

**Documentation of Prediction Models Used for Risk Adjustment of  
Home Health Compare OBQI Quality Measures**

July 2008

by

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## Documentation of Prediction Models Used for Risk Adjustment of Home Health Compare OBQI Quality Measures

The purpose of this document is to provide descriptions of the prediction models used to risk adjust outcome rates for the eleven OBQI quality measures presented on Home Health Compare. These prediction models for risk adjustment were implemented in July 2008 as part of an updating of risk models for all 41 OBQI quality measures and replace the models used previously to risk adjust Home Health Compare quality measures. The models presented in this document were developed using OASIS national repository data from assessments submitted between January 1, 2003 and June 30, 2005. A logistic regression model for each of 41 outcome measures was developed using a national sample of 500,000 home health agency patient episodes and validated using a larger set-aside sample of 1,000,000 patient episodes from the same source.<sup>1</sup> One quality measure currently presented on Home Health Compare, "Emergent Care for New, Infected, or Deteriorating Wound/Lesion", is an Adverse Event and is not risk-adjusted.

### Use of Risk Models in Home Health Compare

Risk adjustment is a mathematical methodology that allows comparisons between home health agencies with different patient case mixes. Patient case mix differences between home health agencies influence how these agencies perform on the unadjusted OBQI quality measures. That is, if an agency has very needy patients in terms of their case mix, this agency is likely to show rates of improvement that are poorer than a home health agency with less needy patients. Risk adjustment is a mathematical attempt to account for these case mix differences so that the two home health agencies can be compared as if they had the same patient case mix. The observed agency outcome rate is the number of patients who achieve a particular outcome (e.g., improvement in ambulation/locomotion) divided by the number of patients eligible<sup>2</sup> for that outcome, over a fixed period of time (12 months). Using a multi-step, scientifically-rigorous process, prediction models for each OBQI quality measure are developed using a very large developmental sample of data. The predictive variables (independent variables) are taken from OASIS items, including patient diagnostic code values, to account for patient case mix differences. Once a model is created using the developmental data, the model is validated using a different sample that is twice the size of the developmental sample.

The quality measures reported to the public on Medicare's Home Health Compare Web site are risk-adjusted by adjusting the home health agency's observed rate by the difference between two predicted rates. The Agency Risk-adjusted Rate is calculated as:

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

The home health agency's risk-adjusted value for each quality measure is displayed on the Home Health Compare Web site, along with the state risk-adjusted rate and the national observed rate for comparison purposes. Through the use of risk-adjusted values, consumers can be more confident that they are comparing the performance of different home health agencies and agencies with state and national averages using a "level playing field" than if they were simply comparing observed values for these agencies.

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<sup>1</sup> The number of cases used for risk model development and validation varies from one outcome measure to another, depending on the specific exclusion criteria that apply to each measure.

<sup>2</sup> A patient is eligible for a functional improvement measure if the patient was not fully independent on the functional status measure at start or resumption of care. Similarly, a patient is eligible for a functional stabilization measure if the patient was not at the most dependent level of functioning measured at start or resumption of care. A similar definition is used for physiological health status measures.

## Reading the Prediction Model Tables

Each table contains the following information:

- Table Title--The title identifies the name of the OBQI quality measure model being presented.
- Risk Factor Measured at SOC/ROC -- This column lists the risk factors included in the prediction model. All risk factors pertain to Start of Care (SOC) or Resumption of Care after inpatient stay (ROC). The number of values in the measurement scale for each risk factor is displayed in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. The meaning associated with specific numeric values for most risk factors can be determined by examining the related OASIS data item(s).
- Coefficient--The coefficient listed next to the risk factor is the coefficient for the risk factor in the logistic regression model for the outcome measure. All coefficients and associated odds ratios are significant at  $p < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero (i.e., the odds ratio is 1.00). A significance criterion of  $p < .0001$  is used for developing risk models because of the very large developmental sample used to create the models. Using a very stringent significance level and a large developmental sample results in very stable models whose performance tends to be excellent under cross validation.
- Odds Ratio--For a 0-1 risk factor, the odds ratio is the likelihood of the outcome when the risk factor is present divided by the likelihood of the outcome when the risk factor is not present. In general, the odds ratio indicates the strength of relationship between a risk factor and the outcome measure. The larger or smaller an odds ratio is for a particular risk factor (i.e.,  $>1.00$  or  $<1.00$ ), the more influence the risk factor has on the outcome measure, in a positive or negative direction.
- 90% CI--These are the 90% confidence limits of the odds ratios in the previous column.
- Number of Risk Factors--This is the number of unique risk factors that are used in the logistic regression model for predicting the outcome measure.
- R<sup>2</sup>--The R<sup>2</sup> value is the squared correlation between predicted and observed values for all patients in the developmental and validation samples, respectively. R<sup>2</sup> values  $\geq 0.10$  are considered very good models, while R<sup>2</sup> values between 0.05 and 0.10 are considered adequate.
- C--The C-statistic is a measure of association commonly used when predicting a binary dependent variable. Formally, it is the area under the Receiver Operating Characteristic curve. In a less formal sense it is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model. C-statistic values  $\geq 0.70$  are considered very good models, while C-statistic values between 0.60 and 0.70 are considered adequate.

**TABLE 1: Logistic Regression Model for Predicting the Outcome of Improvement in Ambulation/Locomotion.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Age: 75 to 84, inclusive (0-1)	-0.097	0.908	(0.892 - 0.923)
Age: 85 or more (0-1)	-0.326	0.722	(0.707 - 0.738)
Gender: female (0-1)	-0.078	0.925	(0.911 - 0.940)
Any HMO payment source (0-1)	-0.089	0.914	(0.893 - 0.936)
Patient lives in own home (0-1)	0.083	1.087	(1.067 - 1.107)
Patient lives with family member (0-1)	0.080	1.084	(1.065 - 1.103)
Patient has informal caregiver(s) (0-1)	0.107	1.113	(1.083 - 1.143)
Caregiver provides ADL assistance (0-1)	-0.065	0.937	(0.921 - 0.953)
Inpatient discharge from hospital (0-1)	0.259	1.296	(1.273 - 1.318)
Medical regimen change in past 14 days (0-1)	0.107	1.113	(1.088 - 1.138)
Overall prognosis moderate or better (0-1)	0.201	1.223	(1.183 - 1.263)
Overall prognosis not known (0-1)	0.251	1.285	(1.200 - 1.376)
Rehabilitative prognosis is good (0-1)	0.304	1.355	(1.325 - 1.385)
Disability in dressing lower body (0-3)	-0.101	0.904	(0.895 - 0.913)
Disability in bathing (0-5)	-0.105	0.900	(0.894 - 0.907)
Disability in toileting (0-4)	-0.151	0.860	(0.846 - 0.874)
Disability in transferring (0-5)	-0.419	0.658	(0.646 - 0.670)
Disability in ambulation: Level 2 (0-1)	3.463	31.916	(31.059 - 32.796)
Disability in ambulation: Level 3 (0-1)	2.780	16.125	(15.398 - 16.885)
Disability in ambulation: Level 4 (0-1)	4.696	109.522	(102.917 - 116.550)
Disability in ambulation: Level 5 (0-1)	6.271	529.193	(478.434 - 585.338)
Prior (2 weeks ago) disability in toileting (0-4)	0.143	1.154	(1.134 - 1.173)
Prior (2 weeks ago) disability in transferring (0-5)	0.051	1.052	(1.032 - 1.073)
Prior (2 weeks ago) disability in ambulation (0-5)	-0.511	0.600	(0.590 - 0.610)
Disability in transportation (0-2)	-0.145	0.865	(0.834 - 0.897)
Disability in housekeeping (0-4)	-0.024	0.976	(0.969 - 0.983)
Disability in telephone use (0-5)	-0.136	0.873	(0.860 - 0.886)
Prior (2 weeks ago) disability in laundry (0-2)	-0.095	0.909	(0.896 - 0.923)
Prior (2 weeks ago) disability in shopping (0-3)	-0.051	0.951	(0.939 - 0.962)
Prior (2 weeks ago) disability in telephone use (0-5)	0.082	1.086	(1.069 - 1.103)
Dyspnea (shortness of breath) (0-4)	0.026	1.026	(1.018 - 1.034)
Vision impairment (0-2)	-0.085	0.918	(0.904 - 0.933)
Speech/language impairment (0-5)	-0.059	0.943	(0.932 - 0.955)
Demonstrated behavior: impaired decision-making (0-1)	0.116	1.123	(1.096 - 1.151)
Anxiety level (0-3)	0.062	1.064	(1.054 - 1.075)
Stage of most problematic pressure ulcer (0-4)	-0.154	0.857	(0.842 - 0.873)
No observable pressure ulcer to measure stage (0-1)	-0.348	0.706	(0.619 - 0.806)
Stasis ulcer(s) present (0-1)	-0.240	0.787	(0.743 - 0.833)
Number of surgical wounds present (0-4)	0.174	1.190	(1.179 - 1.201)
Urinary incontinence severity (0-4)	-0.044	0.957	(0.949 - 0.965)
Bowel incontinence frequency (0-5)	-0.073	0.929	(0.920 - 0.939)
Urinary catheter prior to past 2 weeks (0-1)	-0.171	0.843	(0.795 - 0.894)
Obese at SOC/ROC (0-1)	-0.198	0.820	(0.803 - 0.838)
Severity rating for primary diagnosis (0-4)	0.088	1.092	(1.078 - 1.105)
Number of diagnoses with severity rating >= 2 (0-6)	0.031	1.032	(1.026 - 1.038)
Acute condition: oxygen therapy (0-1)	-0.162	0.850	(0.829 - 0.872)
Acute condition: orthopedic (0-1)	-0.139	0.871	(0.854 - 0.888)
Acute condition: cardiac/peripheral vascular (0-1)	0.085	1.089	(1.070 - 1.109)
Acute condition: gastrointestinal disorder (0-1)	0.128	1.137	(1.101 - 1.174)
Chronic condition: eating disability (0-1)	-0.127	0.881	(0.842 - 0.922)
Chronic condition: urinary incontinence/catheter (0-1)	-0.124	0.883	(0.862 - 0.906)
Diagnosis: genitourinary system diseases (0-1)	-0.083	0.920	(0.898 - 0.943)
Diagnosis: skin/subcutaneous diseases (0-1)	-0.145	0.865	(0.838 - 0.893)
Diagnosis: musculoskeletal system diseases (0-1)	-0.140	0.869	(0.854 - 0.885)
Diagnosis: ill-defined conditions (0-1)	-0.082	0.922	(0.907 - 0.937)

