	0.499	0.043	0.271
Anx Freq: Daily but not constantly	-0.053	0.175	0.106	0.000	0.024	0.538	0.062	0.167	0.145	0.002
Anx Freq: All the time	0.054	0.606	0.166	0.028	0.019	0.856	0.059	0.619	-0.080	0.475
Verbal disruption	-0.153	0.108	-0.001	0.987	-0.154	0.166	-0.412	0.000	-0.176	0.124
Depressive Feelings: Depressed mood	0.031	0.375	-0.045	0.064	-0.033	0.337	-0.068	0.072	-0.102	0.010
Depressive Feelings: Any other elements (2-6)	-0.079	0.296	-0.067	0.269	0.086	0.299	0.044	0.625	-0.062	0.514
OUTCOME SPECIFIC RISK-ADJUSTERS										
Obesity	0.058	0.175	-0.126	0.000	-0.094	0.015	-0.006	0.901	-0.109	0.018
Pain less often daily	0.041	0.342	-0.086	0.005	0.023	0.560	0.046	0.339	-0.119	0.015
Pain daily but not constantly	0.013	0.698	-0.052	0.016	0.090	0.003	0.121	0.001	-0.053	0.139
Pain all the time	0.078	0.159	-0.022	0.535	0.111	0.038	0.158	0.010	-0.052	0.399
Status Prior to Admission										
Bath: Able w/use of devices					-0.151	0.001				
Bath: Able w/partial assistance					-0.452	0.000				
Bath: Requires assistance					-0.259	0.000				
Bath: Unable, Bathed in bed/chair					-0.559	0.000				
Bath: Totally dependent					-0.065	0.740				
Groom: If utensils placed within reach							-0.452	0.000		
Groom: With assistance							-0.424	0.000		
Groom: Totally dependent							-0.410	0.011		
Dress UB: Able if clothing out										
Dress UB: Needs some help										
Dress UB: Totally dependent										
Dress LB: Able if laid out or given										
Dress LB: Needs some help										
Dress LB: Totally dependent										
Toilet: Able when supervised										
Toilet: Uses bedside commode										
Toilet: Uses bedpan independently										
Toilet: Totally dependent										
Transfer: Able w/minimal assistance									-0.352	0.000
Transfer: Unable but pivots									-0.510	0.000

TABLE 6b (continued) (Part II)										
Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization in:					
	Eating		Ambulation		Bathing		Grooming		Transferring	
	Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Transfer: Needs assistance										
Transfer: Needs assistance/bedfast (Levels 3,4)									-0.457	0.000
Transfer: Bedfast (Levels 4,5)										
Eat: Able with intermittent assistance	-0.658	0.000								
Eat: Needs mechanical/personal assistance	-0.921	0.000								
Amb: Needs device to walk			-0.674	0.000						
Amb: Needs assistance to walk			-1.048	0.000						
Amb: Chairfast, Able to wheel			-1.881	0.000						
Amb: Chairfast, Unable wheel			-1.654	0.000						
Amb: Bedfast			-1.074	0.000						
Intercept	1.472	0.000	-0.389	0.000	1.307	0.000	3.774	0.000	3.019	0.000
R ² statistic	0.167		0.244		0.105		0.097		0.104	
c statistic	0.737		0.788		0.778		0.786		0.836	

TABLE 7a. Summary of Regression Models: Instrumental Activities of Daily Living

	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 <i>Clinical Core (Baseline Model)</i>	Model 2 <i>Adds Outcome- Specific</i>	Model 3 <i>Adds OASIS "Prior" Items</i>
IMPROVEMENT IN HOUSINGKEEPING	Yes				
Percent Who Could Improve: 68.6%					
Percent Improving Among Those Who Could: 44.2%					
Number of OASIS Items		48	41	43	46 ^a
Number of OASIS Elements		74	59	65	70
R ² statistic		0.263	0.254	0.254	0.273
c statistic		0.798	0.792	0.793	0.803
IMPROVEMENT IN LAUNDRY	Yes				
Percent Who Could Improve: 67.6%					
Percent Improving Among Those Who Could: 37.1%					
Number of OASIS Items		47	41	43	46 ^b
Number of OASIS Elements		76	59	65	70
R ² statistic		0.264	0.220	0.221	0.246
c statistic		0.805	0.779	0.779	0.794
IMPROVEMENT IN SHOPPING	Yes				
Percent Who Could Improve: 69.3%					
Percent Improving Among Those Who Could: 47.1%					
Number of OASIS Items		46	41	43	46 ^c
Number of OASIS Elements		64	59	65	70
R ² statistic		0.226	0.204	0.204	0.222
c statistic		0.775	0.759	0.760	0.772
IMPROVEMENT IN LIGHT MEAL PREPARATION	Yes				
Percent Who Could Improve: 50.9%					
Percent Improving Among Those Who Could: 52.4%					
Number of OASIS Items		51	41	41	44 ^d
Number of OASIS Elements		79	59	61	66
R ² statistic		0.267	0.215	0.216	0.236
c statistic		0.797	0.766	0.767	0.779
IMPROVEMENT IN TELEPHONE USE	Yes				
Percent Who Could Improve: 18.1%					
Percent Improving Among Those Who Could: 47.1%					
Number of OASIS Items		70	41	41	44 ^e
Number of OASIS Elements		97	59	61	66
R ² statistic		0.124	0.106	0.106	0.116
c statistic		0.702	0.686	0.687	0.695

TABLE 7a (continued)

	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 <i>Clinical Core (Baseline Model)</i>	Model 2 <i>Adds Outcome- Specific</i>	Model 3 <i>Adds OASIS "Prior" Items</i>
IMPROVEMENT IN MEDICATION MANAGEMENT	Yes				
Percent Who Could Improve: 38.7%					
Percent Improving Among Those Who Could: 34.8%					
Number of OASIS Items		48	41	41	44 ¹
Number of OASIS Elements		76	59	61	66
R ² statistic		0.180	0.132	0.133	0.157
c statistic		0.754	0.718	0.720	0.737
STABILIZATION IN HOUSEKEEPING	Yes				
Percent Who Could Stabilize: 31.3%					
Percent Stabilized Among Those Who Could: 82.3%					
Number of OASIS Items		50	41	43	46 ^a
Number of OASIS Elements		71	59	65	70
R ² statistic		0.110	0.088	0.089	0.095
c statistic		0.721	0.699	0.699	0.706
STABILIZATION IN LAUNDRY	Yes				
Percent Who Could Stabilize: 17.2%					
Percent Stabilized Among Those Who Could: 83.1%					
Number of OASIS Items		46	41	43	46 ^b
Number of OASIS Elements		68	59	65	70
R ² statistic		0.133	0.114	0.115	0.120
c statistic		0.752	0.732	0.732	0.739
STABILIZATION IN SHOPPING	Yes				
Percent Who Could Stabilize: 44.1%					
Percent Stabilized Among Those Who Could: 89.2%					
Number of OASIS Items		41	41	43	46 ^c
Number of OASIS Elements		56	59	65	70
R ² statistic		0.120	0.109	0.109	0.116
c statistic		0.776	0.761	0.762	0.771
STABILIZATION IN LIGHT MEAL PREPARATION	Yes				
Percent Who Could Stabilize: 44.3%					
Percent Stabilized Among Those Who Could: 90.1%					
Number of OASIS Items		43	41	41	44 ^d
Number of OASIS Elements		69	59	61	66
R ² statistic		0.118	0.086	0.086	0.091
c statistic		0.777	0.735	0.736	0.742

TABLE 7a (continued)

	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 <i>Clinical Core (Baseline Model)</i>	Model 2 <i>Adds Outcome-Specific</i>	Model 3 <i>Adds OASIS "Prior" Items</i>
STABILIZATION IN TELEPHONE USE	Yes				
Percent Who Could Stabilize: 66.7%					
Percent Stabilized Among Those Who Could: 92.6%					
Number of OASIS Items		45	41	41	44 ^e
Number of OASIS Elements		66	59	61	66
R ² statistic		0.103	0.091	0.092	0.092
c statistic		0.803	0.788	0.788	0.789
STABILIZATION IN MEDICATION MANAGEMENT	No				
Percent Who Could Stabilize: 54.8%					
Percent Stabilized Among Those Who Could: 91.7%					
Number of OASIS Items		N/A	41	41	44 ^f
Number of OASIS Elements			59	61	66
R ² statistic			0.064	0.064	0.066
c statistic			0.728	0.728	0.732
<p>NOTES: "Percent Who Could Improve" calculated using all home health episodes, not just those discharged to the community. The smallest sample size for the IADL risk-adjustment models is 42,946. Shading indicates that CO model statistics are for multiple sub-models; we report the number of unique OASIS items and elements across all sub-models.</p> <p>a. Risk-adjustment model includes help required with housekeeping, impaired decision making and memory loss <i>prior to</i> home health admission. b. Risk-adjustment model includes help required with laundry, impaired decision making, and memory loss <i>prior to</i> home health admission. c. Risk-adjustment model includes help required with shopping, impaired decision making, and memory loss <i>prior to</i> home health admission. d. Risk-adjustment model includes help required with light meal preparation, impaired decision making and memory loss <i>prior to</i> home health admission. e. Risk-adjustment model includes help required with telephone use, impaired decision making, and memory loss <i>prior to</i> home health admission. f. Risk-adjustment model includes help required with taking oral medication(s), impaired decision making and memory loss <i>prior to</i> home health admission.</p>					

TABLE 7b. Final Alternative Risk-Adjustment Models for Instrumental Activities of Daily Living Outcomes (Part I)

