Trends in Risk-Adjusted Skilled Nursing Facility Rates of Community Discharge and Potentially Avoidable Rehospitalization, 2000 through 2008

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Final Report

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1 Introduction

In the year 2000, there were approximately 1.9 million admissions of Medicare beneficiaries to post-acute skilled nursing facilities (SNFS), at a cost to Medicare of about 10.7 billion dollars. By 2008, the number of admissions had grown to 2.5 million, and the cost to Medicare had more than doubled, to $24 billion[1, 2]. The Centers for Medicare and Medicaid Services require all facilities to collect and report resident assessment data, which are used to calculate quality measures that are report on the Nursing Home Compare web site[3]. As part of an effort to develop improved quality measures for short-stay SNF residents, the Medicare Payment Advisory Commission (MedPAC) fund research conducted by faculty and staff of the University of Colorado Division of Health Care Policy and Research to develop two new quality measures[4]. These measures are rehospitalization for selected conditions and community discharge. This work has been updated annually to address trends in these measures and factors associated with the two measures[5-7]. MedPAC has reported on these results in their annual reports[8-13] These measures are increasingly being used in various Centers for Medicare & Medicaid Services (CMS) programs such as value-based purchasing and care transition initiatives. The purpose of this report is to update the trend data to include 2008, introduce a refined methodology for calculating adjusted outcomes over time, and explore facility-level differences in outcomes.

2 Methods

2.1 Data Sources and Sample

The national DataPRO Skilled Nursing Facility (SNF) Stay File, containing information on Medicare-covered SNF stays linked with the preceding qualifying hospitalization and, where applicable, a subsequent hospitalization is used in all analyses. This file is constructed using Medicare SNF and inpatient hospital claims, Minimum Data Set (MDS) assessments, and facility-level staffing data from the Online Survey Certification and Reporting (OSCAR) system. File documentation is available elsewhere[4, 14]. The DataPRO SNF Stay File includes all SNF stays from 2000 through 2008, by calendar year. OSCAR staffing data from 2000 are used for SNF stays from 2000 through 2004. For 2005 through 2008, OSCAR staffing data for each year are matched to the SNF stays for that year. Prior to analysis, staffing data are edited using rules proposed by Abt Associates[15]. Selected variables from the Dartmouth Atlas of Health Care data files (derived from Medicare claims) have been used to take into account regional variation in utilization patterns. An analysis file was created at the level of individual SNF resident stays, which were then aggregated to create a facility-level analysis file. Previous analysis of the stability and variability of outcome rates indicated that a minimum number of 25 stays (excluding deaths) over a one year period is needed to achieve reasonably stable estimates of facility outcome performance[4]. Analysis is therefore restricted to only those SNFs with at least 25 stays with valid outcome data for any year between 2000 and 2008.

2.2 Measures

2.2.1 Outcome Measures

Two outcome measures were investigated: rate of discharge to the community and rate of potentially avoidable rehospitalization. Discharge to the community is defined as discharge from the facility not immediately followed by admission to any inpatient setting. Potentially avoidable

hospitalization is defined as a hospitalization related to any of five conditions for which it is believed, based on earlier research, that good nursing care may result in the avoidance of the need for rehospitalization. These conditions include heart failure, electrolyte imbalance, respiratory infection, sepsis, and urinary tract infection. Both measures are based on an observation interval of 100 days from SNF admission, i.e., the discharge or rehospitalization counts toward the numerator only if it occurs within 100 days of admission, which is effectively the maximum length of stay under the Medicare SNF benefit. Residents who died before 100 days while still a SNF resident are excluded from the denominator.

Community discharge is defined as direct discharge from the SNF to home or assisted living. However, if a resident is discharged to the community but then hospitalized within one day, the stay is reclassified as not a community discharge. The rehospitalization measure is defined as an interruption or termination of the nursing home stay by a hospital stay in an acute care or critical access hospital, for which a diagnosis on the hospital claim matches one of the ICD-9-CM codes for heart failure, electrolyte imbalance, respiratory infection, sepsis, or urinary tract infection. If a hospital admission occurs within one day of SNF discharge (regardless of discharge location), it is included as if it had occurred on the date of discharge.

2.2.2 Comorbidity Index

A comorbidity index for each outcome measure was constructed based on the 17 ICD-9 based disease condition categories initially developed by Charleson/Deyo[16]. Outcome-specific weights were calculated for each diagnosis indicator using a logistic regression approach. Weights for each disease condition were estimated separately for each year, using all available SNF stays for each year (2000-2008). Each comorbidity index included only the subset of the 17 ICD-9 based disease conditions for which the logistic regression coefficient was significant at a probability level of .05 or better. For each stay, the appropriate coefficients for the corresponding year were used to create a comorbidity index value for use in the logistic regression risk adjustment model. Coefficients are shown in Tables 8A and 8B.

2.2.3 Facility Characteristics

Facility characteristics included OSCAR-reported staffing levels for RN, licensed nursing (defined as RNs, LPNs, DONs, and nurses with administrative duties), and CNA hours per resident-day. Facility characteristics also included hospital-based/freestanding, urban/rural, ownership, and region. The Dartmouth Atlas of Health Care variables (with Hospital Referral Regions mapped to each facility by a zip code match) and state indicators were used to capture geographic variation in practice patterns, economic conditions, non-Medicare reimbursement environment, etc. that could influence facility performance. The Dartmouth Atlas of Health Care variable "Primary care physicians per 100,000 residents" from the *selected hospital capacity and physician workforce measures* data file (2006 only) was used in the model for community discharge. The "Percent of Medicare decedents hospitalized at least once during the last six months of life" variable from the *selected measures of inpatient utilization during the last six months of life* data file (2000-2005) was used for rehospitalization. These two variables were selected for modeling based on correlation with the dependent variable. A single resident characteristic, length of stay of the qualifying hospitalization was aggregated to the facility level to use in the facility-level analysis.