**TABLE 1: Logistic Regression Model for Predicting the Outcome of Improvement in Ambulation/Locomotion. (cont'd)**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Diagnosis: neoplasms (0-1)	0.101	1.106	(1.074 - 1.139)
Diagnosis: blood diseases (0-1)	-0.121	0.886	(0.860 - 0.912)
Diagnosis: nervous system disorder (0-1)	-0.241	0.786	(0.767 - 0.805)
Diagnosis: respiratory system diseases (0-1)	0.161	1.175	(1.150 - 1.201)
Diagnosis: digestive system diseases (0-1)	0.080	1.083	(1.050 - 1.117)
Resumption of Care with intervening in-patient stay (0-1)	-0.191	0.826	(0.805 - 0.848)
Attention to artificial openings: urinary (0-1)	0.319	1.376	(1.271 - 1.488)
Aftercare following hip, joint replacement or fracture (0-1)	-0.370	0.691	(0.668 - 0.715)
Attention to artificial openings: gastro/colostomy (0-1)	0.379	1.461	(1.338 - 1.596)
Rehabilitation procedures: physical therapy (0-1)	0.057	1.059	(1.039 - 1.078)
Aftercare following surgery (0-1)	0.276	1.318	(1.281 - 1.356)
Long-term use of therapeutic pharmaceuticals (0-1)	-0.094	0.910	(0.879 - 0.943)
Constant	-0.637		

**Number of Risk Factors:** 67

**R<sup>2</sup>:**<sup>§</sup> Developmental R<sup>2</sup> = 0.257

Validation R<sup>2</sup> = 0.257

**C:**<sup>§</sup> Developmental C-statistic = 0.792

Validation C-statistic = 0.791

\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at P<.0001 using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at P<.0001 because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

§ The R<sup>2</sup> values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both R<sup>2</sup>s and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

**TABLE 2: Logistic Regression Model for Predicting the Outcome of Improvement in Bathing.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Acute condition: orthopedic (0-1)	0.092	1.096	(1.078 - 1.115)
Acute condition: oxygen therapy (0-1)	-0.197	0.821	(0.802 - 0.841)
Acute condition: neurologic (0-1)	0.072	1.075	(1.049 - 1.102)
Acute condition: cardiac/peripheral vascular (0-1)	0.078	1.081	(1.063 - 1.098)
Age: 75 to 84, inclusive (0-1)	-0.078	0.925	(0.909 - 0.940)
Age: 85 or more (0-1)	-0.268	0.765	(0.750 - 0.780)
Disability in ambulation (0-5)	-0.206	0.814	(0.802 - 0.826)
Disability in bathing: Level 2 (0-1)	1.177	3.243	(3.174 - 3.314)
Disability in bathing: Level 3 (0-1)	2.288	9.856	(9.588 - 10.132)
Disability in bathing: Level 4 (0-1)	2.529	12.539	(12.152 - 12.938)
Disability in bathing: Level 5 (0-1)	3.888	48.815	(46.243 - 51.529)
Demonstrated behavior: impaired decision-making (0-1)	0.104	1.110	(1.085 - 1.135)
Bowel incontinence frequency (0-5)	-0.057	0.945	(0.936 - 0.954)
Chronic condition: impaired ambulation/mobility (0-1)	0.165	1.180	(1.149 - 1.212)
Chronic condition: eating disability (0-1)	-0.237	0.789	(0.750 - 0.830)
Chronic condition: urinary incontinence/catheter (0-1)	-0.123	0.884	(0.865 - 0.904)
Caregiver provides ADL assistance (0-1)	-0.107	0.898	(0.884 - 0.913)
Confusion scale (0-4)	-0.044	0.957	(0.948 - 0.966)
Surgical wound(s) present (0-1)	0.234	1.263	(1.228 - 1.300)
Dyspnea (shortness of breath) (0-4)	0.017	1.017	(1.010 - 1.024)
Gender: female (0-1)	-0.101	0.904	(0.890 - 0.917)
Disability in housekeeping (0-4)	-0.038	0.963	(0.956 - 0.969)
Urinary incontinence severity (0-4)	-0.023	0.978	(0.970 - 0.985)
Inpatient discharge from hospital (0-1)	0.297	1.346	(1.324 - 1.369)
Inpatient discharge from rehabilitation facility (0-1)	0.267	1.307	(1.277 - 1.337)
Inpatient discharge from nursing home (0-1)	0.235	1.265	(1.235 - 1.296)
Patient lives with family member (0-1)	0.173	1.189	(1.156 - 1.222)
Patient lives alone (0-1)	0.202	1.224	(1.189 - 1.261)
Patient has informal caregiver(s) (0-1)	0.094	1.098	(1.071 - 1.126)
Disability in management of oral medications (0-2)	-0.150	0.860	(0.850 - 0.871)
No oral medications prescribed (0-1)	-0.247	0.781	(0.724 - 0.843)
Pain interfering with activity (0-3)	0.032	1.032	(1.025 - 1.040)
Prior (2 weeks ago) disability in ambulation (0-5)	-0.090	0.914	(0.900 - 0.928)
Patient lives in own home (0-1)	0.066	1.069	(1.050 - 1.088)
Medicaid (not Medicare) as payment source (0-1)	-0.244	0.784	(0.758 - 0.811)
Both Medicare and Medicaid payment sources (0-1)	-0.081	0.922	(0.895 - 0.951)
Any HMO payment source (0-1)	-0.070	0.933	(0.912 - 0.954)
Prior (2 weeks ago) disability in bathing (0-5)	-0.199	0.819	(0.812 - 0.827)
Memory loss requiring supervision prior to past 2 weeks (0-1)	-0.077	0.926	(0.903 - 0.950)
Prior (2 weeks ago) disability in eating (0-5)	0.052	1.053	(1.036 - 1.071)
Disability in telephone use (0-5)	-0.066	0.936	(0.929 - 0.943)
Patient does not have telephone (0-1)	-0.194	0.823	(0.780 - 0.869)
Prior (2 weeks ago) disability in laundry (0-2)	-0.118	0.889	(0.876 - 0.902)
Overall prognosis moderate or better (0-1)	0.174	1.190	(1.156 - 1.224)
Overall prognosis not known (0-1)	0.213	1.237	(1.164 - 1.314)
Prior (2 weeks ago) disability in shopping (0-3)	-0.034	0.967	(0.956 - 0.978)
Prior (2 weeks ago) disability in toileting (0-4)	0.092	1.096	(1.079 - 1.113)
Stage of most problematic pressure ulcer (0-4)	-0.082	0.921	(0.907 - 0.936)
Rehabilitative prognosis is good (0-1)	0.302	1.352	(1.326 - 1.379)
Obese at SOC/ROC (0-1)	-0.138	0.871	(0.854 - 0.888)
Number of diagnoses with severity rating >= 2 (0-6)	0.030	1.030	(1.025 - 1.036)
Severity rating for primary diagnosis (0-4)	0.082	1.086	(1.073 - 1.099)
Speech/language impairment (0-5)	-0.074	0.928	(0.918 - 0.939)
Number of stasis ulcers present (0-4)	-0.103	0.902	(0.882 - 0.923)
Disability in toileting (0-4)	-0.139	0.871	(0.858 - 0.884)
Disability in transferring (0-5)	-0.096	0.908	(0.896 - 0.920)

**TABLE 2: Logistic Regression Model for Predicting the Outcome of Improvement in Bathing. (cont'd)**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Disability in transportation (0-2)	-0.134	0.875	(0.845 - 0.906)
Disability in dressing upper body (0-3)	-0.095	0.909	(0.900 - 0.919)
Number of surgical wounds present (0-4)	0.047	1.048	(1.033 - 1.063)
No observable surgical wound to measure status (0-1)	-0.377	0.686	(0.640 - 0.735)
Diagnosis: genitourinary system diseases (0-1)	-0.104	0.901	(0.881 - 0.921)
Diagnosis: skin/subcutaneous diseases (0-1)	-0.193	0.825	(0.801 - 0.849)
Diagnosis: neoplasms (0-1)	-0.154	0.857	(0.835 - 0.881)
Diagnosis: mental disease (0-1)	-0.061	0.941	(0.919 - 0.964)
Diagnosis: nervous system disorder (0-1)	-0.214	0.807	(0.789 - 0.826)
Diagnosis: respiratory system diseases (0-1)	0.084	1.088	(1.066 - 1.110)
Diagnosis: digestive system diseases (0-1)	0.079	1.082	(1.058 - 1.107)
Resumption of Care with intervening in-patient stay (0-1)	-0.071	0.932	(0.911 - 0.954)
Rehabilitation procedures: physical therapy (0-1)	0.102	1.108	(1.088 - 1.127)
Rehabilitation procedures: other than physical therapy (0-1)	0.081	1.084	(1.054 - 1.115)
Aftercare following surgery (0-1)	0.172	1.188	(1.153 - 1.224)
Constant	-0.643		

Number of Risk Factors: 71

$R^2$ :<sup>§</sup> Developmental  $R^2$  = 0.205

Validation  $R^2$  = 0.204

$C$ :<sup>§</sup> Developmental C-statistic = 0.765

Validation C-statistic = 0.765

\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

§ The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ s and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