Risk Factor Measured at SOC/ROC	Improvement in:											
	Housekeeping		Laundry		Shopping		Light Meal Prep.		Telephone Use		Medication Mgmt.	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
DEMOGRAPHICS												
Age lt 65	0.052	0.018	0.075	0.016	0.124	0.000	-0.113	0.002	-0.120	0.000	0.014	0.660
Age 75-84	-0.024	0.111	-0.019	0.368	-0.105	0.000	-0.055	0.022	-0.053	0.017	-0.182	0.000
Age 85+	-0.294	0.000	-0.362	0.000	-0.357	0.000	-0.328	0.000	-0.244	0.000	-0.501	0.000
Gender: female	0.207	0.000	0.239	0.000	-0.073	0.000	0.199	0.000	0.060	0.000	0.089	0.000
SOCIOECONOMIC FACTORS												
Any Medicaid	-0.136	0.000	-0.173	0.000	-0.104	0.000	-0.171	0.000	-0.211	0.000	-0.127	0.000
Medicare HMO	-0.196	0.000	-0.314	0.000	-0.207	0.000	-0.174	0.000	0.084	0.001	-0.038	0.129
PRIOR SERVICE USE												
Discharged past 14 days:												
Discharge from hospital	0.319	0.000	0.304	0.000	0.281	0.000	0.381	0.000	0.351	0.000	0.317	0.000
Discharge from rehab facility	0.405	0.000	0.336	0.000	0.328	0.000	0.517	0.000	0.500	0.000	0.409	0.000
Discharge from nursing home	0.308	0.000	0.260	0.000	0.218	0.000	0.395	0.000	0.297	0.000	0.203	0.000
CLINICAL FACTORS												
Prognoses												
Overall prognosis good/fair	0.319	0.000	0.275	0.000	0.337	0.000	0.268	0.000	0.213	0.000	0.271	0.000
Rehabilitation prognosis good	0.285	0.000	0.341	0.000	0.282	0.000	0.225	0.000	0.086	0.000	0.150	0.000
Diagnoses												
Diabetes (PPS Group)	-0.067	0.000	-0.041	0.064	0.017	0.419	-0.053	0.029	0.031	0.107	-0.080	0.000
Orthopedic (PPS Group)	0.067	0.000	-0.017	0.373	0.025	0.164	0.129	0.000	0.137	0.000	0.062	0.000
Neurological (PPS Group)	-0.096	0.000	-0.155	0.000	-0.016	0.483	-0.132	0.000	-0.088	0.000	-0.255	0.000
Wound/Burn (PPS Group)	-0.051	0.063	0.015	0.703	-0.032	0.404	-0.133	0.003	-0.062	0.097	-0.080	0.041
Cancer	-0.219	0.000	-0.242	0.000	-0.185	0.000	-0.304	0.000	-0.182	0.000	-0.123	0.000
Mental condition	0.012	0.710	0.092	0.041	0.095	0.024	-0.022	0.653	0.015	0.665	-0.244	0.000
Dementia	-0.115	0.004	-0.256	0.000	-0.252	0.000	-0.300	0.000	-0.149	0.000	-0.441	0.000
Hypertension	0.032	0.016	0.055	0.004	0.030	0.099	0.056	0.009	0.009	0.599	0.085	0.000
Ischemia	0.024	0.199	-0.025	0.339	0.052	0.038	0.048	0.114	0.004	0.888	0.039	0.088
Arrhythmia	0.073	0.000	0.028	0.361	0.050	0.076	0.078	0.020	0.022	0.416	-0.055	0.031
Heart failure	-0.094	0.000	-0.123	0.000	-0.059	0.018	-0.024	0.404	0.012	0.585	-0.083	0.000
COPD	-0.165	0.000	-0.148	0.000	-0.118	0.000	-0.038	0.220	0.084	0.001	0.067	0.005
Skin ulcer	-0.069	0.015	-0.032	0.433	-0.055	0.154	-0.162	0.000	-0.062	0.095	-0.089	0.021
Orthopedic (other than PPS)	0.133	0.000	0.154	0.000	0.070	0.001	0.171	0.000	0.106	0.000	0.149	0.000
Incontinence	-0.125	0.006	-0.040	0.575	-0.067	0.272	-0.110	0.095	-0.159	0.000	-0.078	0.134
Symptoms, signs, & ill-defined conditions	0.008	0.684	-0.014	0.654	-0.009	0.744	-0.002	0.948	-0.025	0.277	-0.133	0.000
Diagnosis Severity												
Number of severity ratings ≥ 2	0.036	0.000	0.048	0.000	0.036	0.000	0.034	0.000	0.046	0.000	0.049	0.000
Sensory Status												
Partially vision impaired	-0.103	0.000	-0.086	0.000	-0.091	0.000	-0.138	0.000	-0.096	0.000	-0.070	0.000
Severely vision impaired	-0.440	0.000	-0.442	0.000	-0.423	0.000	-0.332	0.000	-0.450	0.000	-0.518	0.000
Speech: Minimum difficulty	-0.022	0.203	0.004	0.864	0.015	0.520	-0.085	0.001	-0.167	0.000	-0.093	0.000
Speech: Moderate difficulty	-0.123	0.000	-0.124	0.021	-0.205	0.000	-0.230	0.000	-0.416	0.000	-0.240	0.000
Speech: Severe difficulty	-0.403	0.000	-0.387	0.000	-0.676	0.000	-0.593	0.000	-1.004	0.000	-0.687	0.000

TABLE 7b (Part I) (continued)

Risk Factor Measured at SOC/ROC	Improvement in:											
	Housekeeping		Laundry		Shopping		Light Meal Prep.		Telephone Use		Medication Mgmt.	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Integumentary Status												
Surgical wound present	0.269	0.000	0.270	0.000	0.267	0.000	0.457	0.000	0.209	0.000	0.421	0.000
Stage of most problematic pressure ulcer	-0.129	0.000	-0.167	0.000	-0.125	0.000	-0.133	0.000	-0.076	0.000	-0.093	0.000
Status of most problematic stasis ulcer	-0.084	0.000	-0.073	0.006	-0.085	0.000	-0.070	0.018	-0.004	0.846	0.029	0.225
Functional Status/Physical Functioning												
ADL/IADL index	-0.232	0.000	-0.258	0.000	-0.184	0.000	-0.214	0.000	-0.070	0.000	-0.094	0.000
Hous: Light tasks only												
Hous: Intermittent assistance	2.962	0.000										
Hous: Usually requires assistance	3.273	0.000										
Hous: Totally dependent	3.558	0.000										
Laun: Light laundry only												
Laun: Totally dependent			2.612	0.000								
Shop: Needs some assistance												
Shop: Only if delivered					2.539	0.000						
Shop: Totally dependent					3.674	0.000						
Lt Meal: Able, but not regularly												
Lt Meal: Totally dependent							1.108	0.000				
Phon: Able, with adapted phone												
Phon: Answers, but has trouble calling									0.283	0.000		
Phon: Sometimes answers/limited conversation									0.698	0.000		
Phon: Can listen with assistive device									0.906	0.000		
Phon: Totally dependent									1.386	0.000		
Oral Med: Able if prepared												
Oral Med: Totally dependent											1.260	0.000
Elimination Status												
Urinary incontinence during the night	-0.007	0.752	-0.091	0.007	-0.027	0.377	-0.046	0.195	-0.087	0.001	-0.060	0.032
Urinary incontinence during the day	-0.128	0.002	-0.192	0.003	-0.226	0.000	-0.129	0.040	-0.244	0.000	-0.157	0.001
Urinary incontinence during the night & day	-0.141	0.000	-0.212	0.000	-0.166	0.000	-0.172	0.000	-0.170	0.000	-0.151	0.000
Urinary catheter present	-0.182	0.000	-0.135	0.005	-0.148	0.001	-0.267	0.000	-0.238	0.000	-0.176	0.000
Bowel incontinent less than weekly	-0.065	0.102	0.007	0.910	-0.016	0.772	-0.038	0.522	-0.032	0.373	-0.052	0.254
Bowel incontinent 1-3 times/week	-0.208	0.000	-0.059	0.359	-0.104	0.047	-0.112	0.043	-0.165	0.000	-0.212	0.000
Bowel incontinent 4-6 times/week	-0.383	0.000	-0.295	0.009	-0.346	0.000	-0.338	0.000	-0.247	0.000	-0.351	0.000
Bowel incontinent daily or more often	-0.379	0.000	-0.347	0.000	-0.386	0.000	-0.388	0.000	-0.351	0.000	-0.436	0.000
Ostomy	0.063	0.126	0.065	0.275	0.008	0.887	-0.093	0.167	0.030	0.618	0.045	0.430
Neuro/Emotional/Behavioral Status												
Cog Func: Requires prompting	-0.011	0.546	-0.022	0.425	-0.047	0.067	-0.059	0.038	-0.100	0.000	-0.189	0.000
Cog Func: Requires assistance & some direction	-0.066	0.038	-0.078	0.125	-0.162	0.000	-0.172	0.000	-0.146	0.000	-0.310	0.000
Cog Func: Requires considerable assistance	-0.106	0.066	-0.432	0.000	-0.558	0.000	-0.158	0.048	-0.167	0.000	-0.458	0.000
Cog Func: Totally dependent	-0.498	0.002	-1.030	0.019	-1.173	0.000	-0.627	0.004	-0.479	0.000	-0.961	0.000
Conf Freq: In new situations	0.003	0.834	-0.020	0.395	-0.029	0.185	-0.127	0.000	-0.063	0.003	-0.193	0.000

TABLE 7b (Part I) (continued)

Risk Factor Measured at SOC/ROC	Improvement in:											
	Housekeeping		Laundry		Shopping		Light Meal Prep.		Telephone Use		Medication Mgmt.	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Conf Freq: Awakening at night	-0.022	0.647	-0.246	0.002	-0.205	0.002	-0.178	0.012	-0.137	0.002	-0.304	0.000
c statistic	-0.115	0.000	-0.248	0.000	-0.177	0.000	-0.301	0.000	-0.215	0.000	-0.360	0.000
Conf Freq: Constantly	-0.283	0.000	-0.573	0.000	-0.366	0.000	-0.471	0.000	-0.422	0.000	-0.593	0.000
Anx Freq: Less than daily	0.030	0.041	0.059	0.006	0.058	0.004	0.056	0.017	0.046	0.012	0.073	0.000
Anx Freq: Daily but not constantly	0.039	0.030	0.110	0.000	0.061	0.012	0.127	0.000	0.136	0.000	0.165	0.000
Anx Freq: All the time	0.043	0.388	0.121	0.094	0.120	0.076	0.083	0.283	0.283	0.000	0.211	0.000
Verbal disruption	-0.242	0.000	-0.148	0.181	-0.336	0.000	-0.317	0.001	-0.243	0.000	-0.289	0.000
Depressive Feelings: Depressed mood	-0.054	0.001	-0.078	0.001	-0.057	0.008	-0.065	0.007	0.011	0.562	-0.075	0.000
Depressive Feelings: Any other elements (2-6)	-0.040	0.299	-0.058	0.334	-0.001	0.985	-0.016	0.785	0.201	0.000	-0.058	0.205
OUTCOME SPECIFIC RISK-ADJUSTERS												
Obesity	-0.011	0.515	-0.046	0.064	-0.015	0.515						
Pain less often daily	0.004	0.827	0.056	0.051	0.056	0.033						
Pain daily but not constantly	0.056	0.000	0.080	0.000	0.041	0.031						
Pain all the time	0.003	0.894	0.032	0.327	-0.011	0.736						
Memory deficit	-0.092	0.000	-0.137	0.001	-0.115	0.001	-0.156	0.000	-0.059	0.004	-0.227	0.000
Impaired decision making	-0.022	0.401	-0.060	0.166	-0.024	0.515	-0.056	0.134	-0.050	0.016	-0.013	0.638
Status Prior to Admission												
Hous: Light tasks only	-0.288	0.000										
Hous: Intermittent assistance	-0.466	0.000										
Hous: Usually requires assistance	-0.774	0.000										
Hous: Totally dependent	-0.979	0.000										
Laun: Light laundry only			-0.318	0.000								
Laun: Totally dependent			-1.008	0.000								
Shop: Needs some assistance					-0.225	0.000						
Shop: Only if delivered					-0.744	0.000						
Shop: Totally dependent					-0.905	0.000						
Lt Meal: Able, but not regularly							-0.671	0.000				
Lt Meal: Totally dependent							-0.933	0.000				
Phon: Able, with adapted phone									-0.429	0.000		
Phon: Answers, but has trouble calling									-0.578	0.000		
Phon: Sometimes answers/limited conversation									-0.623	0.000		
Phon: Can listen with assistive device									-0.729	0.000		
Phon: Totally dependent									-0.952	0.000		
Oral Med: Able if prepared											-0.756	0.000
Oral Med: Totally dependent											-0.995	0.000
Impaired decision making prior 2 weeks	-0.040	0.106	-0.191	0.022	-0.085	0.013	-0.101	0.005	-0.057	0.007	-0.171	0.000
Memory loss prior 2 weeks	-0.199	0.000	-0.175	0.000	-0.184	0.000	-0.136	0.001	-0.098	0.000	-0.190	0.000
Intercept	-1.803	0.000	-1.238	0.000	-1.728	0.000	1.132	0.000	0.619	0.000	0.206	0.000
R ² statistic	0.273		0.246		0.222		0.236		0.116		0.157	
c statistic	0.803		0.794		0.772		0.779		0.695		0.737	

TABLE 7b. Final Alternative Risk-Adjustment Models for Instrumental Activities of Daily Living Outcomes (Part II)

Risk Factor Measured at SOC/ROC	Stabilization in:											
	Housekeeping		Laundry		Shopping		Light Meal Prep.		Telephone Use		Medication Mgmt.	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
DEMOGRAPHICS												
Age lt 65	0.124	0.001	0.124	0.018	0.339	0.000	0.088	0.003	0.170	0.000	0.294	0.000
Age 75-84	-0.080	0.002	-0.086	0.017	-0.043	0.260	-0.066	0.001	-0.194	0.000	-0.290	0.000
Age 85+	-0.205	0.000	-0.271	0.000	-0.314	0.000	-0.321	0.000	-0.599	0.000	-0.662	0.000
Gender: female	0.277	0.000	0.318	0.000	0.083	0.010	0.368	0.000	0.162	0.000	0.270	0.000
SOCIOECONOMIC FACTORS												
Any Medicaid	0.016	0.662	0.026	0.602	0.067	0.206	-0.170	0.000	-0.127	0.001	-0.050	0.203
Medicare HMO	-0.192	0.000	-0.278	0.000	-0.191	0.000	-0.211	0.000	-0.010	0.756	-0.153	0.000
PRIOR SERVICE USE												
Discharged past 14 days:												
Discharge from hospital	0.036	0.132	-0.057	0.081	0.005	0.883	0.161	0.000	0.207	0.000	0.159	0.000
Discharge from rehab facility	0.085	0.016	-0.082	0.114	-0.079	0.117	0.201	0.000	0.178	0.000	0.102	0.004
Discharge from nursing home	0.101	0.011	-0.047	0.422	0.057	0.329	0.228	0.000	0.103	0.006	0.043	0.283
CLINICAL FACTORS												
Prognoses												
Overall prognosis good/fair	0.207	0.000	0.223	0.004	0.319	0.000	0.262	0.000	0.335	0.000	0.360	0.000
Rehabilitation prognosis good	0.258	0.000	0.268	0.000	0.118	0.008	0.224	0.000	0.143	0.000	0.157	0.000
Diagnoses												
Diabetes (PPS Group)	-0.075	0.003	-0.023	0.523	-0.035	0.361	-0.034	0.081	-0.035	0.183	-0.136	0.000
Orthopedic (PPS Group)	0.028	0.237	-0.072	0.033	0.064	0.066	0.074	0.000	0.168	0.000	0.139	0.000
Neurological (PPS Group)	-0.079	0.008	-0.101	0.025	-0.0056	0.195	-0.177	0.000	-0.192	0.000	-0.337	0.000
Wound/Burn (PPS Group)	-0.051	0.279	-0.006	0.919	-0.101	0.145	-0.121	0.001	-0.096	0.055	-0.045	0.374
Cancer	-0.293	0.000	-0.302	0.00	-0.428	0.000	-0.410	0.000	-0.396	0.000	-0.290	0.000
Mental condition	0.095	0.060	0.081	0.249	0.132	0.091	-0.128	0.001	-0.051	0.308	-0.258	0.000
Dementia	-0.068	0.316	-0.400	0.000	-0.058	0.573	-0.327	0.000	-0.441	0.000	-0.645	0.000
Hypertension	0.058	0.012	-0.026	0.408	0.011	0.754	0.109	0.000	0.037	0.116	0.097	0.000
Ischemia	0.070	0.032	-0.017	0.703	0.042	0.391	0.101	0.000	0.199	0.000	0.003	0.934
Arrhythmia	0.054	0.137	0.033	0.515	0.100	0.073	0.110	0.000	-0.018	0.604	-0.079	0.033
Heart failure	-0.046	0.140	-0.098	0.028	-0.051	0.259	-0.046	0.042	-0.046	0.123	-0.059	0.060
COPD	-0.156	0.000	-0.185	0.000	-0.050	0.317	-0.008	0.735	0.111	0.001	0.100	0.004
Skin ulcer	-0.036	0.437	0.032	0.598	-0.047	0.499	-0.060	0.087	-0.084	0.085	-0.074	0.135
Orthopedic (other than PPS)	0.159	0.000	0.112	0.003	0.159	0.000	0.220	0.000	0.306	0.000	0.329	0.000
Incontinence	-0.018	0.838	0.162	0.226	-0.035	0.756	-0.079	0.178	-0.124	0.035	-0.143	0.055
Symptoms, signs, & ill-defined conditions	0.033	0.354	0.005	0.930	0.083	0.117	-0.002	0.930	-0.053	0.105	-0.089	0.012
Diagnosis Severity												
Number of severity ratings ≥ 2	0.003	0.669	0.026	0.026	-0.010	0.383	0.012	0.045	0.003	0.675	0.008	0.324
Sensory Status												
Partially vision impaired	-0.057	0.022	-0.040	0.272	-0.012	0.746	-0.096	0.000	-0.173	0.000	-0.011	0.956
Severely vision impaired	-0.346	0.000	-0.273	0.013	-0.462	0.000	-0.411	0.000	-0.801	0.000	-0.444	0.000
Speech: Minimum difficulty	-0.031	0.297	-0.015	0.732	-0.059	0.167	-0.093	0.000	-0.294	0.000	-0.131	0.000
Speech: Moderate difficulty	-0.095	0.116	-0.098	0.340	-0.315	0.000	-0.167	0.000	-0.551	0.000	-0.275	0.000
Speech: Severe difficulty	-0.169	0.077	-0.154	0.383	-0.490	0.000	-0.459	0.000	-1.254	0.000	-0.791	0.000

TABLE 7b (Part II) (continued)

Risk Factor Measured at SOC/ROC	Stabilization in:											
	Housekeeping		Laundry		Shopping		Light Meal Prep.		Telephone Use		Medication Mgmt.	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Integumentary Status												
Surgical wound present	0.236	0.000	0.140	0.000	0.335	0.000	0.400	0.000	0.552	0.000	0.598	0.000
Stage of most problematic pressure ulcer	-0.159	0.000	-0.103	0.004	-0.112	0.001	-0.106	0.000	-0.079	0.000	-0.102	0.000
Status of most problematic stasis ulcer	-0.041	0.125	0.016	0.645	-0.016	0.695	-0.014	0.472	0.028	0.345	0.044	0.132
Functional Status/Physical Functioning												
ADL/IADL index	-0.227	0.000	-0.269	0.000	-0.226	0.000	-0.274	0.000	-0.201	0.000	-0.190	0.000
Hous: Light tasks only	2.000	0.000										
Hous: Intermittent assistance	2.354	0.000										
Hous: Usually requires assistance	2.960	0.000										
Hous: Totally dependent												
Laun: Light laundry only			2.181	0.000								
Laun: Totally dependent												
Shop: Needs some assistance					2.142	0.000						
Shop: Only if delivered					4.017	0.000						
Shop: Totally dependent												
Lt Meal: Able, but not regularly								1.738	0.000			
Lt Meal: Totally dependent												
Phon: Able, with adapted phone									-0.006	0.932		
Phon: Answers, but has trouble calling									0.538	0.000		
Phon: Sometimes answers/limited conversation									1.133	0.000		
Phon: Can listen with assistive device									1.434	0.000		
Phon: Totally dependent												
Oral Med: Able if prepared											1.438	0.000
Oral Med: Totally dependent												
Elimination Status												
Urinary incontinence during the night	0.030	0.456	0.035	0.552	-0.080	0.157	0.017	0.557	-0.079	0.029	-0.065	0.102
Urinary incontinence during the day	0.058	0.440	-0.176	0.120	-0.166	0.095	-0.091	0.080	-0.168	0.004	-0.093	0.200
Urinary incontinence during the night & day	-0.042	0.205	0.067	0.177	-0.055	0.235	0.022	0.351	-0.047	0.101	-0.026	0.417
Urinary catheter present	-0.081	0.154	-0.045	0.572	-0.003	0.966	-0.039	0.343	-0.094	0.061	0.126	0.028
Bowel incontinent less than weekly	-0.291	0.000	-0.193	0.085	-0.169	0.074	-0.073	0.154	-0.004	0.946	-0.099	0.150
Bowel incontinent 1-3 times/week	-0.097	0.205	-0.104	0.397	-0.129	0.186	-0.049	0.349	-0.056	0.257	-0.110	0.108
Bowel incontinent 4-6 times/week	-0.351	0.009	-0.521	0.019	-0.254	0.114	-0.345	0.000	-0.184	0.014	-0.184	0.113
Bowel incontinent daily or more often	-0.302	0.002	-0.287	0.067	-0.304	0.010	-0.268	0.000	-0.422	0.000	-0.339	0.000
Ostomy	0.034	0.641	-0.018	0.859	-0.035	0.738	0.017	0.761	0.019	0.806	0.087	0.261
Neuro/Emotional/Behavioral Status												
Cog Func: Requires prompting	0.004	0.907	0.059	0.223	-0.053	0.254	-0.032	0.179	-0.285	0.000	-0.179	0.000
Cog Func: Requires assistance & some direction	-0.029	0.606	0.163	0.077	-0.134	0.109	-0.042	0.300	-0.319	0.000	-0.201	0.001
Cog Func: Requires considerable assistance	0.277	0.021	-0.089	0.708	0.036	0.846	0.038	0.654	-0.293	0.000	-0.008	0.952
Cog Func: Totally dependent	-0.637	0.127	-10.843	0.897	-0.585	0.501	-0.488	0.141	-0.249	0.199	-0.073	0.864
Conf Freq: In new situations	0.004	0.888	0.009	0.818	-0.030	0.456	-0.110	0.000	-0.265	0.000	-0.213	0.000

TABLE 7b (Part II) (continued)

Risk Factor Measured at SOC/ROC	Stabilization in:											
	Housekeeping		Laundry		Shopping		Light Meal Prep.		Telephone Use		Medication Mgmt.	
	Full Model		Full Model		Full Model		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Conf Freq: Awakening at night	-0.124	0.166	0.063	0.673	-0.247	0.034	-0.217	0.001	-0.414	0.000	-0.466	0.000
c statistic	-0.213	0.000	-0.212	0.021	-0.350	0.000	-0.345	0.000	-0.498	0.000	-0.651	0.000
Conf Freq: Constantly	-0.294	0.033	-0.071	0.801	-0.740	0.001	-0.735	0.000	-0.636	0.000	-0.794	0.000
Anx Freq: Less than daily	0.044	0.084	0.059	0.105	0.013	0.739	0.090	0.000	0.137	0.000	0.057	0.032
Anx Freq: Daily but not constantly	0.050	0.128	0.049	0.291	0.068	0.155	0.146	0.000	0.165	0.000	0.113	0.001
Anx Freq: All the time	0.038	0.669	0.163	0.206	-0.012	0.925	0.221	0.001	0.153	0.063	0.109	0.236
Verbal disruption	-0.034	0.770	0.093	0.637	-0.061	0.717	0.060	0.487	-0.162	0.035	-0.267	0.031
Depressive Feelings: Depressed mood	-0.044	0.113	-0.037	0.352	-0.085	0.032	-0.033	0.107	0.008	0.756	-0.057	0.043
Depressive Feelings: Any other elements (2-6)	0.040	0.567	0.266	0.011	0.099	0.315	0.056	0.268	0.136	0.023	0.095	0.181
OUTCOME SPECIFIC RISK-ADJUSTERS												
Obesity	0.032	0.304	-0.017	0.685	0.061	0.173						
Pain less often daily	0.085	0.009	0.147	0.001	-0.017	0.721						
Pain daily but not constantly	0.084	0.000	0.077	0.019	0.103	0.004						
Pain all the time	0.027	0.522	-0.020	0.727	-0.002	0.969						
Memory deficit	-0.107	0.025	-0.087	0.281	-0.032	0.641	-0.196	0.000	-0.122	0.000	-0.031	0.558
Impaired decision making	0.023	0.652	-0.138	0.114	-0.056	0.427	0.040	0.265	0.040	0.253	0.027	0.607
Status Prior to Admission												
Hous: Light tasks only	-0.360	0.000										
Hous: Intermittent assistance	-0.464	0.000										
Hous: Usually requires assistance	-0.634	0.000										
Hous: Totally dependent	-0.244	0.000										
Laun: Light laundry only			-0.505	0.000								
Laun: Totally dependent			-0.184	0.009								
Shop: Needs some assistance					-0.312	0.000						
Shop: Only if delivered					-0.810	0.000						
Shop: Totally dependent					-0.325	0.001						
Lt Meal: Able, but not regularly							-0.549	0.000				
Lt Meal: Totally dependent							-0.101	0.025				
Phon: Able, with adapted phone									0.109	0.134		
Phon: Answers, but has trouble calling									-0.172	0.004		
Phon: Sometimes answers/limited conversation									-0.112	0.129		
Phon: Can listen with assistive device									-0.165	0.094		
Phon: Totally dependent									-0.140	0.430		
Oral Med: Able if prepared											-0.406	0.000
Oral Med: Totally dependent											-0.088	0.188
Impaired decision making prior 2 weeks	-0.084	0.062	-0.002	0.975	-0.067	0.301	-0.113	0.000	-0.078	0.021	-0.238	0.000
Memory loss prior 2 weeks	-0.255	0.000	-0.403	0.000	-0.145	0.045	-0.264	0.000	-0.196	0.000	-0.360	0.000
Intercept	0.022	0.746	0.347	0.000	-0.027	0.796	2.236	0.000	3.729	0.000	2.628	0.000
R ² statistic	0.095		0.120		0.116		0.091		0.092		0.066	
c statistic	0.706		0.739		0.771		0.742		0.789		0.732	