**TABLE 3: Logistic Regression Model for Predicting the Outcome of Improvement in Transferring.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Age: 75 to 84, inclusive (0-1)	-0.044	0.957	(0.940 - 0.974)
Age: 85 or more (0-1)	-0.217	0.805	(0.788 - 0.822)
Gender: female (0-1)	-0.061	0.940	(0.926 - 0.955)
Any HMO payment source (0-1)	-0.064	0.938	(0.916 - 0.960)
Both Medicare and Medicaid payment sources (0-1)	-0.104	0.901	(0.872 - 0.931)
Medicaid (not Medicare) as payment source (0-1)	-0.141	0.869	(0.837 - 0.902)
Patient has informal caregiver(s) (0-1)	0.111	1.117	(1.090 - 1.144)
Inpatient discharge from hospital (0-1)	0.281	1.325	(1.302 - 1.348)
Inpatient discharge from rehabilitation facility (0-1)	0.163	1.178	(1.151 - 1.205)
Inpatient discharge from nursing home (0-1)	0.125	1.134	(1.106 - 1.162)
Overall prognosis moderate or better (0-1)	0.111	1.118	(1.085 - 1.151)
Rehabilitative prognosis is good (0-1)	0.233	1.262	(1.235 - 1.290)
Rehabilitative prognosis not known (0-1)	0.210	1.233	(1.159 - 1.312)
Disability in grooming (0-3)	-0.039	0.962	(0.951 - 0.974)
Disability in dressing lower body (0-3)	-0.075	0.927	(0.917 - 0.938)
Disability in bathing (0-5)	-0.050	0.951	(0.944 - 0.959)
Disability in toileting (0-4)	-0.151	0.860	(0.847 - 0.873)
Disability in transferring: Level 2 (0-1)	2.387	10.876	(10.492 - 11.274)
Disability in transferring: Level 3 (0-1)	2.947	19.040	(17.901 - 20.251)
Disability in transferring: Level 4 (0-1)	3.621	37.357	(33.866 - 41.208)
Disability in transferring: Level 5 (0-1)	3.887	48.771	(44.380 - 53.596)
Disability in ambulation (0-5)	-0.241	0.786	(0.773 - 0.799)
Disability in eating (0-5)	-0.054	0.948	(0.935 - 0.961)
Prior (2 weeks ago) disability in dressing upper body (0-3)	-0.042	0.959	(0.946 - 0.972)
Prior (2 weeks ago) disability in toileting (0-4)	0.078	1.082	(1.063 - 1.100)
Prior (2 weeks ago) disability in transferring (0-5)	-0.272	0.762	(0.747 - 0.777)
Prior (2 weeks ago) disability in ambulation (0-5)	-0.170	0.844	(0.829 - 0.859)
Disability in transportation (0-2)	-0.134	0.875	(0.844 - 0.907)
Disability in telephone use (0-5)	-0.092	0.912	(0.899 - 0.925)
Disability in management of oral medications (0-2)	-0.075	0.928	(0.912 - 0.944)
Prior (2 weeks ago) disability in laundry (0-2)	-0.061	0.941	(0.924 - 0.959)
Prior (2 weeks ago) disability in housekeeping (0-4)	-0.032	0.969	(0.960 - 0.978)
Prior (2 weeks ago) disability in telephone use (0-5)	0.050	1.052	(1.036 - 1.067)
Prior (2 weeks ago) disability in mgt. of oral medications (0-2)	0.094	1.098	(1.074 - 1.122)
Vision impairment (0-2)	-0.078	0.925	(0.911 - 0.939)
Speech/language impairment (0-5)	-0.068	0.935	(0.924 - 0.946)
Demonstrated behavior: impaired decision-making (0-1)	0.067	1.069	(1.044 - 1.094)
Anxiety level (0-3)	0.025	1.025	(1.015 - 1.035)
Stage of most problematic pressure ulcer (0-4)	-0.096	0.908	(0.893 - 0.924)
Stasis ulcer(s) present (0-1)	-0.176	0.839	(0.793 - 0.887)
Surgical wound(s) present (0-1)	0.103	1.108	(1.075 - 1.142)
Number of surgical wounds present (0-4)	0.114	1.121	(1.106 - 1.137)
Urinary incontinence severity (0-4)	-0.059	0.942	(0.935 - 0.949)
Bowel incontinence frequency (0-5)	-0.051	0.950	(0.941 - 0.959)
Urinary incontinence prior to past 2 weeks (0-1)	-0.098	0.906	(0.886 - 0.927)
Urinary catheter prior to past 2 weeks (0-1)	-0.283	0.753	(0.712 - 0.797)
Obese at SOC/ROC (0-1)	-0.130	0.878	(0.861 - 0.896)
Acute condition: oxygen therapy (0-1)	-0.071	0.932	(0.909 - 0.955)
Acute condition: IV/infusion therapy (0-1)	-0.195	0.823	(0.781 - 0.868)
Acute condition: orthopedic (0-1)	0.087	1.091	(1.072 - 1.109)
Acute condition: neurologic (0-1)	0.119	1.127	(1.098 - 1.156)
Acute condition: open wound/lesion (0-1)	-0.059	0.943	(0.925 - 0.961)
Acute condition: gastrointestinal disorder (0-1)	0.081	1.085	(1.057 - 1.112)
Chronic condition: impaired ambulation/mobility (0-1)	0.234	1.264	(1.227 - 1.301)
Chronic condition: dependence in medication admin. (0-1)	-0.140	0.869	(0.846 - 0.894)

**TABLE 3: Logistic Regression Model for Predicting the Outcome of Improvement in Transferring. (cont'd)**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Diagnosis: skin/subcutaneous diseases (0-1)	-0.157	0.855	(0.828 - 0.882)
Diagnosis: ill-defined conditions (0-1)	0.062	1.064	(1.048 - 1.081)
Diagnosis: nervous system disorder (0-1)	-0.172	0.842	(0.822 - 0.862)
Diagnosis: respiratory system diseases (0-1)	0.099	1.104	(1.081 - 1.127)
Resumption of Care with intervening in-patient stay (0-1)	-0.152	0.859	(0.838 - 0.881)
Aftercare following hip, joint replacement or fracture (0-1)	-0.086	0.918	(0.889 - 0.948)
Attention to artificial openings: gastro/colostomy (0-1)	0.249	1.283	(1.168 - 1.409)
Rehabilitation procedures: physical therapy (0-1)	0.182	1.200	(1.179 - 1.220)
Aftercare following surgery (0-1)	0.145	1.156	(1.121 - 1.191)
Constant	0.742		

Number of Risk Factors: 64

$R^2$ :<sup>§</sup> Developmental  $R^2$  = 0.138

Validation  $R^2$  = 0.137

$C$ :<sup>§</sup> Developmental C-statistic = 0.712

Validation C-statistic = 0.712

\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

§ The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ 's and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

**TABLE 4: Logistic Regression Model for Predicting the Outcome of Improvement in Management of Oral Medications.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Age: 75 to 84, inclusive (0-1)	-0.218	0.804	(0.787 - 0.821)
Age: 85 or more (0-1)	-0.444	0.641	(0.626 - 0.658)
Gender: female (0-1)	0.125	1.134	(1.112 - 1.155)
Patient lives in own home (0-1)	0.388	1.474	(1.443 - 1.507)
Patient lives with family member (0-1)	0.447	1.563	(1.504 - 1.625)
Patient lives alone (0-1)	0.553	1.738	(1.671 - 1.807)
Patient has informal caregiver(s) (0-1)	0.188	1.207	(1.165 - 1.251)
Primary caregiver present (0-1)	0.170	1.185	(1.117 - 1.258)
Caregiver provides ADL assistance (0-1)	-0.086	0.917	(0.896 - 0.939)
Infrequency of caregiver assistance (1-7)	-0.059	0.943	(0.932 - 0.954)
Inpatient discharge from hospital (0-1)	0.270	1.310	(1.282 - 1.338)
Inpatient discharge from rehabilitation facility (0-1)	0.300	1.350	(1.311 - 1.390)
Inpatient discharge from nursing home (0-1)	0.159	1.172	(1.137 - 1.208)
Medical regimen change in past 14 days (0-1)	0.067	1.069	(1.041 - 1.097)
Overall prognosis moderate or better (0-1)	0.123	1.130	(1.093 - 1.169)
Rehabilitative prognosis is good (0-1)	0.171	1.187	(1.159 - 1.216)
Disability in toileting (0-4)	-0.115	0.891	(0.876 - 0.906)
Disability in ambulation (0-5)	-0.145	0.865	(0.853 - 0.878)
Prior (2 weeks ago) disability in toileting (0-4)	0.049	1.050	(1.032 - 1.068)
Disability in light meal preparation (0-2)	-0.063	0.939	(0.921 - 0.956)
Disability in telephone use (0-5)	-0.151	0.860	(0.853 - 0.867)
Patient does not have telephone (0-1)	-0.525	0.591	(0.550 - 0.636)
Disability in management of oral medications: Level 2 (0-1)	1.438	4.214	(4.084 - 4.348)
Prior (2 weeks ago) disability in light meal preparation (0-2)	-0.136	0.873	(0.851 - 0.896)
Prior (2 weeks ago) disability in transportation (0-2)	-0.089	0.915	(0.892 - 0.939)
Prior (2 weeks ago) disability in laundry (0-2)	-0.096	0.909	(0.893 - 0.925)
Prior (2 weeks ago) disability in mgt. of oral medications (0-2)	-0.197	0.821	(0.799 - 0.845)
Prior (2 weeks ago) no oral medications prescribed (0-1)	-0.296	0.744	(0.669 - 0.827)
Dyspnea (shortness of breath) (0-4)	0.062	1.063	(1.054 - 1.073)
Vision impairment (0-2)	-0.082	0.922	(0.906 - 0.938)
Speech/language impairment (0-5)	-0.117	0.890	(0.877 - 0.903)
Pain interfering with activity (0-3)	0.077	1.080	(1.070 - 1.090)
Demonstrated behavior: impaired decision-making (0-1)	0.116	1.123	(1.088 - 1.159)
Anxiety level (0-3)	0.062	1.064	(1.052 - 1.076)
Disability in cognitive functioning (0-4)	-0.118	0.888	(0.873 - 0.904)
Confusion scale (0-4)	-0.145	0.865	(0.855 - 0.876)
Stage 1-4 pressure ulcer(s) present (0-1)	-0.122	0.885	(0.853 - 0.919)
Surgical wound(s) present (0-1)	0.212	1.236	(1.175 - 1.299)
Status of surgical wound (0-3)	0.065	1.067	(1.039 - 1.096)
Urinary incontinence severity (0-4)	-0.022	0.979	(0.971 - 0.987)
Urinary incontinence prior to past 2 weeks (0-1)	-0.090	0.914	(0.890 - 0.937)
Memory loss requiring supervision prior to past 2 weeks (0-1)	-0.185	0.831	(0.804 - 0.858)
Obese at SOC/ROC (0-1)	0.076	1.079	(1.052 - 1.107)
Severity rating for primary diagnosis (0-4)	0.099	1.104	(1.088 - 1.120)
Number of diagnoses with severity rating >= 2 (0-6)	0.026	1.027	(1.020 - 1.033)
Acute condition: oxygen therapy (0-1)	-0.119	0.887	(0.862 - 0.913)
Acute condition: enteral/parenteral nutrition (0-1)	-0.331	0.718	(0.662 - 0.779)
Acute condition: ventilator (0-1)	-0.917	0.400	(0.281 - 0.567)
Acute condition: orthopedic (0-1)	0.107	1.113	(1.088 - 1.138)
Acute condition: gastrointestinal disorder (0-1)	0.071	1.073	(1.042 - 1.105)
Chronic condition: dependence in living skills (0-1)	0.169	1.184	(1.142 - 1.227)
Chronic condition: impaired ambulation/mobility (0-1)	0.112	1.119	(1.085 - 1.154)
Chronic condition: dependence in medication admin. (0-1)	-0.512	0.599	(0.577 - 0.622)
Chronic condition: cognitive/mental/behavioral problems (0-1)	-0.194	0.824	(0.800 - 0.848)
Chronic condition: at least one, but caregiver present (0-1)	0.120	1.127	(1.097 - 1.159)