TABLE 8a. Summary of Regression Models: Physiologic Measures					
	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 Clinical Core (Baseline Model)	Model 2 Adds Outcome- Specific	Model 3 Adds OASIS "Prior" Items
IMPROVEMENT IN PAIN	Yes				
Percent Who Could Improve: 44.4%					
Percent Improving Among Those Who Could: 56.2%					
Number of OASIS Items		40	42	43	45 ^a
Number of OASIS Elements		65	60	61	64
R ² statistic		0.065	0.053	0.056	0.058
c statistic		0.643	0.630	0.633	0.635
IMPROVEMENT IN NUMBER OF SURGICAL WOUNDS	No				
Percent Who Could Improve: 21.9%					
Percent Improving Among Those Who Could: 59.3%					
Number of OASIS Items		N/A	42		
Number of OASIS Elements			60		
R ² statistic			0.047		
c statistic			0.627		
IMPROVEMENT IN STATUS OF SUGICAL WOUNDS	No				
Percent Who Could Improve: 22.9%					
Percent Improving Among Those Who Could: 75.0%					
Number of OASIS Items		N/A	42		
Number of OASIS Elements			60		
R ² statistic			0.065		
c statistic			0.670		
IMPROVEMENT IN DYSPNEA	Yes				
Percent Who Could Improve: 44.2%					
Percent Improving Among Those Who Could: 53.3%					
Number of OASIS Items		57	42	44	^b
Number of OASIS Elements		85	60	66	
R ² statistic		0.114	0.098	0.110	
c statistic		0.695	0.680	0.690	

TABLE 8a (continued)

	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 Clinical Core (Baseline Model)	Model 2 Adds Outcome- Specific	Model 3 Adds OASIS "Prior" Items
IMPROVEMENT IN URINARY TRACT INFECTION	Yes				
Percent Who Could Improve: 6.0%					
Percent Improving Among Those Who Could: 83.7%					
Number of OASIS Items		18	41	43	45 ^c
Number of OASIS Elements		32	59	63	67
R ² statistic		0.121	0.048	0.059	0.059
c statistic		0.740	0.658	0.665	0.665
IMPROVEMENT IN URINARY INCONTINENCE	Yes				
Percent Who Could Improve: 20.7%					
Percent Improving Among Those Who Could: 49.0%					
Number of OASIS Items		53	41	43	46 ^d
Number of OASIS Elements		55	59	65	72
R ² statistic		0.119	0.088	0.092	0.103
c statistic		0.696	0.667	0.670	0.682
IMPROVEMENT IN BOWEL INCONTINENCE	Yes				
Percent Who Could Improve: 7.0%					
Percent Improving Among Those Who Could: 59.1%					
Number of OASIS Items		37	41	43	46 ^d
Number of OASIS Elements		55	59	65	72
R ² statistic		0.141	0.117	0.126	0.131
c statistic		0.719	0.700	0.707	0.711
IMPROVEMENT IN SPEECH	No				
Percent Who Could Improve: 21.2%					
Percent Improving Among Those Who Could: 43.3%					
Number of OASIS Items		N/A	41		
Number of OASIS Elements			59		
R ² statistic			0.080		
c statistic			0.665		

TABLE 8a (continued)

	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 <i>Clinical Core</i> (<i>Baseline Model</i>)	Model 2 <i>Adds Outcome- Specific</i>	Model 3 <i>Adds OASIS</i> <i>"Prior" Items</i>
STABILIZATION IN SPEECH	No				
Percent Who Could Stabilize: 70.0%					
Percent Stabilized Among Those Who Could: 91.0%					
Number of OASIS Items		N/A	41		
Number of OASIS Elements			59		
R ² statistic			0.085		
c statistic			0.742		
<p>NOTES: "Percent Who Could Improve" calculated using all home health episodes, not just those discharged to the community. The smallest sample size for the Physiologic risk-adjustment models is 27,248. Shading indicates that U of CO model statistics are for multiple sub-models; we report the number of unique OASIS items and elements across all sub-models.</p> <p>a. Risk-adjustment model includes presence of intractable pain <i>prior to</i> home health admission.</p> <p>b. There are no "prior" items for inclusion in the dyspnea risk-adjustment model.</p> <p>c. Risk-adjustment model includes presence of urinary incontinence and indwelling/suprapubic catheter <i>prior to</i> home health admission.</p> <p>d. Risk-adjustment model includes help required with toileting <i>prior to</i> home health admission as well as presence of urinary incontinence, indwelling/suprapubic catheter, impaired decision making, and memory loss prior to home health admission.</p>					

TABLE 8b. Final Alternative Risk-Adjustment Models for Physiologic Outcomes (Part I)

Risk Factor Measured at SOC/ROC	Improvement in:											
	Pain		No. of Surg. Wounds		Status of Surg. Wounds		Dyspnea		Urinary Tract Infection		Urinary Incontinence	
	Full Model		Core Only		Core Only		Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
DEMOGRAPHICS												
Age lt 65	-0.182	0.000	-0.095	0.002	-0.202	0.000	-0.014	0.417	-0.069	0.319	-0.204	0.000
Age 75-84	0.095	0.000	0.110	0.000	0.139	0.000	-0.022	0.068	0.018	0.703	-0.015	0.418
Age 85+	0.141	0.000	0.285	0.000	0.340	0.000	-0.066	0.000	-0.045	0.399	-0.106	0.000
Gender: female	-0.114	0.000	0.084	0.000	0.137	0.000	0.038	0.000	0.055	0.167	-0.059	0.000
SOCIOECONOMIC FACTORS												
Any Medicaid	-0.077	0.001	-0.036	0.292	0.004	0.913	-0.101	0.000	-0.041	0.506	-0.109	0.000
Medicare HMO	-0.132	0.000	-0.240	0.000	-0.268	0.000	0.128	0.000	-0.171	0.002	0.138	0.000
PRIOR SERVICE USE												
Discharged past 14 days:												
Discharge from hospital	0.117	0.000	-0.042	0.133	0.071	0.029	0.286	0.000	0.350	0.000	0.310	0.000
Discharge from rehab facility	0.091	0.000	0.165	0.000	0.117	0.002	0.423	0.000	0.674	0.000	0.396	0.000
Discharge from nursing home	-0.061	0.012	-0.080	0.040	-0.110	0.013	0.266	0.000	0.545	0.000	0.221	0.000
CLINICAL FACTORS												
Prognoses												
Overall prognosis good/fair	0.286	0.000	0.073	0.264	0.256	0.000	0.251	0.000	0.147	0.034	0.091	0.001
Rehabilitation prognosis good	0.289	0.000	-0.110	0.005	-0.045	0.317	0.256	0.000	0.054	0.263	0.164	0.000
Diagnoses												
Diabetes (PPS Group)	0.023	0.180	0.038	0.133	-0.082	0.004	-0.050	0.000	0.053	0.238	-0.036	0.042
Orthopedic (PPS Group)	-0.215	0.000	0.126	0.000	0.168	0.000	0.257	0.000	0.353	0.000	0.089	0.000
Neurological (PPS Group)	0.034	0.092	0.089	0.017	0.102	0.017	0.139	0.000	0.250	0.000	-0.086	0.000
Wound/Burn (PPS Group)	0.088	0.002	-0.027	0.422	-0.107	0.005	-0.191	0.000	0.304	0.006	-0.151	0.000
Cancer	-0.086	0.000	-0.061	0.037	-0.151	0.000	-0.163	0.000	0.006	0.924	-0.056	0.040
Mental condition	0.067	0.055	0.031	0.618	0.093	0.186	0.032	0.181	0.058	0.527	0.000	0.993
Dementia	0.167	0.000	-0.004	0.968	-0.017	0.895	0.109	0.000	-0.050	0.563	-0.024	0.436
Hypertension	0.085	0.000	0.074	0.001	0.111	0.000	0.004	0.691	0.161	0.000	0.010	0.519
Ischemia	0.093	0.000	-0.205	0.000	-0.048	0.110	-0.017	0.210	0.147	0.022	0.040	0.089
Arrhythmia	0.090	0.000	0.141	0.000	0.169	0.000	-0.020	0.199	0.050	0.441	0.033	0.182
Heart failure	-0.056	0.010	0.266	0.000	0.209	0.000	-0.156	0.000	0.257	0.000	-0.022	0.268
COPD	-0.004	0.873	0.156	0.000	0.164	0.000	-0.327	0.000	0.282	0.000	0.015	0.517
Skin ulcer	0.083	0.006	-0.092	0.020	-0.236	0.000	-0.140	0.000	0.185	0.053	-0.100	0.002
Orthopedic (other than PPS)	-0.293	0.000	0.047	0.038	0.238	0.000	0.195	0.000	0.177	0.000	0.005	0.783
Incontinence	-0.072	0.109	0.111	0.261	0.276	0.023	-0.194	0.000	-0.050	0.544	-0.234	0.000
Symptoms, signs, & ill-defined conditions	-0.047	0.047	0.149	0.001	0.111	0.031	0.045	0.005	0.044	0.435	-0.016	0.473
Diagnosis Severity												
Number of severity ratings ≥2	0.011	0.031	0.049	0.000	0.025	0.004	-0.037	0.000	0.033	0.012	-0.003	0.584
Sensory Status												
Partially vision impaired	0.028	0.072	0.204	0.000	0.166	0.000	-0.189	0.000	-0.080	0.049	-0.055	0.000
Severely vision impaired	0.046	0.302	0.189	0.033	0.259	0.015	-0.157	0.000	-0.025	0.803	-0.020	0.600
Speech: Minimum difficulty	0.040	0.046	0.154	0.000	0.112	0.006	-0.056	0.000	0.053	0.292	-0.048	0.011
Speech: Moderate difficulty	0.194	0.000	0.144	0.065	0.244	0.009	-0.005	0.843	0.089	0.266	-0.092	0.001
Speech: Severe difficulty	0.317	0.000	0.236	0.015	0.113	0.302	-0.034	0.322	0.051	0.604	-0.167	0.000

TABLE 8b (Part I) (continued)

Risk Factor Measured at SOC/ROC	Improvement in:												
	Pain		No. of Surg. Wounds		Status of Surg. Wounds		Dyspnea		Urinary Tract Infection		Urinary Incontinence		
	Full Model		Core Only		Core Only		Full Model		Full Model		Full Model		
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
Speech: Severe difficulty/unable (Levels 3, 4)													
Speech: Severe difficulty/unable/non-responsive (Levels 3-5)													
Integumentary Status													
Surgical wound present	0.155	0.000					0.276	0.000	0.214	0.000	0.140	0.000	
Stage of most problematic pressure ulcer	-0.073	0.000	0.116	0.000	0.089	0.002	-0.023	0.044	0.045	0.259	-0.107	0.000	
Status of most problematic stasis ulcer	-0.075	0.000	0.102	0.016	-0.023	0.613	-0.052	0.000	0.304	0.001	-0.009	0.662	
2 surgical wounds			0.662	0.000									
3 surgical wounds			0.881	0.000									
4 surgical wounds			0.542	0.000									
Surg Wnd Status: Early/partial granulation					0.972	0.000							
Surg Wnd Status: Not healing					1.889	0.000							
Functional Status/Physical Functioning													
ADL/IADL index	-0.012	0.000	0.042	0.000	0.041	0.000	0.004	0.041	0.061	0.000	-0.016	0.000	
Toilet: Able when supervised											0.146	0.000	
Toilet: Uses bedside commode											0.164	0.000	
Toilet: Uses bedpan independently													
Toilet: Totally dependent													
Toilet: Uses bedpan indep/totally dependent											-0.058	0.165	
Amb: Needs device to walk									-0.048	0.431			
Amb: Needs assistance to walk									-0.164	0.050			
Amb: Chairfast or Bedfast (Levels 3-5)									-0.336	0.000			
Elimination Status													
Urinary incontinence during the night	-0.072	0.003	-0.016	0.710	-0.025	0.615	-0.057	0.001	-0.116	0.088			
Urinary incontinence during the day	0.081	0.073	0.015	0.868	-0.071	0.494	-0.070	0.027	0.004	0.977	0.257	0.000	
Urinary incontinence during the night & day	-0.049	0.013	0.052	0.149	0.015	0.731	-0.181	0.000	-0.137	0.016	0.087	0.000	
Urinary catheter present	-0.019	0.586	0.103	0.039	0.025	0.662	-0.168	0.000	-0.703	0.000	0.284	0.000	
Bowel incontinent less than weekly	-0.039	0.352	0.081	0.360	-0.069	0.493	0.007	0.810	0.118	0.210	-0.110	0.000	
Bowel incontinent 1-3 times/week	-0.057	0.147	0.062	0.476	-0.019	0.847	-0.071	0.007	-0.094	0.213	-0.285	0.000	
Bowel incontinent 4-6 times/week	-0.006	0.920	0.141	0.286	0.124	0.427	-0.071	0.078	-0.014	0.888	-0.410	0.000	
Bowel incontinent daily or more often	0.097	0.028	0.047	0.591	0.085	0.405	-0.032	0.302	-0.108	0.166	-0.384	0.000	
Ostomy	0.213	0.000	0.330	0.000	0.134	0.023	0.059	0.089	-0.005	0.965	-0.305	0.000	
Neuro/Emotional/Behavioral Status													
Cog Func: Requires prompting	0.016	0.465	0.010	0.788	0.024	0.577	-0.050	0.001	-0.033	0.546	-0.067	0.001	
Cog Func: Requires assistance & some direction	0.102	0.004	-0.061	0.397	-0.084	0.313	0.034	0.149	-0.066	0.420	-0.099	0.001	
Cog Func: Requires considerable assistance	-0.013	0.830	-0.072	0.600	-0.087	0.585	0.045	0.256	-0.264	0.020	-0.165	0.000	
Cog Func: Totally dependent	-0.183	0.124	-0.168	0.553	-0.182	0.585	-0.150	0.061	0.120	0.525	-0.176	0.019	
Conf Freq: In new situations	-0.009	0.633	0.074	0.011	0.093	0.006	-0.101	0.000	-0.047	0.328	-0.071	0.000	
Conf Freq: Awakening at night	-0.024	0.652	0.069	0.540	0.005	0.972	-0.038	0.288	0.000	0.998	-0.108	0.014	

TABLE 8b (Part I) (continued)

Risk Factor Measured at SOC/ROC	Improvement in:												
	Pain		No. of Surg. Wounds		Status of Surg. Wounds		Dyspnea		Urinary Tract Infection		Urinary Incontinence		
	Full Model		Core Only		Core Only		Full Model		Full Model		Full Model		
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
Conf Freq: Day/evenings, not constant	0.084	0.014	0.059	0.399	-0.006	0.945	-0.067	0.003	0.025	0.747	-0.112	0.000	
Conf Freq: Constantly	0.301	0.000	-0.038	0.816	-0.042	0.825	0.076	0.093	-0.130	0.285	-0.241	0.000	
Anx Freq: Less than daily	-0.071	0.000	0.025	0.312	0.005	0.866	-0.124	0.000	0.015	0.725	-0.057	0.001	
c statistic	-0.169	0.000	-0.041	0.171	-0.052	0.134	-0.131	0.000	-0.087	0.081	0.006	0.750	
Anx Freq: All the time	-0.153	0.003	-0.166	0.069	-0.063	0.548	-0.091	0.010	-0.235	0.055	0.020	0.686	
Verbal disruption	-0.007	0.917	-0.010	0.941	-0.089	0.571	-0.071	0.095	-0.081	0.514	-0.065	0.155	
Depressive Feelings: Depressed mood	-0.108	0.000	-0.013	0.639	-0.031	0.315	-0.029	0.013	0.052	0.241	-0.019	0.256	
Depressive Feelings: Any other elements (2-6)	-0.215	0.000	-0.031	0.711	-0.169	0.069	-0.089	0.001	0.206	0.058	0.045	0.219	
OUTCOME SPECIFIC RISK-ADJUSTERS													
Smoking								-0.101	0.000				
Obesity								-0.204	0.000	-0.049	0.334	-0.074	0.000
Pain daily but not constantly	0.229	0.000											
Pain all the time	1.701	0.000											
Dyspnea when moderate exertion								1.022	0.000				
Dyspnea with minimum exertion								1.619	0.000				
Dyspnea when at rest								2.187	0.000				
Intractable pain	-0.256	0.000											
Memory deficit											-0.083	0.000	
Impaired decision making											-0.034	0.121	
Status Prior to Admission													
Toilet: Able when supervised												-0.223	0.000
Toilet: Uses bedside commode												-0.338	0.000
Toilet: Uses bedpan indep/totally dependent (Levels 3, 4)												-0.511	0.000
Urinary incontinence prior 2 weeks									-0.097	0.045	-0.358	0.000	
Indwelling/suprapubic catheter prior 2 weeks									-0.113	0.107	-0.629	0.000	
Intractable pain prior 2 weeks	-0.262	0.000											
Impaired decision making prior 2 weeks											-0.052	0.018	
Memory loss prior 2 weeks											0.011	0.630	
Clinical Factors: Therapies													
Oxygen therapy								-0.719	0.000				
IV/Infusion therapy										-1.098	0.000		
Ventilator								-1.203	0.000				
Urinary Tract Infection											-0.082	0.000	
Intercept	-0.381	0.000	-0.396	0.000	-0.406	0.000	-0.901	0.000	0.609	0.000	0.360	0.000	
R ² statistic	0.058		0.047		0.065		0.110		0.059		0.103		
c statistic	0.635		0.626		0.670		0.690		0.665		0.682		

TABLE 8b. Final Alternative Risk-Adjustment Models for Physiologic Outcomes (Part II)						
Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization in:	
	Bowel Incontinence		Speech		Speech	
	Full Model		Core Only		Core Only	
	Coef.	p	Coef.	p	Coef.	p
DEMOGRAPHICS						
Age lt 65	-0.209	0.000	-0.174	0.000	0.030	0.417
Age 75-84	0.042	0.229	0.054	0.037	-0.112	0.000
Age 85+	-0.012	0.748	0.015	0.604	-0.349	0.000
Gender: female	-0.010	0.684	0.107	0.000	0.100	0.000
SOCIOECONOMIC FACTORS						
Any Medicaid	-0.141	0.000	-0.226	0.000	-0.155	0.000
Medicare HMO	0.084	0.049	0.099	0.003	-0.024	0.417
PRIOR SERVICE USE						
Discharged past 14 days:						
Discharge from hospital	0.231	0.000	0.398	0.000	0.227	0.000
Discharge from rehab facility	0.335	0.000	0.488	0.000	0.203	0.000
Discharge from nursing home	0.275	0.000	0.265	0.000	0.063	0.057
CLINICAL FACTORS						
Prognoses						
Overall prognosis good/fair	0.040	0.273	0.089	0.010	0.214	0.000
Rehabilitation prognosis good	0.125	0.000	0.075	0.002	0.187	0.000
Diagnoses						
Diabetes (PPS Group)	0.009	0.774	0.047	0.050	-0.014	0.538
Orthopedic (PPS Group)	0.126	0.000	0.163	0.000	0.248	0.000
Neurological (PPS Group)	-0.073	0.007	-0.202	0.000	-0.347	0.000
Wound/Burn (PPS Group)	-0.007	0.900	-0.043	0.338	-0.041	0.340
Cancer	-0.069	0.198	0.019	0.618	-0.148	0.000
Mental condition	0.056	0.312	-0.139	0.000	-0.318	0.000
Dementia	-0.054	0.198	-0.321	0.000	-0.416	0.000
Hypertension	0.058	0.045	-0.008	0.719	0.021	0.314
Ischemia	-0.020	0.669	0.042	0.175	0.171	0.000
Arrhythmia	0.022	0.646	0.042	0.208	0.022	0.496
Heart failure	0.053	0.162	0.047	0.090	-0.024	0.0363
COPD	0.034	0.468	0.1113	0.000	0.110	0.000
Skin ulcer	-0.065	0.192	-0.039	0.389	-0.047	0.261
Orthopedic (other than PPS)	0.017	0.627	0.090	0.000	0.360	0.000
Incontinence	-0.219	0.000	-0.036	0.480	0.014	0.787
Symptoms, signs, & ill-defined conditions	-0.042	0.261	-0.018	0.539	-0.036	0.222
Diagnosis Severity						
Number of severity ratings ≥ 2	0.024	0.012	0.013	0.081	-0.024	0.001
Sensory Status						
Partially vision impaired	-0.015	0.571	-0.072	0.000	-0.070	0.001
Severely vision impaired	-0.001	0.983	0.040	0.432	-0.090	0.081
Speech: Minimum difficulty	0.049	0.177			1.480	0.000
Speech: Moderate difficulty	-0.024	0.592	0.936	0.000	2.115	0.000
Speech: Severe difficulty	-0.169	0.001				

TABLE 8b (Part II) (continued)						
Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization in:	
	Bowel Incontinence		Speech		Speech	
	Full Model		Core Only		Core Only	
	Coef.	p	Coef.	p	Coef.	p
Speech: Severe difficulty/unable (Levels 3, 4)					2.770	0.000
Speech: Severe difficulty/unable/non-responsive (Levels 3-5)			1.054	0.000		
Integumentary Status						
Surgical wound present	0.103	0.006	0.222	0.000	0.468	0.000
Stage of most problematic pressure ulcer	-0.094	0.000	-0.025	0.246	-0.007	0.709
Status of most problematic stasis ulcer	-0.017	0.637	-0.046	0.095	0.035	0.181
2 surgical wounds						
3 surgical wounds						
4 surgical wounds						
Surg Wnd Status: Early/partial granulation						
Surg Wnd Status: Not healing						
Functional Status/Physical Functioning						
ADL/IADL index	-0.087	0.000	-0.048	0.000	-0.113	0.000
Toilet: Able when supervised	0.256	0.000				
Toilet: Uses bedside commode	0.285	0.000				
Toilet: Uses bedpan independently	0.211	0.027				
Toilet: Totally dependent	-0.066	0.361				
Toilet: Uses bedpan indep/totally dependent						
Amb: Needs device to walk						
Amb: Needs assistance to walk						
Amb: Chairfast or Bedfast (Levels 3-5)						
Elimination Status						
Urinary incontinence during the night	-0.192	0.000	-0.093	0.004	-0.081	0.015
Urinary incontinence during the day	-0.208	0.007	-0.221	0.000	-0.141	0.012
Urinary incontinence during the night & day	-0.398	0.000	-0.189	0.000	-0.125	0.000
Urinary catheter present	-0.496	0.000	-0.176	0.000	0.000	0.993
Bowel incontinent less than weekly			-0.084	0.075	-0.060	0.242
Bowel incontinent 1-3 times/week	-0.098	0.003	-0.104	0.011	-0.165	0.000
Bowel incontinent 4-6 times/week	0.230	0.000	-0.234	0.000	-0.283	0.000
Bowel incontinent daily or more often	0.468	0.000	-0.181	0.000	-0.340	0.000
Ostomy			0.028	0.723	0.062	0.356
Neuro/Emotional/Behavioral Status						
Cog Func: Requires prompting	0.017	0.680	-0.366	0.000	-0.544	0.000
Cog Func: Requires assistance & some direction	-0.045	0.365	-0.661	0.000	-0.963	0.000
Cog Func: Requires considerable assistance	-0.020	0.739	-0.774	0.000	-1.104	0.000
Cog Func: Totally dependent	0.009	0.915	-0.815	0.000	-0.936	0.000
Conf Freq: In new situations	-0.128	0.001	-0.158	0.000	-0.486	0.000
Conf Freq: Awakening at night	-0.084	0.247	-0.084	0.144	-0.586	0.000
Conf Freq: Day/evenings, not constant	-0.147	0.003	-0.350	0.000	-0.762	0.000
Conf Freq: Constantly	-0.274	0.000	-0.473	0.000	-0.993	0.000
Anx Freq: Less than daily	-0.009	0.763	0.000	0.991	0.004	0.875
c statistic	0.045	0.170	0.042	0.101	0.038	0.151