**TABLE 4: Logistic Regression Model for Predicting the Outcome of Improvement in Management of Oral Medications. (cont'd)**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Diagnosis: genitourinary system diseases (0-1)	-0.069	0.933	(0.909 - 0.959)
Diagnosis: musculoskeletal system diseases (0-1)	0.071	1.073	(1.051 - 1.096)
Diagnosis: neoplasms (0-1)	-0.119	0.888	(0.858 - 0.918)
Diagnosis: endocrine/nutritional/metabolic (0-1)	-0.047	0.954	(0.936 - 0.973)
Diagnosis: mental disease (0-1)	-0.240	0.787	(0.765 - 0.810)
Diagnosis: nervous system disorder (0-1)	-0.181	0.834	(0.812 - 0.857)
Diagnosis: respiratory system diseases (0-1)	0.077	1.080	(1.054 - 1.106)
Resumption of Care with intervening in-patient stay (0-1)	-0.087	0.917	(0.891 - 0.943)
Aftercare following hip, joint replacement or fracture (0-1)	0.307	1.359	(1.291 - 1.431)
Aftercare following surgery (0-1)	0.181	1.199	(1.153 - 1.246)
Constant	-0.945		

Number of Risk Factors: 65

$R^2$ :<sup>§</sup> Developmental  $R^2$  = 0.183

Validation  $R^2$  = 0.184

$C$ :<sup>§</sup> Developmental C-statistic = 0.752

Validation C-statistic = 0.753

\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

§ The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ s and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

**TABLE 5: Logistic Regression Model for Predicting the Outcome of Improvement in Pain Interfering with Activity.**

Risk Factor Measured at SOC/ROC <sup>†</sup>	Coefficient <sup>‡</sup>	Odds Ratio <sup>‡</sup>	(90% CI) <sup>‡</sup>
Age: under 65 (0-1)	-0.143	0.866	(0.843 - 0.890)
Age: 75 to 84, inclusive (0-1)	0.049	1.050	(1.030 - 1.070)
Age: 85 or more (0-1)	0.094	1.099	(1.073 - 1.125)
Gender: female (0-1)	-0.093	0.911	(0.896 - 0.926)
Any HMO payment source (0-1)	-0.121	0.886	(0.865 - 0.907)
Medicaid (not Medicare) as payment source (0-1)	-0.104	0.901	(0.870 - 0.934)
Patient lives in own home (0-1)	-0.062	0.940	(0.922 - 0.958)
Medical regimen change in past 14 days (0-1)	0.107	1.113	(1.088 - 1.139)
Overall prognosis moderate or better (0-1)	0.163	1.177	(1.140 - 1.216)
Rehabilitative prognosis is good (0-1)	0.246	1.279	(1.250 - 1.309)
Rehabilitative prognosis not known (0-1)	0.164	1.178	(1.105 - 1.256)
Prior (2 weeks ago) disability in bathing (0-5)	-0.049	0.952	(0.945 - 0.959)
Prior (2 weeks ago) disability in toileting (0-4)	0.046	1.047	(1.035 - 1.060)
Prior (2 weeks ago) disability in ambulation (0-5)	-0.112	0.894	(0.881 - 0.906)
Disability in management of oral medications (0-2)	0.038	1.039	(1.026 - 1.052)
Prior (2 weeks ago) disability in transportation (0-2)	0.066	1.068	(1.049 - 1.089)
Prior (2 weeks ago) disability in telephone use (0-5)	0.030	1.030	(1.022 - 1.039)
Pain interfering with activity: Level 2 (0-1)	0.289	1.336	(1.310 - 1.362)
Pain interfering with activity: Level 3 (0-1)	1.709	5.525	(5.343 - 5.713)
Intractable pain (0-1)	-0.232	0.793	(0.775 - 0.811)
Demonstrated behavior: impaired decision-making (0-1)	0.103	1.108	(1.074 - 1.144)
Anxiety level (0-3)	-0.088	0.916	(0.907 - 0.925)
Depression symptom scale (0-5)	-0.114	0.893	(0.879 - 0.906)
Number of stasis ulcers present (0-4)	-0.078	0.925	(0.903 - 0.947)
Status of surgical wound (0-3)	0.095	1.099	(1.088 - 1.111)
Presence of urinary incontinence (0-1)	-0.059	0.943	(0.926 - 0.960)
Intractable pain prior to past 2 weeks (0-1)	-0.238	0.788	(0.769 - 0.807)
Heavy smoking at SOC/ROC (0-1)	-0.138	0.871	(0.847 - 0.895)
Obese at SOC/ROC (0-1)	-0.104	0.901	(0.884 - 0.920)
Drug dependency at SOC/ROC (0-1)	-0.483	0.617	(0.569 - 0.669)
Acute condition: oxygen therapy (0-1)	-0.169	0.845	(0.823 - 0.867)
Acute condition: IV/infusion therapy (0-1)	-0.165	0.848	(0.808 - 0.890)
Acute condition: orthopedic (0-1)	-0.110	0.896	(0.877 - 0.915)
Acute condition: open wound/lesion (0-1)	-0.085	0.919	(0.900 - 0.937)
Acute condition: terminal (0-1)	-0.116	0.891	(0.864 - 0.919)
Total number of acute conditions reported (0-16)	0.068	1.070	(1.060 - 1.080)
Chronic condition: impaired ambulation/mobility (0-1)	0.097	1.102	(1.069 - 1.136)
Chronic condition: cognitive/mental/behavioral problems (0-1)	0.064	1.067	(1.039 - 1.095)
Diagnosis: musculoskeletal system diseases (0-1)	-0.253	0.776	(0.762 - 0.790)
Diagnosis: ill-defined conditions (0-1)	-0.053	0.948	(0.934 - 0.963)
Diagnosis: fractures (0-1)	-0.084	0.919	(0.896 - 0.944)
Diagnosis: other injury (0-1)	0.128	1.137	(1.103 - 1.172)
Diagnosis: neoplasms (0-1)	-0.141	0.868	(0.844 - 0.893)
Diagnosis: mental disease (0-1)	0.068	1.070	(1.042 - 1.100)
Diagnosis: circulatory system diseases (0-1)	0.113	1.120	(1.102 - 1.138)
Resumption of Care with intervening in-patient stay (0-1)	-0.182	0.833	(0.812 - 0.855)
Aftercare following surgery (0-1)	0.187	1.205	(1.173 - 1.239)
Constant	-0.082		

Number of Risk Factors: 47

$R^2$ :<sup>§</sup> Developmental  $R^2 = 0.059$

Validation  $R^2 = 0.058$

$C$ :<sup>§</sup> Developmental C-statistic = 0.637

Validation C-statistic = 0.636

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**TABLE 5: Logistic Regression Model for Predicting the Outcome of Improvement in Pain Interfering with Activity. (cont'd)**