TABLE 8b (Part II) (continued)						
Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization in:	
	Bowel Incontinence		Speech		Speech	
	Full Model		Core Only		Core Only	
	Coef.	p	Coef.	p	Coef.	p
Anx Freq: All the time	0.072	0.360	0.092	0.158	0.013	0.851
Verbal disruption	-0.152	0.006	-0.131	0.023	-0.196	0.002
Depressive Feelings: Depressed mood	-0.028	0.338	0.021	0.356	-0.046	0.045
Depressive Feelings: Any other elements (2-6)	0.070	0.240	0.138	0.004	0.023	0.663
OUTCOME SPECIFIC RISK ADJUSTERS						
Smoking						
Obesity	-0.004	0.915				
Pain daily but not constantly						
Pain all the time						
Dyspnea when moderate exertion						
Dyspnea with minimum exertion						
Dyspnea when at rest						
Intractable pain						
Memory deficit	-0.088	0.007				
Impaired decision making	-0.007	0.837				
Status Prior to Admission						
Toilet: Able when supervised	-0.309	0.000				
Toilet: Uses bedside commode	-0.330	0.000				
Toilet: Uses bedpan indep/totally dependent (Levels 3, 4)	-0.574	0.000				
Urinary incontinence prior 2 weeks	-0.138	0.000				
Indwelling/suprapubic catheter prior 2 weeks	-0.161	0.014				
Intractable pain prior 2 weeks						
Impaired decision making prior 2 weeks	-0.126	0.000				
Memory loss prior 2 weeks	0.086	0.015				
Clinical Factors: Therapies						
Oxygen therapy						
IV/Infusion therapy						
Ventilator						
Urinary Tract Infection	0.017	0.619				
Intercept	1.685	0.000	-0.030	0.586	2.719	0.000
R ² statistic	0.131		0.080		0.085	
c statistic	0.711		0.665		0.742	

TABLE 9a. Summary of Regression Models: Emotional/Behavioral Measures					
	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 Clinical Core (Baseline Model)	Model 2 Adds Outcome- Specific	Model 3 Adds OASIS "Prior" Items
IMPROVEMENT IN ANXIETY	No				
Percent Who Could Improve: 27.5%					
Percent Improving Among Those Who Could: 51.8%					
Number of OASIS Items		N/A	41		
Number of OASIS Elements			59		
R ² statistic			0.058		
c statistic			0.637		
IMPROVEMENT IN BEHAVIORAL PROBLEM FREQUENCY	No				
Percent Who Could Improve: 4.8%					
Percent Improving Among Those Who Could: 61.8%					
Number of OASIS Items		N/A	41		
Number of OASIS Elements			59		
R ² statistic			0.057		
c statistic			0.639		
STABILIZATION IN ANXIETY	No				
Percent Who Could Stabilize: 69.1%					
Percent Stabilizing Among Those Who Could: 87.6%					
Number of OASIS Items		N/A	41		
Number of OASIS Elements			59		
R ² statistic			0.045		
c statistic			0.684		
NOTES: "Percent Who Could Improve" calculated using all home health episodes, not just those discharged to the community. The smallest sample size for the Emotional/Behavioral risk-adjustment models is 12,054.					

TABLE 9b. Final Alternative Risk-Adjustment Models for Emotional/Behavioral Outcomes						
Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization in:	
	Anxiety		Behavioral Problem Frequency		Anxiety	
	Core Only		Core Only		Core Only	
	Coef.	p	Coef.	p	Coef.	p
DEMOGRAPHICS						
Age lt 65	-0.158	0.000	-0.292	0.000	-0.136	0.000
Age 75-84	0.057	0.006	-0.124	0.031	0.005	0.817
Age 85+	0.079	0.001	-0.191	0.002	0.071	0.002
Gender: female	-0.205	0.000	0.055	0.187	-0.359	0.000
SOCIOECONOMIC FACTORS						
Any Medicaid	-0.014	0.610	-0.117	0.079	0.116	0.000
Medicare HMO	0.122	0.000	0.089	0.217	0.065	0.009
PRIOR SERVICE USE						
Discharged past 14 days:						
Discharge from hospital	0.165	0.000	0.276	0.000	0.044	0.014
Discharge from rehab facility	0.317	0.000	0.458	0.000	0.041	0.118
Discharge from nursing home	0.141	0.000	0.202	0.006	-0.011	0.714
CLINICAL FACTORS						
Prognoses						
Overall prognosis good/fair	0.108	0.001	0.050	0.433	0.110	0.001
Rehabilitation prognosis good	0.180	0.000	0.036	0.466	0.153	0.000
Diagnoses						
Diabetes (PPS Group)	0.042	0.043	-0.062	0.239	0.065	0.001
Orthopedic (PPS Group)	0.082	0.000	-0.027	0.550	0.155	0.000
Neurological (PPS Group)	0.010	0.670	-0.027	0.563	-0.025	0.243
Wound/Burn (PPS Group)	-0.070	0.061	-0.029	0.756	-0.058	0.098
Cancer	-0.118	0.000	0.080	0.400	-0.195	0.000
Mental condition	-0.293	0.000	-0.152	0.013	-0.515	0.000
Dementia	-0.044	0.298	-0.064	0.262	-0.120	0.006
Hypertension	0.038	0.036	0.062	0.187	0.072	0.000
Ischemia	-0.002	0.934	-0.013	0.854	0.000	0.993
Arrhythmia	0.022	0.443	0.115	0.135	-0.040	0.145
Heart failure	-0.032	0.187	0.008	0.897	-0.022	0.348
COPD	-0.181	0.000	-0.057	0.434	-0.210	0.000
Skin ulcer	0.057	0.144	-0.071	0.457	0.062	0.087
Orthopedic (other than PPS)	0.078	0.000	0.008	0.884	0.200	0.000
Incontinence	0.017	0.731	-0.260	0.004	0.100	0.060
Symptoms, signs, & ill-defined conditions	-0.016	0.559	0.002	0.969	0.075	0.005
Diagnosis Severity						
Number of severity ratings ≥ 2	-0.020	0.001	-0.004	0.794	-0.062	0.000
Sensory Status						
Partially vision impaired	-0.065	0.000	-0.050	0.232	-0.014	0.466
Severely vision impaired	-0.111	0.027	0.083	0.396	-0.014	0.775
Speech: Minimum difficulty	-0.059	0.008	-0.123	0.031	-0.065	0.005
Speech: Moderate difficulty	-0.086	0.021	-0.041	0.557	-0.167	0.000
Speech: Severe difficulty	-0.111	0.025	0.009	0.916	-0.210	0.000

TABLE 9b (continued)						
Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization in:	
	Anxiety		Behavioral Problem Frequency		Anxiety	
	Core Only		Core Only		Core Only	
	Coef.	P	Coef.	P	Coef.	P
Integumentary Status						
Surgical wound present	0.097	0.000	-0.033	0.590	0.169	0.000
Stage of most problematic pressure ulcer	-0.027	0.152	-0.010	0.811	-0.040	0.026
Status of most problematic stasis ulcer	-0.024	0.318	0.011	0.855	-0.039	0.071
Functional Status/ Physical Functioning						
ADL/IADL index	0.021	0.000	-0.021	0.014	-0.014	0.000
Elimination Status						
Urinary incontinence during the night	-0.066	0.021	-0.056	0.427	-0.053	0.075
Urinary incontinence during the day	-0.078	0.141	-0.030	0.775	0.039	0.472
Urinary incontinence during the night & day	-0.149	0.000	-0.121	0.023	-0.013	0.592
Urinary catheter present	-0.184	0.000	-0.077	0.466	-0.070	0.079
Bowel incontinent less than weekly	-0.003	0.951	-0.048	0.585	-0.106	0.030
Bowel incontinent 1-3 times/week	0.010	0.808	-0.079	0.273	-0.027	0.540
Bowel incontinent 4-6 times/week	-0.026	0.672	-0.045	0.634	0.018	0.782
Bowel incontinent daily or more often	0.015	0.757	0.022	0.770	0.053	0.261
Ostomy	-0.011	0.850	0.055	0.742	-0.223	0.000
Neuro/Emotional/Behavioral Status						
Cog Func: Requires prompting	-0.122	0.000	-0.236	0.001	-0.053	0.035
Cog Func: Requires assistance & some direction	-0.241	0.000	-0.352	0.000	-0.071	0.072
Cog Func: Requires considerable assistance	-0.339	0.000	-0.535	0.000	-0.049	0.422
Cog Func: Totally dependent	-0.465	0.000	-0.648	0.000	-0.004	0.970
Conf Freq: In new situations	-0.165	0.000	0.014	0.847	-0.158	0.000
Conf Freq: Awakening at night	-0.153	0.005	-0.023	0.854	-0.293	0.000
Conf Freq: Day/evenings, not constant	-0.122	0.001	-0.153	0.063	-0.177	0.000
Conf Freq: Constantly	-0.118	0.065	-0.449	0.000	-0.209	0.003
Anx Freq: Less than daily			-0.218	0.000	0.803	0.000
Anx Freq: Daily but not constantly	0.672	0.000	-0.118	0.023	2.863	0.000
Anx Freq: All the time	1.651	0.000	-0.202	0.040		
Verbal disruption	-0.313	0.000	-0.149	0.007	-0.418	0.000
Behav Prob Freq: Once a month			0.113	0.341		
Behav Prob Freq: Several times a month			-0.106	0.179		
Behav Prob Freq: Several times a week			-0.046	0.508		
Behav Prob Freq: At least daily			-0.019	0.770		
Depressive Feelings: Depressed mood	-0.182	0.000	0.000	1.000	-0.369	0.000
Depressive Feelings: Any other elements (2-6)	-0.397	0.000	0.060	0.415	-0.575	0.000
Intercept						
Intercept	-0.274	0.000	1.336	0.000	1.889	0.000
R² statistic						
R ² statistic	0.058		0.057		0.045	
c statistic						
c statistic	0.637		0.639		0.683	

TABLE 10a. Summary of Regression Models: Cognitive Measures					
	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 Clinical Core (Baseline Model)	Model 2 Adds Outcome- Specific	Model 3 Adds OASIS "Prior" Items
IMPROVEMENT IN CONFUSION FREQUENCY	Yes				
Percent Who Could Improve: 26.7%					
Percent Improving Among Those Who Could: 41.1%					
Number of OASIS Items		66	41	41	43 ^a
Number of OASIS Elements		94	59	61	67
R ² statistic		0.111	0.091	0.095	0.097
c statistic		0.693	0.673	0.678	0.680
IMPROVEMENT IN COGNITIVE FUNCTIONING	No				
Percent Who Could Improve: 21.8%					
Percent Improving Among Those Who Could: 43.0%					
Number of OASIS Items		N/A	41		
Number of OASIS Elements			59		
R ² statistic			0.082		
c statistic			0.665		
STABILIZATION IN COGNITIVE FUNCTIONING	No				
Percent Who Could Stabilize: 69.6%					
Percent Stabilizing Among Those Who Could: 90.6%					
Number of OASIS Items		N/A	41		
Number of OASIS Elements			59		
R ² statistic			0.078		
c statistic			0.738		
NOTES: "Percent Who Could Improve" calculated using all home health episodes, not just those discharged to the community. The smallest sample size for the Cognitive risk-adjustment models is 54,263. Shading indicates that U of CO model statistics are for multiple sub-models; we report the number of unique OASIS items and elements across all sub-models.					
a. Risk-adjustment model includes presence of impaired decision making, disruptive behavior, and memory loss <i>prior to</i> home health admission.					

TABLE 10b. Final Alternative Risk-Adjustment Models for Cognitive Outcomes						
Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization In:	
	Confusion Frequency		Cognitive Functioning		Cognitive Functioning	
	Full Model		Core Only		Core Only	
	Coef.	p	Coef.	p	Coef.	p
DEMOGRAPHICS						
Age lt 65	0.038	0.144	-0.097	0.001	0.114	0.000
Age 75-84	-0.165	0.000	-0.120	0.000	-0.324	0.000
Age 85+	-0.336	0.000	-0.274	0.000	-0.629	0.000
Gender: female	-0.071	0.000	-0.026	0.064	0.004	0.766
SOCIOECONOMIC FACTORS						
Any Medicaid	-0.078	0.000	-0.094	0.000	-0.050	0.026
Medicare HMO	0.084	0.000	0.044	0.053	-0.042	0.036
PRIOR SERVICE USE						
Discharged past 14 days:						
Discharge from hospital	0.325	0.000	0.365	0.000	0.194	0.000
Discharge from rehab facility	0.474	0.000	0.432	0.000	0.084	0.000
Discharge from nursing home	0.203	0.000	0.193	0.000	-0.010	0.650
CLINICAL FACTORS						
Prognoses						
Overall prognosis good/fair	0.133	0.000	0.146	0.000	0.225	0.000
Rehabilitation prognosis good	0.123	0.000	0.099	0.000	0.125	0.000
Diagnoses						
Diabetes (PPS Group)	-0.017	0.277	0.034	0.040	-0.056	0.001
Orthopedic (PPS Group)	0.096	0.000	0.086	0.000	0.088	0.000
Neurological (PPS Group)	-0.097	0.000	-0.133	0.000	-0.263	0.000
Wound/Burn (PPS Group)	-0.123	0.000	-0.044	0.171	-0.073	0.015
Cancer	-0.057	0.022	0.028	0.306	-0.167	0.000
Mental condition	-0.128	0.000	-0.243	0.000	-0.462	0.000
Dementia	-0.444	0.000	-0.463	0.000	-0.709	0.000
Hypertension	0.027	0.051	0.052	0.000	0.092	0.000
Ischemia	0.065	0.001	0.082	0.000	0.157	0.000
Arrhythmia	0.020	0.342	0.026	0.243	-0.041	0.059
Heart failure	-0.042	0.017	0.030	0.122	0.011	0.558
COPD	0.006	0.748	0.058	0.008	0.110	0.000
Skin ulcer	-0.039	0.192	-0.096	0.003	-0.073	0.013
Orthopedic (other than PPS)	0.074	0.000	0.060	0.001	0.247	0.000
Incontinence	-0.089	0.010	-0.084	0.017	0.001	0.969
Symptoms, signs, & ill-defined conditions	-0.035	0.065	-0.049	0.015	-0.084	0.000
Diagnosis Severity						
Number of severity ratings ≥ 2	0.016	0.001	0.016	0.001	-0.017	0.001
Sensory Status						
Partially vision impaired	-0.044	0.001	-0.031	0.025	0.003	0.810
Severely vision impaired	-0.053	0.123	-0.059	0.097	-0.073	0.045
Speech: Minimum difficulty	-0.194	0.000	-0.336	0.000	-0.562	0.000
Speech: Moderate difficulty	-0.290	0.000	-0.603	0.000	-0.959	0.000
Speech: Severe difficulty	-0.440	0.000	-0.965	0.000	-1.290	0.000

TABLE 10b (continued)						
Risk Factor Measured at SOC/ROC	Improvement in:				Stabilization In:	
	Confusion Frequency		Cognitive Functioning		Cognitive Functioning	
	Full Model		Core Only		Core Only	
	Coef.	p	Coef.	p	Coef.	p
Integumentary Status						
Surgical wound present	0.191	0.000	0.216	0.000	0.484	0.000
Stage of most problematic pressure ulcer	-0.021	0.147	0.001	0.956	-0.016	0.266
Status of most problematic stasis ulcer	0.007	0.684	0.020	0.294	0.027	0.133
Functional Status/Physical Functioning						
ADL/IADL index	-0.011	0.000	-0.038	0.000	-0.102	0.000
Elimination Status						
Urinary incontinence during the night	-0.160	0.000	-0.168	0.000	-0.159	0.000
Urinary incontinence during the day	-0.224	0.000	-0.311	0.000	-0.197	0.000
Urinary incontinence during the night & day	-0.193	0.000	-0.235	0.000	-0.171	0.000
Urinary catheter present	-0.169	0.000	-0.129	0.000	0.012	0.715
Bowel incontinent less than weekly	-0.073	0.021	-0.073	0.026	-0.061	0.091
Bowel incontinent 1-3 times/week	-0.134	0.000	-0.132	0.000	-0.142	0.000
Bowel incontinent 4-6 times/week	-0.223	0.000	-0.319	0.000	-0.276	0.000
Bowel incontinent daily or more often	-0.181	0.000	-0.225	0.000	-0.354	0.000
Ostomy	0.023	0.623	0.060	0.262	-0.035	0.457
Neuro/Emotional Behavioral Status						
Cog Func: Requires prompting	-0.395	0.000			1.400	0.000
Cog Func: Requires assistance & some direction	-0.617	0.000	0.970	0.000	2.552	0.000
Cog Func: Requires considerable assistance	-0.901	0.000	1.782	0.000	3.902	0.000
Cog Func: Totally dependent	-1.486	0.000	2.527	0.000		
Conf Freq: In new situations			-0.366	0.000	-0.632	0.000
Conf Freq: Awakening at night	1.393	0.000	-0.484	0.000	-0.785	0.000
Conf Freq: Day/evenings, not constant	1.243	0.000	-0.823	0.000	-1.287	0.000
Conf Freq: Constantly	1.908	0.000	-1.322	0.000	-1.811	0.000
Anx Freq: Less than daily	-0.070	0.000	-0.004	0.790	-0.013	0.400
Anx Freq: Daily but not constantly	-0.021	0.201	0.045	0.011	-0.022	0.244
Anx Freq: All the time	0.094	0.022	0.176	0.000	0.031	0.539
Verbal disruption	-0.240	0.000	-0.284	0.000	-0.291	0.000
Depressive Feelings: Depressed mood	0.016	0.274	0.033	0.035	-0.038	0.016
Depressive Feelings: Any other elements (2-6)	0.078	0.014	0.079	0.018	0.036	0.338
OUTCOME SPECIFIC RISK-ADJUSTERS						
Memory deficit	-0.207	0.000				
Impaired decision making	-0.096	0.000				
Status Prior to Admission						
Impaired decision making prior 2 weeks	-0.190	0.000				
Disruptive behavior prior 2 weeks	-0.109	0.010				
Memory loss prior 2 weeks	-0.212	0.000				
Intercept	-0.155	0.000	0.189	0.000	2.922	0.000
R ² statistic	0.097		0.082		0.078	
c statistic	0.680		0.665		0.738	

TABLE 11a. Summary of Regression Models: Utilization Measures					
	Risk-Adjusted in OBQI or HHQI	University of Colorado Model	Model 1 Clinical Core (Baseline Model)	Model 2 Adds Outcome- Specific	Model 3 Adds OASIS "Prior" Items
ACUTE CARE HOSPITALIZATION					
Percent Who Could Be Hospitalized: 100.0%					
Percent Hospitalized: 28.2%					
Number of OASIS Items		49	41	44	a
Number of OASIS Elements		75	59	62	
R ² statistic		0.152	0.119	0.125	
c statistic		0.740	0.714	0.719	
DISCHARGED TO THE COMMUNITY					
Percent Who Could Be Discharged to Community: 99.5%					
Percent Discharged to the Community: 68.1%					
Number of OASIS Items		53	41	44	a
Number of OASIS Elements		79	59	62	
R ² statistic		0.185	0.147	0.153	
c statistic		0.753	0.728	0.732	
EMERGENT CARE					
Percent Who Could Have Emergent Care: 97.6%					
Percent with Emergent Care: 22.7%					
Number of OASIS Items		44	41	44	a
Number of OASIS Elements		69	59	62	
R ² statistic		0.100	0.072	0.075	
c statistic		0.710	0.679	0.683	
NOTES: The smallest sample size for the Utilization risk-adjustment models is 243,865.					
a. There are no "prior" items for inclusion in the utilization risk-adjustment models.					

TABLE 11b. Final Alternative Risk-Adjustment Models for Utilization Outcomes						
Risk Factor Measured at SOC/ROC	Acute Care Hospitalization		Discharged to Community		Emergent Care	
	Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p
DEMOGRAPHICS						
Age lt 65	0.159	0.000	-0.127	0.000	0.159	0.000
Age 75-84	-0.025	0.050	0.012	0.347	-0.010	0.440
Age 85+	-0.068	0.000	0.028	0.055	-0.005	0.754
Gender: female	-0.029	0.004	0.035	0.000	-0.003	0.760
SOCIOECONOMIC FACTORS						
Any Medicaid	0.228	0.000	-0.226	0.000	0.213	0.000
Medicare HMO	-0.319	0.000	0.296	0.000	-0.154	0.000
PRIOR SERVICE USE						
Discharged past 14 days:						
Discharge from hospital	0.282	0.000	-0.249	0.000	0.307	0.000
Discharge from rehab facility	-0.027	0.136	0.012	0.495	-0.031	0.116
Discharge from nursing home	0.077	0.000	-0.113	0.000	0.106	0.000
CLINICAL FACTORS						
Prognoses						
Overall prognosis good/fair	-0.171	0.000	0.399	0.000	-0.159	0.000
Rehabilitation prognosis good	-0.363	0.000	0.400	0.000	-0.300	0.000
Diagnoses						
Diabetes (PPS Group)	0.256	0.000	-0.251	0.000	0.192	0.000
Orthopedic (PPS Group)	-0.199	0.000	0.199	0.000	-0.149	0.000
Neurological (PPS Group)	-0.214	0.000	0.207	0.000	-0.156	0.000
Wound/Burn (PPS Group)	0.196	0.000	-0.215	0.000	0.071	0.002
Cancer	0.340	0.000	-0.507	0.000	0.231	0.000
Mental condition	0.067	0.004	-0.052	0.025	0.079	0.001
Dementia	-0.224	0.000	0.172	0.000	-0.132	0.000
Hypertension	-0.063	0.000	0.083	0.000	-0.049	0.000
Ischemia	0.048	0.001	-0.032	0.031	0.107	0.000
Arrhythmia	0.055	0.001	-0.051	0.002	0.060	0.001
Heart failure	0.287	0.000	-0.276	0.000	0.247	0.000
COPD	0.101	0.000	-0.079	0.000	0.138	0.000
Skin ulcer	0.135	0.000	-0.130	0.000	0.044	0.043
Orthopedic (other than PPS)	-0.326	0.000	0.315	0.000	-0.243	0.000
Incontinence	0.139	0.000	-0.171	0.000	0.064	0.028
Symptoms, signs, & ill-defined conditions	-0.048	0.005	0.042	0.011	0.006	0.740
Diagnosis Severity						
Number of severity ratings ≥2	0.130	0.000	-0.129	0.000	0.090	0.000
Sensory Status						
Partially vision impaired	0.043	0.000	-0.043	0.000	0.021	0.074
Severely vision impaired	0.040	0.163	-0.029	0.316	0.022	0.475
Speech: Minimum difficulty	0.009	0.521	-0.014	0.303	0.011	0.458
Speech: Moderate difficulty	-0.055	0.019	0.069	0.003	0.007	0.790
Speech: Severe difficulty/unable/non-responsive (Levels 3-5)	-0.034	0.247	0.067	0.023	0.020	0.523