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- \* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.
- † The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.
- ‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.
- § The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ s and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.
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**TABLE 6: Logistic Regression Model for Predicting the Outcome of Improvement in Dyspnea.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Gender: female (0-1)	0.052	1.054	(1.037 - 1.071)
Any HMO payment source (0-1)	0.121	1.128	(1.100 - 1.158)
Medicaid (not Medicare) as payment source (0-1)	-0.084	0.920	(0.888 - 0.953)
Caregiver provides ADL assistance (0-1)	0.050	1.052	(1.034 - 1.070)
Inpatient discharge from hospital (0-1)	0.237	1.267	(1.244 - 1.291)
Inpatient discharge from rehabilitation facility (0-1)	0.239	1.270	(1.235 - 1.305)
Inpatient discharge from nursing home (0-1)	0.236	1.266	(1.230 - 1.302)
Overall prognosis moderate or better (0-1)	0.191	1.211	(1.172 - 1.251)
Overall prognosis not known (0-1)	0.265	1.303	(1.217 - 1.395)
Rehabilitative prognosis is good (0-1)	0.180	1.197	(1.171 - 1.223)
Disability in grooming (0-3)	-0.036	0.964	(0.954 - 0.975)
Disability in transferring (0-5)	-0.035	0.966	(0.954 - 0.979)
Prior (2 weeks ago) disability in ambulation (0-5)	-0.098	0.907	(0.894 - 0.920)
Disability in laundry (0-2)	0.076	1.078	(1.057 - 1.101)
Disability in shopping (0-3)	0.071	1.073	(1.056 - 1.091)
Prior (2 weeks ago) disability in laundry (0-2)	-0.093	0.912	(0.895 - 0.928)
Prior (2 weeks ago) disability in shopping (0-3)	-0.051	0.951	(0.937 - 0.964)
Dyspnea (shortness of breath): Level 2 (0-1)	1.129	3.092	(3.037 - 3.148)
Dyspnea (shortness of breath): Level 3 (0-1)	1.702	5.482	(5.348 - 5.620)
Dyspnea (shortness of breath): Level 4 (0-1)	2.226	9.261	(8.846 - 9.694)
Vision impairment (0-2)	-0.135	0.873	(0.859 - 0.888)
Hearing impairment (0-4)	-0.056	0.945	(0.935 - 0.956)
Anxiety level (0-3)	-0.059	0.943	(0.933 - 0.952)
Depression symptom scale (0-5)	-0.050	0.951	(0.937 - 0.965)
Surgical wound(s) present (0-1)	0.158	1.171	(1.120 - 1.225)
Status of surgical wound (0-3)	0.061	1.063	(1.040 - 1.088)
Urinary incontinence severity (0-4)	-0.036	0.964	(0.957 - 0.972)
Memory loss requiring supervision prior to past 2 weeks (0-1)	0.101	1.107	(1.077 - 1.137)
Heavy smoking at SOC/ROC (0-1)	-0.182	0.834	(0.812 - 0.857)
Obese at SOC/ROC (0-1)	-0.230	0.795	(0.779 - 0.811)
Acute condition: oxygen therapy (0-1)	-0.762	0.467	(0.456 - 0.477)
Acute condition: IV/infusion therapy (0-1)	-0.166	0.847	(0.805 - 0.891)
Acute condition: ventilator (0-1)	-0.565	0.568	(0.450 - 0.718)
Acute condition: orthopedic (0-1)	0.214	1.239	(1.216 - 1.263)
Acute condition: neurologic (0-1)	0.140	1.150	(1.118 - 1.183)
Acute condition: open wound/lesion (0-1)	-0.053	0.949	(0.931 - 0.967)
Acute condition: terminal (0-1)	-0.088	0.916	(0.890 - 0.941)
Chronic condition: impaired ambulation/mobility (0-1)	0.202	1.224	(1.188 - 1.261)
Chronic condition: urinary incontinence/catheter (0-1)	-0.087	0.917	(0.894 - 0.940)
Chronic condition: chronic pain (0-1)	-0.098	0.906	(0.879 - 0.935)
Diagnosis: skin/subcutaneous diseases (0-1)	-0.095	0.910	(0.884 - 0.936)
Diagnosis: ill-defined conditions (0-1)	0.083	1.086	(1.068 - 1.104)
Diagnosis: neoplasms (0-1)	-0.228	0.796	(0.774 - 0.819)
Diagnosis: circulatory system diseases (0-1)	-0.099	0.906	(0.891 - 0.921)
Diagnosis: respiratory system diseases (0-1)	-0.178	0.837	(0.821 - 0.854)
Resumption of Care with intervening in-patient stay (0-1)	-0.133	0.875	(0.854 - 0.897)
Aftercare following hip, joint replacement or fracture (0-1)	0.282	1.326	(1.265 - 1.390)
Rehabilitation procedures: physical therapy (0-1)	0.251	1.285	(1.260 - 1.311)
Aftercare following surgery (0-1)	0.083	1.087	(1.053 - 1.122)
Constant	-0.735		

**Number of Risk Factors:** 49

**R<sup>2</sup>:**<sup>§</sup> Developmental R<sup>2</sup> = 0.120

Validation R<sup>2</sup> = 0.119

**C:**<sup>§</sup> Developmental C-statistic = 0.699

Validation C-statistic = 0.699

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**TABLE 6: Logistic Regression Model for Predicting the Outcome of Improvement in Dyspnea.  
(cont'd)**

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\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

§ The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ s and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

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**TABLE 7: Logistic Regression Model for Predicting the Outcome of Improvement in Urinary Incontinence.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Any HMO payment source (0-1)	0.196	1.216	(1.174 - 1.260)
Medicaid (not Medicare) as payment source (0-1)	-0.162	0.850	(0.806 - 0.897)
Patient lives in own home (0-1)	0.110	1.117	(1.091 - 1.143)
Patient lives with family member (0-1)	0.127	1.136	(1.112 - 1.160)
Inpatient discharge from hospital (0-1)	0.266	1.305	(1.273 - 1.337)
Inpatient discharge from rehabilitation facility (0-1)	0.365	1.440	(1.391 - 1.492)
Inpatient discharge from nursing home (0-1)	0.195	1.215	(1.173 - 1.258)
Rehabilitative prognosis is good (0-1)	0.091	1.096	(1.069 - 1.123)
Disability in toileting (0-4)	-0.054	0.948	(0.935 - 0.960)
Disability in ambulation (0-5)	-0.061	0.941	(0.924 - 0.958)
Prior (2 weeks ago) disability in bathing (0-5)	-0.042	0.959	(0.949 - 0.969)
Prior (2 weeks ago) disability in ambulation (0-5)	-0.078	0.925	(0.910 - 0.941)
Disability in laundry (0-2)	0.109	1.115	(1.084 - 1.146)
Disability in shopping (0-3)	0.066	1.068	(1.049 - 1.088)
Disability in telephone use (0-5)	-0.041	0.960	(0.951 - 0.969)
Patient does not have telephone (0-1)	-0.255	0.775	(0.722 - 0.832)
Prior (2 weeks ago) disability in laundry (0-2)	-0.073	0.930	(0.911 - 0.949)
Dyspnea (shortness of breath) (0-4)	-0.046	0.955	(0.946 - 0.964)
Vision impairment (0-2)	-0.065	0.937	(0.918 - 0.956)
Speech/language impairment (0-5)	-0.052	0.949	(0.934 - 0.965)
Demonstrated behavior: impaired decision-making (0-1)	-0.071	0.932	(0.906 - 0.958)
Disability in cognitive functioning (0-4)	-0.094	0.910	(0.895 - 0.925)
Stage of most problematic pressure ulcer (0-4)	-0.063	0.939	(0.921 - 0.956)
Surgical wound(s) present (0-1)	0.182	1.200	(1.164 - 1.237)
Urinary tract infection (0-1)	-0.117	0.889	(0.862 - 0.917)
Presence of urinary incontinence (0-1)	-0.390	0.677	(0.644 - 0.712)
Urinary incontinence severity: Level 2 (0-1)	0.260	1.297	(1.241 - 1.355)
Urinary incontinence severity: Level 3 (0-1)	0.132	1.142	(1.113 - 1.171)
Bowel incontinence frequency (0-5)	-0.081	0.922	(0.913 - 0.932)
Bowel ostomy (0-1)	-0.222	0.801	(0.741 - 0.867)
Urinary catheter prior to past 2 weeks (0-1)	-0.316	0.729	(0.685 - 0.776)
Obese at SOC/ROC (0-1)	-0.075	0.928	(0.903 - 0.953)
Acute condition: IV/infusion therapy (0-1)	-0.242	0.785	(0.725 - 0.851)
Acute condition: open wound/lesion (0-1)	-0.173	0.841	(0.819 - 0.864)
Acute condition: terminal (0-1)	-0.147	0.863	(0.833 - 0.894)
Total number of acute conditions reported (0-16)	0.047	1.048	(1.037 - 1.060)
Chronic condition: urinary incontinence/catheter (0-1)	-0.339	0.713	(0.695 - 0.731)
Diagnosis: nervous system disorder (0-1)	-0.177	0.838	(0.814 - 0.863)
Resumption of Care with intervening in-patient stay (0-1)	-0.184	0.832	(0.804 - 0.861)
Attention to artificial openings: urinary (0-1)	0.265	1.303	(1.208 - 1.406)
Rehabilitation procedures: other than physical therapy (0-1)	0.137	1.147	(1.102 - 1.194)
Rehabilitation procedures: physical therapy (0-1)	0.119	1.127	(1.100 - 1.154)
Constant	0.404		

Number of Risk Factors: 42

$R^2$ :<sup>§</sup> Developmental  $R^2 = 0.099$

Validation  $R^2 = 0.098$

$C$ :<sup>§</sup> Developmental C-statistic = 0.679

Validation C-statistic = 0.677

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**TABLE 7: Logistic Regression Model for Predicting the Outcome of Improvement in Urinary Incontinence. (cont'd)**

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\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

§ The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ s and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

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**TABLE 8: Logistic Regression Model for Predicting the Outcome of Improvement in Status of Surgical Wounds.**

Risk Factor Measured at SOC/ROC <sup>*†</sup>	Coefficient <sup>‡</sup>	Odds Ratio <sup>‡</sup>	(90% CI) <sup>‡</sup>
Age: under 65 (0-1)	-0.216	0.806	(0.776 - 0.836)
Age: 75 to 84, inclusive (0-1)	0.116	1.123	(1.090 - 1.158)
Age: 85 or more (0-1)	0.238	1.269	(1.211 - 1.330)
Gender: female (0-1)	0.125	1.133	(1.104 - 1.164)
Any HMO payment source (0-1)	-0.218	0.804	(0.776 - 0.834)
Both Medicare and Medicaid payment sources (0-1)	0.221	1.247	(1.163 - 1.336)
Patient lives in own home (0-1)	0.117	1.124	(1.085 - 1.164)
Patient has informal caregiver(s) (0-1)	-0.158	0.854	(0.806 - 0.904)
Inpatient discharge from rehabilitation facility (0-1)	0.089	1.093	(1.055 - 1.132)
Overall prognosis moderate or better (0-1)	0.248	1.282	(1.197 - 1.372)
Overall prognosis not known (0-1)	0.382	1.465	(1.257 - 1.708)
Disability in grooming (0-3)	0.062	1.064	(1.043 - 1.084)
Disability in transferring (0-5)	0.073	1.075	(1.052 - 1.099)
Prior (2 weeks ago) disability in bathing (0-5)	-0.031	0.970	(0.961 - 0.978)
Disability in housekeeping (0-4)	0.038	1.039	(1.028 - 1.049)
Disability in management of oral medications (0-2)	0.083	1.087	(1.062 - 1.112)
Dyspnea (shortness of breath) (0-4)	0.080	1.083	(1.068 - 1.098)
Vision impairment (0-2)	0.101	1.106	(1.068 - 1.146)
Number of surgical wounds present (0-4)	-0.109	0.897	(0.886 - 0.909)
Status of surgical wound: Level 2 (0-1)	1.271	3.564	(3.468 - 3.662)
Status of surgical wound: Level 3 (0-1)	2.358	10.569	(9.885 - 11.299)
Obese at SOC/ROC (0-1)	-0.090	0.914	(0.883 - 0.946)
Number of diagnoses with severity rating >= 2 (0-6)	0.054	1.056	(1.046 - 1.065)
Acute condition: orthopedic (0-1)	0.212	1.236	(1.197 - 1.276)
Acute condition: neurologic (0-1)	0.288	1.334	(1.246 - 1.428)
Acute condition: pulmonary (0-1)	0.128	1.136	(1.082 - 1.193)
Diagnosis: skin/subcutaneous diseases (0-1)	-0.141	0.869	(0.830 - 0.910)
Diagnosis: other injury (0-1)	-0.126	0.882	(0.837 - 0.929)
Diagnosis: circulatory system diseases (0-1)	0.153	1.165	(1.133 - 1.198)
Aftercare following hip, joint replacement or fracture (0-1)	-0.124	0.883	(0.847 - 0.922)
Aftercare following surgery (0-1)	-0.164	0.848	(0.822 - 0.876)
Constant	-0.405		

Number of Risk Factors: 31

$R^2$ :<sup>§</sup> Developmental  $R^2 = 0.091$

Validation  $R^2 = 0.086$

$C$ :<sup>§</sup> Developmental C-statistic = 0.701

Validation C-statistic = 0.696

\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

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**TABLE 8: Logistic Regression Model for Predicting the Outcome of Improvement in Status of Surgical Wounds. (cont'd)**

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<sup>§</sup> The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ s and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

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**TABLE 9: Logistic Regression Model for Predicting the Outcome of Acute Care Hospitalization.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Age: under 65 (0-1)	0.077	1.080	(1.059 - 1.102)
Age: 75 to 84, inclusive (0-1)	-0.051	0.950	(0.936 - 0.965)
Age: 85 or more (0-1)	-0.103	0.902	(0.886 - 0.918)
Gender: female (0-1)	-0.047	0.954	(0.942 - 0.966)
Any HMO payment source (0-1)	-0.225	0.798	(0.783 - 0.814)
Both Medicare and Medicaid payment sources (0-1)	0.162	1.176	(1.149 - 1.203)
Medicaid (not Medicare) as payment source (0-1)	0.395	1.485	(1.449 - 1.522)
Patient lives with family member (0-1)	0.066	1.068	(1.046 - 1.090)
Patient lives alone (0-1)	0.163	1.176	(1.150 - 1.204)
Caregiver provides ADL assistance (0-1)	-0.039	0.962	(0.948 - 0.977)
Caregiver provides IADL assistance (0-1)	-0.050	0.952	(0.936 - 0.968)
Inpatient discharge from hospital (0-1)	0.173	1.188	(1.171 - 1.206)
Inpatient discharge from rehabilitation facility (0-1)	0.081	1.084	(1.062 - 1.108)
Inpatient discharge from nursing home (0-1)	0.087	1.091	(1.068 - 1.115)
Medical regimen change in past 14 days (0-1)	-0.057	0.944	(0.928 - 0.961)
Overall prognosis moderate or better (0-1)	-0.098	0.907	(0.890 - 0.924)
Rehabilitative prognosis is good (0-1)	-0.270	0.764	(0.752 - 0.775)
Disability in grooming (0-3)	0.026	1.026	(1.016 - 1.036)
Disability in dressing upper body (0-3)	0.056	1.057	(1.046 - 1.069)
Disability in toileting (0-4)	0.071	1.073	(1.061 - 1.086)
Disability in ambulation (0-5)	0.064	1.067	(1.057 - 1.076)
Prior (2 weeks ago) disability in bathing (0-5)	0.043	1.044	(1.038 - 1.050)
Prior (2 weeks ago) disability in toileting (0-4)	-0.076	0.927	(0.916 - 0.938)
Disability in housekeeping (0-4)	0.027	1.028	(1.022 - 1.034)
Disability in management of oral medications (0-2)	0.136	1.146	(1.130 - 1.162)
Prior (2 weeks ago) disability in transportation (0-2)	0.149	1.160	(1.142 - 1.179)
Prior (2 weeks ago) disability in laundry (0-2)	0.079	1.083	(1.071 - 1.095)
Prior (2 weeks ago) disability in telephone use (0-5)	-0.023	0.977	(0.971 - 0.982)
Prior (2 weeks ago) disability in mgt. of oral medications (0-2)	-0.158	0.854	(0.840 - 0.869)
Dyspnea (shortness of breath) (0-4)	0.133	1.142	(1.136 - 1.149)
Vision impairment (0-2)	0.032	1.032	(1.020 - 1.044)
Speech/language impairment (0-5)	-0.046	0.955	(0.947 - 0.964)
Pain interfering with activity (0-3)	0.039	1.039	(1.033 - 1.046)
Intractable pain (0-1)	0.108	1.114	(1.094 - 1.133)
Anxiety level (0-3)	0.044	1.045	(1.037 - 1.052)
Depression symptom scale (0-5)	0.050	1.051	(1.040 - 1.062)
Confusion scale (0-4)	0.019	1.019	(1.012 - 1.027)
Stage 1-4 pressure ulcer(s) present (0-1)	-0.156	0.855	(0.800 - 0.914)
Stage 3-4 pressure ulcer(s) present (0-1)	0.182	1.200	(1.123 - 1.283)
Stage of most problematic pressure ulcer (0-4)	0.149	1.161	(1.120 - 1.203)
No observable pressure ulcer to measure stage (0-1)	0.395	1.485	(1.366 - 1.615)
Status of most problematic stasis ulcer (0-3)	0.170	1.186	(1.169 - 1.203)
Surgical wound(s) present (0-1)	-0.418	0.658	(0.633 - 0.684)
Status of surgical wound (0-3)	0.107	1.113	(1.092 - 1.135)
No observable surgical wound to measure status (0-1)	0.517	1.677	(1.573 - 1.788)
Urinary tract infection (0-1)	-0.094	0.911	(0.891 - 0.931)
Urinary catheter (0-1)	0.326	1.385	(1.340 - 1.431)
Bowel incontinence frequency (0-5)	0.032	1.033	(1.026 - 1.040)
Bowel ostomy (0-1)	0.327	1.387	(1.334 - 1.442)
Urinary catheter prior to past 2 weeks (0-1)	0.258	1.294	(1.244 - 1.346)
Memory loss requiring supervision prior to past 2 weeks (0-1)	-0.085	0.919	(0.900 - 0.938)
Obese at SOC/ROC (0-1)	-0.059	0.943	(0.928 - 0.958)
Maximum severity rating among all diagnoses (0-4)	0.081	1.084	(1.075 - 1.094)
Number of diagnoses with severity rating >= 2 (0-6)	0.072	1.074	(1.070 - 1.079)
Acute condition: mental/emotional (0-1)	0.339	1.404	(1.345 - 1.465)
Acute condition: oxygen therapy (0-1)	0.229	1.258	(1.237 - 1.278)
Acute condition: IV/infusion therapy (0-1)	0.387	1.472	(1.427 - 1.518)
Acute condition: enteral/parenteral nutrition (0-1)	0.475	1.608	(1.544 - 1.674)

**TABLE 9: Logistic Regression Model for Predicting the Outcome of Acute Care Hospitalization. (cont'd)**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Acute condition: orthopedic (0-1)	-0.157	0.855	(0.841 - 0.870)
Acute condition: neurologic (0-1)	-0.139	0.870	(0.851 - 0.890)
Acute condition: open wound/lesion (0-1)	0.091	1.095	(1.080 - 1.111)
Acute condition: cardiac/peripheral vascular (0-1)	0.108	1.114	(1.097 - 1.131)
Chronic condition: impaired ambulation/mobility (0-1)	-0.078	0.925	(0.906 - 0.944)
Chronic condition: eating disability (0-1)	-0.090	0.914	(0.885 - 0.943)
Chronic condition: dependence in medication admin. (0-1)	0.232	1.261	(1.236 - 1.287)
Diagnosis: infectious/parasitic disease (0-1)	0.103	1.109	(1.077 - 1.142)
Diagnosis: genitourinary system diseases (0-1)	0.210	1.234	(1.212 - 1.256)
Diagnosis: skin/subcutaneous diseases (0-1)	0.147	1.158	(1.133 - 1.184)
Diagnosis: musculoskeletal system diseases (0-1)	-0.098	0.906	(0.893 - 0.920)
Diagnosis: fractures (0-1)	-0.099	0.906	(0.883 - 0.929)
Diagnosis: neoplasms (0-1)	0.345	1.412	(1.385 - 1.440)
Diagnosis: endocrine/nutritional/metabolic (0-1)	0.173	1.188	(1.174 - 1.203)
Diagnosis: blood diseases (0-1)	0.250	1.284	(1.258 - 1.310)
Diagnosis: nervous system disorder (0-1)	-0.093	0.911	(0.894 - 0.929)
Diagnosis: circulatory system diseases (0-1)	0.108	1.114	(1.097 - 1.130)
Diagnosis: digestive system diseases (0-1)	0.097	1.101	(1.082 - 1.121)
Resumption of Care with intervening in-patient stay (0-1)	0.646	1.908	(1.878 - 1.938)
Attention to artificial openings: urinary (0-1)	0.194	1.215	(1.156 - 1.277)
Aftercare following hip, joint replacement or fracture (0-1)	-0.572	0.564	(0.541 - 0.589)
Attention to artificial openings: gastro/colostomy (0-1)	-0.190	0.827	(0.776 - 0.881)
Rehabilitation procedures: physical therapy (0-1)	-0.123	0.885	(0.871 - 0.899)
Aftercare following surgery (0-1)	-0.118	0.889	(0.868 - 0.911)
Constant	-2.485		