TABLE 11b (continued)						
Risk Factor Measured at SOC/ROC	Acute Care Hospitalization		Discharged to Community		Emergent Care	
	Full Model		Full Model		Full Model	
	Coef.	p	Coef.	p	Coef.	p
Integumentary Status						
Surgical wound present	-0.278	0.000	0.315	0.000	-0.246	0.000
Stage of most problematic pressure ulcer	0.183	0.000	-0.207	0.000	0.108	0.000
Status of most problematic stasis ulcer	0.249	0.000	-0.254	0.000	0.146	0.000
Functional Status/Physical Functioning						
ADL/IADL index	0.069	0.000	-0.081	0.000	0.057	0.000
Elimination Status						
Urinary incontinence during the night	-0.063	0.001	0.069	0.000	-0.020	0.330
Urinary incontinence during the day	-0.091	0.008	0.115	0.001	-0.049	0.177
Urinary incontinence during the night & day	-0.011	0.435	0.016	0.255	0.002	0.910
Urinary catheter present	0.534	0.000	-0.618	0.000	0.392	0.000
Bowel incontinent less than weekly	0.053	0.068	-0.072	0.012	0.069	0.023
Bowel incontinent 1-3 times/week	0.088	0.000	-0.111	0.000	0.034	0.188
Bowel incontinent 4-6 times/week	0.146	0.000	-0.162	0.000	0.113	0.001
Bowel incontinent daily or more often	0.205	0.000	-0.216	0.000	0.141	0.000
Ostomy	0.292	0.000	-0.297	0.000	0.162	0.000
Neuro/Emotional/Behavioral Status						
Cog Func: Requires prompting	0.025	0.100	-0.036	0.017	-0.006	0.728
Cog Func: Requires assistance & some direction	-0.055	0.017	0.016	0.475	-0.057	0.020
Cog Func: Requires considerable assistance	-0.147	0.000	0.057	0.111	-0.131	0.001
Cog Func: Totally dependent	-0.189	0.003	0.137	0.031	-0.148	0.029
Conf Freq: In new situations	0.084	0.000	-0.102	0.000	0.091	0.000
Conf Freq: Awakening at night	0.119	0.001	-0.146	0.000	0.154	0.000
Conf Freq: Day/evenings, not constant	0.064	0.004	-0.107	0.000	0.052	0.027
Conf Freq: Constantly	0.021	0.610	-0.028	0.495	-0.008	0.849
Anx Freq: Less than daily	0.066	0.000	-0.062	0.000	0.078	0.000
Anx Freq: Daily but not constantly	0.130	0.000	-0.144	0.000	0.143	0.000
Anx Freq: All the time	0.175	0.000	-0.170	0.000	0.215	0.000
Verbal disruption	0.042	0.271	-0.057	0.132	0.070	0.073
Depressive Feelings: Depressed mood	0.121	0.000	-0.152	0.000	0.091	0.000
Depressive Feelings: Any other elements (2-6)	0.188	0.000	-0.250	0.000	0.155	0.000
OUTCOME SPECIFIC RISK-ADJUSTERS						
Dyspnea when walking/climbing stairs	0.145	0.000	-0.137	0.000	0.147	0.000
Dyspnea when moderate exertion	0.276	0.000	-0.275	0.000	0.238	0.000
Dyspnea with minimum exertion	0.469	0.000	-0.481	0.000	0.368	0.000
Dyspnea when at rest	0.643	0.000	-0.674	0.000	0.522	0.000
Clinical Factors: Therapies						
IV/Infusion therapy	0.489	0.000	-0.476	0.000	0.328	0.000
Ventilator	0.044	0.742	0.043	0.753	0.017	0.904
Intercept	-1.947	0.000	1.628	0.000	-2.104	0.000
R ² statistic	0.125		0.153		0.075	
c statistic	0.719		0.732		0.683	

TABLE 12. Summary of Agency-Level Analyses: Activities of Daily Living

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
IMPROVEMENT IN BATHING Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 56.3% Full Model: 56.5%	4,160 (79.4%)	0.178% (1.84%)	-2.86	3.16	0.976	162 (3.89%)
IMPROVEMENT IN GROOMING Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 61.2% Full Model: 61.3%	3,388 (64.6%)	0.098% (2.11%)	-3.43	3.49	0.969	220 (6.49%)
IMPROVEMENT IN DRESSING UPPER BODY Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 61.0% Full Model: 61.1%	3,590 (68.5%)	0.083% (2.28%)	-3.59	3.83	0.960	305 (8.50%)
IMPROVEMENT IN DRESSING LOWER BODY Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 60.7% Full Model: 60.9%	3,755 (71.6%)	0.157% (2.42%)	-3.40	4.33	0.954	364 (9.69%)
IMPROVEMENT IN TOILETING Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 60.2% Full Model: 60.2%	2,778 (53.0%)	0.053% (2.32%)	-3.78	3.85	0.956	294 (10.6%)

TABLE 12 (continued)

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
IMPROVEMENT IN TRANSFERRING Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 48.8% Full Model: 48.9%	3,738 (71.3%)	0.121% (1.56%)	-2.30	2.82	0.989	34 (0.91%)
IMPROVEMENT IN EATING Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 53.4% Full Model: 53.4%	2,565 (48.9%)	0.014% (2.23%)	-3.54	3.83	0.978	82 (3.20%)
IMPROVEMENT IN AMBULATION Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 33.4% Full Model: 33.6%	4,134 (78.9%)	0.199% (2.73%)	-4.45	4.40	0.925	715 (17.3%)
STABILIZATION IN BATHING Risk-Adjusted Percent Stabilizing Among Those Who Could: U of CO: 91.5% Full Model: 91.3%	4,225 (80.6%)	0.173% (0.867%)	-1.65	1.14	0.982	118 (2.79%)
STABILIZATION IN GROOMING Risk-Adjusted Percent Stabilizing Among Those Who Could: U of CO: 93.8% Full Model: 93.7%	4,185 (79.8%)	0.116% (0.944%)	-1.76	1.25	0.968	251 (6.00%)

TABLE 12 (continued)

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
STABILIZATION IN TRANSFERRING Risk-Adjusted Percent Stabilizing Among Those Who Could: U of CO: 94.2% Full Model: 94.1%	4,280 (81.6%)	0.079% (0.721%)	-1.32	1.01	0.977	171 (4.00%)

NOTE: The total number of agencies is 5,242. Agencies must have at least 20 home health episodes where individuals have the potential to improve or stabilize (respectively) to be included in the agency comparison of the risk-adjusted outcome.

TABLE 13. Summary of Agency-Level Analyses: Instrumental Activities of Daily Living

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
IMPROVEMENT IN HOUSEKEEPING Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 44.0% Full Model: 44.0%	4,267 (81.4%)	0.057% (2.47%)	-4.00	3.95	0.957	380 (8.91%)
IMPROVEMENT IN LAUNDRY Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 37.5% Full Model: 37.5%	4,248 (81.0%)	5.00% (2.04%)	-3.39	3.27	0.965	297 (6.99%)
IMPROVEMENT IN SHOPPING Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 47.4% Full Model: 47.4%	4,276 (81.6%)	0.027% (2.06%)	-3.30	3.48	0.974	214 (5.00%)
IMPROVEMENT IN LIGHT MEAL PREP Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 52.2% Full Model: 52.1%	3,874 (73.9%)	0.103% (2.57%)	-4.02	4.15	0.960	310 (8.00%)
IMPROVEMENT IN TELEPHONE USE Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 46.1% Full Model: 46.1%	2,332 (44.5%)	0.030% (2.20%)	-3.58	3.71	0.98	84 (3.60%)

TABLE 13 (continued)

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
IMPROVEMENT IN MEDICATION MGMT. Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 33.7% Full Model: 33.9%	3,574 (68.2%)	0.130% (2.34%)	-3.87	3.66	0.962	289 (8.10%)
STABILIZATION IN HOUSEKEEPING Risk-Adjusted Percent Stabilizing Among Those Who Could: U of CO: 83.5% Full Model: 83.4%	3,089 (58.9%)	0.137% (1.44%)	-2.53	2.08	0.981	74 (2.40%)
STABILIZATION IN LAUNDRY Risk-Adjusted Percent Stabilizing Among Those Who Could: U of CO: 84.0% Full Model: 83.8%	2,191 (41.8%)	0.223% (1.60%)	-2.85	2.17	0.976	85 (3.90%)
STABILIZATION IN SHOPPING Risk-Adjusted Percent Stabilizing Among Those Who Could: U of CO: 90.1% Full Model: 90.0%	3,648 (69.6%)	0.132% (1.11%)	-1.97	1.55	0.981	117 (3.20%)
STABILIZATION IN LIGHT MEAL PREPARATION Risk-Adjusted Percent Stabilizing Among Those Who Could: U of CO: 90.8% Full Model: 90.6%	3,682 (70.2%)	0.164% (1.49%)	-2.65	1.89	0.959	284 (7.70%)

TABLE 13 (continued)

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
STABILIZATION IN TELEPHONE USE Risk-Adjusted Percent Stabilizing Among Those Who Could: U of CO: 93.0% Full Model: 93.0%	4,212 (80.4%)	0.059% (1.02%)	-1.79	1.42	0.970	249 (5.90%)

NOTE: The total number of agencies is 5,242. Agencies must have at least 20 home health episodes where individuals have the potential to improve or stabilize (respectively) to be included in the agency comparison of the risk-adjusted outcome.

TABLE 14. Summary of Agency-Level Analyses: Physiologic Measures

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
IMPROVEMENT IN PAIN Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 56.0% Full Model: 55.9%	3,818 (72.8%)	0.119% (1.58%)	-2.78	2.43	0.989	31 (0.812%)
IMPROVEMENT IN DYSPNEA Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 51.3% Full Model: 51.5%	3,831 (73.1%)	0.181% (1.73%)	-2.66	3.00	0.989	34 (0.887%)
IMPROVEMENT IN UTI Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 83.9% Full Model: 83.7%	771 (14.7%)	0.287% (2.89%)	-4.96	4.56	0.912	155 (20.1%)
IMPROVEMENT IN URINARY INCONTINENCE Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 48.1% Full Model: 48.2%	2,710 (51.7%)	0.100% (1.81%)	-2.74	3.06	0.990	19 (0.701%)
IMPROVEMENT IN BOWEL INCONTINENCE Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 58.9% Full Model: 58.8%	1,023 (19.5%)	0.154% (2.13%)	-3.61	3.41	0.981	26 (2.54%)

NOTE: The total number of agencies is 5,242. Agencies must have at least 20 home health episodes where individuals have the potential to improve to be included in the agency comparison of the risk-adjusted outcome.

TABLE 15. Summary of Agency-Level Analyses: Cognitive Measures

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
IMPROVEMENT IN CONFUSION FREQUENCY Risk-Adjusted Percent Improving Among Those Who Could: U of CO: 39.3% Full Model: 39.4%	3,165 (60.4%)	0.158% (1.80%)	-2.83	3.02	0.988	28 (0.885%)
NOTE: The total number of agencies is 5,242. Agencies must have at least 20 home health episodes where individuals have the potential to improve to be included in the agency comparison of the risk-adjusted outcome.						

TABLE 16. Summary of Agency-Level Analyses: Utilization Measures

	Number (Percent) of Agencies Compared	Percentage Point Difference: Mean (SD)	Percentage Point Difference at the 5th Percentile	Percentage Point Difference at the 95th Percentile	Spearman's Rank Correlation	Number (Percent) of Agencies Changing 2+ Deciles in Ranking
ACUTE CARE HOSPITALIZATION Risk-Adjusted Percent Hospitalized Among Those Who Could: U of CO: 29.1% Full Model: 28.9%	4,798 (91.5%)	0.184% (2.50%)	-4.34	3.90	0.958	465 (9.69%)
DISCHARGED TO THE COMMUNITY Risk-Adjusted Percent Discharged to Community Among Those Who Could: U of CO: 66.5% Full Model: 66.9%	4,779 (91.2%)	0.374% (2.62%)	-3.94	4.75	0.956	473 (9.90%)
EMERGENT CARE Risk-Adjusted Percent Who Had Emergent Care Among Those Who Could: U of CO: 23.1% Full Model: 23.4%	4,770 (91.0%)	0.228% (1.79%)	-2.62	3.02	0.980	134 (2.81%)
NOTE: The total number of agencies is 5,242. Agencies must have at least 20 home health episodes where individuals have the potential to have the outcome to be included in the agency comparison of the risk-adjusted outcome.						