Number of Risk Factors: 82

$R^2$ :<sup>§</sup> Developmental  $R^2 = 0.146$

Validation  $R^2 = 0.144$

$C$ :<sup>§</sup> Developmental C-statistic = 0.734

Validation C-statistic = 0.733

\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

§ The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ 's and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

**TABLE 10: Logistic Regression Model for Predicting the Outcome of Discharged to Community.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Age: 75 to 84, inclusive (0-1)	0.050	1.051	(1.037 - 1.066)
Age: 85 or more (0-1)	0.073	1.076	(1.058 - 1.094)
Gender: female (0-1)	0.054	1.056	(1.043 - 1.069)
Any HMO payment source (0-1)	0.220	1.246	(1.222 - 1.270)
Both Medicare and Medicaid payment sources (0-1)	-0.139	0.870	(0.850 - 0.890)
Medicaid (not Medicare) as payment source (0-1)	-0.427	0.653	(0.638 - 0.667)
Patient lives in own home (0-1)	0.058	1.060	(1.045 - 1.075)
Patient lives with family member (0-1)	-0.063	0.939	(0.920 - 0.959)
Patient lives alone (0-1)	-0.183	0.833	(0.813 - 0.853)
Caregiver provides ADL assistance (0-1)	0.057	1.059	(1.043 - 1.075)
Caregiver provides IADL assistance (0-1)	0.103	1.109	(1.081 - 1.137)
Infrequency of caregiver assistance (1-7)	-0.015	0.985	(0.980 - 0.990)
Inpatient discharge from hospital (0-1)	-0.146	0.864	(0.852 - 0.876)
Inpatient discharge from rehabilitation facility (0-1)	-0.087	0.916	(0.898 - 0.935)
Inpatient discharge from nursing home (0-1)	-0.106	0.899	(0.880 - 0.918)
Medical regimen change in past 14 days (0-1)	0.075	1.078	(1.060 - 1.097)
Overall prognosis moderate or better (0-1)	0.242	1.274	(1.248 - 1.301)
Overall prognosis not known (0-1)	0.148	1.159	(1.110 - 1.210)
Rehabilitative prognosis is good (0-1)	0.284	1.329	(1.310 - 1.349)
Disability in grooming (0-3)	-0.028	0.972	(0.962 - 0.982)
Disability in dressing upper body (0-3)	-0.064	0.938	(0.929 - 0.948)
Disability in bathing (0-5)	-0.024	0.977	(0.970 - 0.983)
Disability in toileting (0-4)	-0.089	0.915	(0.905 - 0.926)
Disability in ambulation (0-5)	-0.082	0.922	(0.913 - 0.930)
Prior (2 weeks ago) disability in bathing (0-5)	-0.026	0.974	(0.967 - 0.981)
Prior (2 weeks ago) disability in toileting (0-4)	0.090	1.094	(1.081 - 1.107)
Disability in laundry (0-2)	0.057	1.059	(1.040 - 1.078)
Disability in housekeeping (0-4)	-0.035	0.965	(0.959 - 0.972)
Disability in telephone use (0-5)	-0.029	0.971	(0.961 - 0.982)
Disability in management of oral medications (0-2)	-0.152	0.859	(0.847 - 0.871)
Prior (2 weeks ago) disability in transportation (0-2)	-0.144	0.866	(0.852 - 0.879)
Prior (2 weeks ago) disability in laundry (0-2)	-0.097	0.908	(0.897 - 0.919)
Prior (2 weeks ago) disability in telephone use (0-5)	0.041	1.042	(1.031 - 1.054)
Prior (2 weeks ago) disability in mgt. of oral medications (0-2)	0.161	1.175	(1.156 - 1.195)
Dyspnea (shortness of breath) (0-4)	-0.136	0.873	(0.868 - 0.878)
Vision impairment (0-2)	-0.029	0.972	(0.961 - 0.983)
Speech/language impairment (0-5)	0.048	1.049	(1.039 - 1.058)
Pain interfering with activity (0-3)	-0.047	0.954	(0.948 - 0.960)
Intractable pain (0-1)	-0.116	0.890	(0.875 - 0.906)
Anxiety level (0-3)	-0.044	0.957	(0.950 - 0.964)
Depression symptom scale (0-5)	-0.070	0.932	(0.922 - 0.942)
Confusion scale (0-4)	-0.032	0.968	(0.961 - 0.975)
Stage 3-4 pressure ulcer(s) present (0-1)	-0.238	0.788	(0.746 - 0.832)
Stage of most problematic pressure ulcer (0-4)	-0.096	0.908	(0.895 - 0.922)
No observable pressure ulcer to measure stage (0-1)	-0.420	0.657	(0.604 - 0.715)
Status of most problematic stasis ulcer (0-3)	-0.174	0.841	(0.828 - 0.853)
Surgical wound(s) present (0-1)	0.433	1.542	(1.484 - 1.601)
Status of surgical wound (0-3)	-0.101	0.904	(0.887 - 0.921)
No observable surgical wound to measure status (0-1)	-0.488	0.614	(0.576 - 0.654)
Urinary tract infection (0-1)	0.093	1.097	(1.074 - 1.122)
Urinary catheter (0-1)	-0.364	0.695	(0.672 - 0.718)
Bowel incontinence frequency (0-5)	-0.036	0.965	(0.958 - 0.971)
Bowel ostomy (0-1)	-0.311	0.733	(0.705 - 0.762)
Urinary catheter prior to past 2 weeks (0-1)	-0.321	0.726	(0.697 - 0.756)
Memory loss requiring supervision prior to past 2 weeks (0-1)	0.078	1.081	(1.059 - 1.103)
Obese at SOC/ROC (0-1)	0.080	1.083	(1.066 - 1.100)

**TABLE 10: Logistic Regression Model for Predicting the Outcome of Discharged to Community. (cont'd)**

Risk Factor Measured at SOC/ROC <sup>†</sup>	Coefficient <sup>‡</sup>	Odds Ratio <sup>‡</sup>	(90% CI) <sup>‡</sup>
Drug dependency at SOC/ROC (0-1)	-0.144	0.866	(0.816 - 0.919)
Maximum severity rating among all diagnoses (0-4)	-0.089	0.915	(0.907 - 0.924)
Number of diagnoses with severity rating >= 2 (0-6)	-0.075	0.928	(0.924 - 0.932)
Acute condition: mental/emotional (0-1)	-0.346	0.707	(0.678 - 0.738)
Acute condition: oxygen therapy (0-1)	-0.243	0.784	(0.771 - 0.797)
Acute condition: IV/infusion therapy (0-1)	-0.389	0.678	(0.657 - 0.699)
Acute condition: enteral/parenteral nutrition (0-1)	-0.442	0.643	(0.617 - 0.670)
Acute condition: orthopedic (0-1)	0.162	1.175	(1.156 - 1.195)
Acute condition: neurologic (0-1)	0.113	1.120	(1.096 - 1.145)
Acute condition: open wound/lesion (0-1)	-0.084	0.919	(0.906 - 0.932)
Acute condition: terminal (0-1)	-0.109	0.897	(0.880 - 0.914)
Acute condition: cardiac/peripheral vascular (0-1)	-0.096	0.909	(0.895 - 0.923)
Chronic condition: impaired ambulation/mobility (0-1)	0.083	1.086	(1.064 - 1.109)
Chronic condition: eating disability (0-1)	0.083	1.086	(1.052 - 1.121)
Chronic condition: dependence in medication admin. (0-1)	-0.227	0.797	(0.781 - 0.813)
Diagnosis: infectious/parasitic disease (0-1)	-0.106	0.899	(0.873 - 0.926)
Diagnosis: genitourinary system diseases (0-1)	-0.194	0.824	(0.809 - 0.839)
Diagnosis: skin/subcutaneous diseases (0-1)	-0.141	0.869	(0.850 - 0.888)
Diagnosis: musculoskeletal system diseases (0-1)	0.099	1.104	(1.089 - 1.120)
Diagnosis: fractures (0-1)	0.089	1.094	(1.067 - 1.121)
Diagnosis: neoplasms (0-1)	-0.506	0.603	(0.591 - 0.614)
Diagnosis: endocrine/nutritional/metabolic (0-1)	-0.168	0.845	(0.835 - 0.856)
Diagnosis: blood diseases (0-1)	-0.242	0.785	(0.769 - 0.801)
Diagnosis: nervous system disorder (0-1)	0.084	1.087	(1.067 - 1.108)
Diagnosis: circulatory system diseases (0-1)	-0.088	0.916	(0.903 - 0.930)
Diagnosis: digestive system diseases (0-1)	-0.100	0.905	(0.889 - 0.920)
Resumption of Care with intervening in-patient stay (0-1)	-0.669	0.512	(0.504 - 0.520)
Attention to artificial openings: urinary (0-1)	-0.222	0.801	(0.761 - 0.842)
Aftercare following hip, joint replacement or fracture (0-1)	0.533	1.705	(1.637 - 1.775)
Attention to artificial openings: gastro/colostomy (0-1)	0.180	1.197	(1.123 - 1.276)
Rehabilitation procedures: physical therapy (0-1)	0.148	1.159	(1.142 - 1.177)
Aftercare following surgery (0-1)	0.141	1.151	(1.124 - 1.179)
Constant	2.186		

Number of Risk Factors: 88

$R^2$ :<sup>§</sup> Developmental  $R^2 = 0.171$

Validation  $R^2 = 0.171$

$C$ :<sup>§</sup> Developmental C-statistic = 0.745

Validation C-statistic = 0.745

\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

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**TABLE 10: Logistic Regression Model for Predicting the Outcome of Discharged to Community.  
(cont'd)**

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<sup>§</sup> The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ s and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model.

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**TABLE 11: Logistic Regression Model for Predicting the Outcome of Any Emergent Care Provided.**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Age: under 65 (0-1)	0.077	1.080	(1.059 - 1.102)
Any HMO payment source (0-1)	-0.063	0.939	(0.920 - 0.959)
Both Medicare and Medicaid payment sources (0-1)	0.126	1.134	(1.106 - 1.162)
Medicaid (not Medicare) as payment source (0-1)	0.370	1.448	(1.411 - 1.486)
Patient lives alone (0-1)	0.087	1.091	(1.075 - 1.108)
Caregiver provides IADL assistance (0-1)	-0.046	0.955	(0.940 - 0.970)
Inpatient discharge from hospital (0-1)	0.186	1.205	(1.186 - 1.224)
Inpatient discharge from rehabilitation facility (0-1)	0.090	1.094	(1.070 - 1.120)
Inpatient discharge from nursing home (0-1)	0.147	1.158	(1.131 - 1.185)
Medical regimen change in past 14 days (0-1)	-0.052	0.949	(0.931 - 0.967)
Overall prognosis moderate or better (0-1)	-0.105	0.900	(0.882 - 0.918)
Rehabilitative prognosis is good (0-1)	-0.254	0.776	(0.763 - 0.788)
Disability in dressing upper body (0-3)	0.040	1.040	(1.031 - 1.050)
Disability in bathing (0-5)	0.024	1.024	(1.016 - 1.032)
Disability in toileting (0-4)	0.051	1.052	(1.039 - 1.065)
Disability in ambulation (0-5)	0.021	1.021	(1.012 - 1.030)
Prior (2 weeks ago) disability in bathing (0-5)	0.020	1.021	(1.013 - 1.028)
Prior (2 weeks ago) disability in toileting (0-4)	-0.069	0.933	(0.922 - 0.944)
Prior (2 weeks ago) disability in eating (0-5)	-0.043	0.958	(0.947 - 0.970)
Disability in housekeeping (0-4)	0.024	1.024	(1.017 - 1.031)
Disability in management of oral medications (0-2)	0.132	1.141	(1.124 - 1.158)
Prior (2 weeks ago) disability in transportation (0-2)	0.083	1.086	(1.068 - 1.105)
Prior (2 weeks ago) disability in laundry (0-2)	0.073	1.076	(1.063 - 1.089)
Prior (2 weeks ago) disability in telephone use (0-5)	-0.020	0.980	(0.974 - 0.986)
Prior (2 weeks ago) disability in mgt. of oral medications (0-2)	-0.098	0.907	(0.890 - 0.923)
Dyspnea (shortness of breath) (0-4)	0.085	1.089	(1.082 - 1.095)
Speech/language impairment (0-5)	-0.027	0.973	(0.965 - 0.982)
Pain interfering with activity (0-3)	0.023	1.024	(1.016 - 1.031)
Intractable pain (0-1)	0.105	1.111	(1.090 - 1.132)
Anxiety level (0-3)	0.052	1.054	(1.045 - 1.062)
Depression symptom scale (0-5)	0.062	1.064	(1.052 - 1.076)
Stage of most problematic pressure ulcer (0-4)	0.067	1.069	(1.058 - 1.080)
Number of stasis ulcers present (0-4)	0.088	1.092	(1.075 - 1.109)
Surgical wound(s) present (0-1)	-0.195	0.822	(0.807 - 0.838)
No observable surgical wound to measure status (0-1)	0.164	1.179	(1.112 - 1.249)
Urinary catheter (0-1)	0.224	1.251	(1.209 - 1.295)
Bowel incontinence frequency (0-5)	0.023	1.023	(1.016 - 1.030)
Bowel ostomy (0-1)	0.187	1.206	(1.159 - 1.254)
Urinary catheter prior to past 2 weeks (0-1)	0.167	1.181	(1.135 - 1.230)
Heavy smoking at SOC/ROC (0-1)	0.058	1.060	(1.037 - 1.083)
Maximum severity rating among all diagnoses (0-4)	0.051	1.053	(1.042 - 1.063)
Number of diagnoses with severity rating >= 2 (0-6)	0.046	1.047	(1.043 - 1.052)
Acute condition: mental/emotional (0-1)	0.246	1.278	(1.222 - 1.338)
Acute condition: oxygen therapy (0-1)	0.224	1.251	(1.228 - 1.273)
Acute condition: IV/infusion therapy (0-1)	0.227	1.254	(1.213 - 1.296)
Acute condition: enteral/parenteral nutrition (0-1)	0.361	1.434	(1.376 - 1.495)
Acute condition: orthopedic (0-1)	-0.147	0.863	(0.847 - 0.879)
Acute condition: neurologic (0-1)	-0.093	0.911	(0.890 - 0.933)
Acute condition: open wound/lesion (0-1)	0.117	1.124	(1.107 - 1.141)
Acute condition: cardiac/peripheral vascular (0-1)	0.085	1.089	(1.071 - 1.107)
Acute condition: contagious/communicable disease (0-1)	0.124	1.132	(1.085 - 1.182)
Chronic condition: dependence in medication admin. (0-1)	0.165	1.179	(1.153 - 1.205)
Diagnosis: genitourinary system diseases (0-1)	0.130	1.139	(1.119 - 1.159)
Diagnosis: musculoskeletal system diseases (0-1)	-0.101	0.904	(0.890 - 0.918)
Diagnosis: fractures (0-1)	-0.095	0.910	(0.885 - 0.935)

**TABLE 11: Logistic Regression Model for Predicting the Outcome of Any Emergent Care Provided. (cont'd)**

<b>Risk Factor Measured at SOC/ROC<sup>†</sup></b>	<b>Coefficient<sup>‡</sup></b>	<b>Odds Ratio<sup>‡</sup></b>	<b>(90% CI)<sup>‡</sup></b>
Diagnosis: neoplasms (0-1)	0.183	1.201	(1.176 - 1.226)
Diagnosis: endocrine/nutritional/metabolic (0-1)	0.114	1.121	(1.106 - 1.136)
Diagnosis: blood diseases (0-1)	0.145	1.157	(1.132 - 1.182)
Diagnosis: nervous system disorder (0-1)	-0.063	0.939	(0.920 - 0.958)
Diagnosis: circulatory system diseases (0-1)	0.073	1.076	(1.058 - 1.093)
Diagnosis: respiratory system diseases (0-1)	0.067	1.069	(1.052 - 1.087)
Diagnosis: digestive system diseases (0-1)	0.090	1.094	(1.074 - 1.115)
Resumption of Care with intervening in-patient stay (0-1)	0.630	1.878	(1.847 - 1.909)
Attention to artificial openings: urinary (0-1)	0.143	1.154	(1.097 - 1.214)
Aftercare following hip, joint replacement or fracture (0-1)	-0.386	0.680	(0.651 - 0.710)
Rehabilitation procedures: physical therapy (0-1)	-0.061	0.941	(0.925 - 0.957)
Aftercare following surgery (0-1)	-0.081	0.922	(0.898 - 0.946)
Constant	-2.484		

Number of Risk Factors: 67

$R^2$ :<sup>§</sup> Developmental  $R^2 = 0.087$

Validation  $R^2 = 0.086$

$C$ :<sup>§</sup> Developmental C-statistic = 0.699

Validation C-statistic = 0.698

\* SOC = Start of Care, ROC = Resumption of Care after inpatient stay. Risk factors pertain to SOC/ROC values.

† The number of values in the measurement scale for each risk factor is in parentheses. For risk factors that take on the value 0 and 1, the value 1 denotes the presence of the attribute and 0 denotes its absence. For risk factors that pertain to health or functional status and are defined using a scale that takes on more than two values, higher values of the scale typically indicate greater impairment or severity of illness. Selective risk factors take on values that simply represent counts (typically the number of problems) -- these are clear from context. The meaning associated with specific values for each risk factor can be determined from the OASIS data set.

‡ All coefficients/odds ratios are significant at  $P < .0001$  using the likelihood ratio test for the hypothesis that the coefficient is zero. The odds ratios and their associated 90% CIs (confidence intervals) are given. These are considered significant at  $P < .0001$  because of the very large developmental sample used to create the models. Using this significance level and large developmental sample results in more stable models whose performance is superior under cross validation.

§ The  $R^2$  values are the squared correlations between predicted and observed values for all patients in the developmental (validation) sample. The developmental sample size for all outcomes is 500,000, with some variation in the number of number of valid cases in this sample for particular outcome measures. The validation sample is 1,000,000 for all models, with similar variation in the number of valid cases for different outcome measures. These sample sizes pertain to both  $R^2$ 's and C-statistics. The C-statistic is the area under the Receiver Operating Characteristic curve. Intuitively, the C-statistic can be described as follows: It is the probability that two individuals who differ on the dependent variable (e.g., one achieves the outcome and one does not) also differ (in the same direction) on the predicted value calculated from the model. substituting a patient's values for all risk factors into the risk model for the outcome under consideration.]