2.3 Analysis Conducted

2.3.1 Risk Adjustment

A resident-level risk-adjustment model was developed using SNF stays from all available years of data. In order to have a risk adjustment model that would be useful for making comparisons from year to year, data from all years were pooled to developing a single risk model for each measure. Predictors included comorbidity indices, functional indicators (Barthel Score and Cognitive Performance Score), selected disease indicators, do not resuscitate indicator, marital status, and a set of five binary indicator variables for rehabilitation RUG (ultra high, very high, high, medium, and low vs. other categories).

2.3.2 Changes in Outcomes Over Time

For each of the two outcomes (community discharge and rehospitalization), simple descriptive statistics were computed by year at the facility level. Unadjusted facility observed rates and facility-level adjusted rates[3] were calculated for all years from 2000 to 2008. In addition, facility expected rates, based on the risk adjustment models and the admitting characteristics of SNF residents at each facility, and national observed rates were also calculated. The national rate is the average of all facility observed rates.

Adjusted rates are calculated for each facility using the method described in the National Nursing Home Quality Measures User's Manual[3]. This method uses a formula that incorporates the facility observed rate, the facility expected rate, and the national (observed) rate described above. This differs from previous work, which used the average of all stay-level observed outcomes as the national rate for calculating adjusted values[8-12]. Two methods for calculating the adjusted rates over time were compared. The previous method (Method 1) uses the method described for each year independently, with the national value for each year based on the national observed outcome rate for that year. The new methodology (Method 2) uses a common national average for all years, which is the in base year 2000 as a constant national rate for all years.

The rationale for the second method of calculating risk-adjusted outcome rates for each facility is that the problem of risk adjustment is different when comparing individual facilities or groups of facilities over time than it is when comparing facilities to one another or to a national average at a single point in time. If one wants to compare a single facility (or a group of facilities, such as all facilities within a state or region within state) with the national average at a single point in time, the risk adjustment formula should be based on the facility observed and expected rates and the national rate at that point in time. If a single facility or group of facilities is to be compared with itself at an earlier point in time, the adjusted rate at each point in time should be a function of the observed and expected values at that time point, relative to a constant value, which we have chosen to be the baseline (2000) national rate. Therefore, when simultaneously comparing a facility or group of facilities (or even all facilities) with all facilities at an earlier point in time, it is appropriate to use a constant national average from the earlier time point in the risk adjustment formula. Using a national rate that varies from year to year in the risk adjustment formula has the effect of distorting the magnitude of changes in average values from year to year.

The issue can perhaps best be illustrated with a series of hypothetical examples. In Table 1, five scenarios are illustrated. In each scenario, a "typical" facility is presented with an observed outcome rate equal to the national mean at two time points. In the first scenario, the facility

expected rate is a constant. Because this means that facility case mix is essentially the same at both time points, risk adjustment should have no effect. There are no case mix differences that need to be adjusted away. However, contrary to expectations, Method 1 shows a greater adjusted difference than the observed difference. The reason this is true is that the use of the national mean for the later year in the calculation of the adjusted rate ends up double counting the change in the rate over time. The facility is getting credit (or blame, depending on the measure) for increasing its own rate, plus an increment for the change in the national rate. Similar results prevail for other scenarios. In the second scenario, the increase in observed rate should be offset somewhat by the increase in expected rate. While this is true for Method 2, the adjusted rate using Method 1 is actually higher than the observed rate. In scenario 3, a decrease in expected rate should result in an adjusted difference over time that is greater than the unadjusted difference. However, Method 1 results in an adjusted difference that is more than twice the original difference. This is hardly plausible given that the difference in expected values from one time point to the next is less than the observed difference. Scenario 4 illustrates what happens when the expected rate change is greater than the observed rate change, and in the same direction. Since the expected rate changes by twice as much as the observed rate, we would expect the adjusted rate to actually go down, which is what Method 2 reflects. However, using Method 1, the adjusted rate is unchanged. Therefore, it is underestimating the amount of outcome change over time. Finally, in Scenario 5 there is no difference between Method 1 and Method 2, because the national rate is constant.

Prior studies[5, 6] suggested that facilities that were present for both the beginning and the end of the analysis period had different outcome rates than facilities that were present only in the beginning or only at the end. "Presence" required at least 25 observations (excluding deaths) for which the outcome was not missing. A facility might be "not present" if it had fewer than 25 stays or if it was not in business at all. Unadjusted comparisons of facility characteristics were made with the group of facilities initially present regardless of status at the end and with the group of facilities present at the end regardless of status in the beginning.

2.3.3.   Facility-Level Regression Analysis for Outcomes

For the facility-level analysis, only data for years 2000 and 2008 were used. The analysis file consisted of two records for each facility, one for 2000 and one for 2008. A dichotomous variable (time) indicated whether the observation was from 2000 or 2008. Two binary variables were constructed indicating whether the facility was present in the data file in 2000 but not in 2008 (2000 only) or if the facility was present in the data file in 2008 but not in 2000 (2008 only). The reference group was facilities present at both time points. A series of preliminary regression models were fitted to assess the crude impact of various facility measures on outcome rates. Both observed rates, and adjusted rates using the national average in base year 2000 for all years (Method 2) were considered as alternate dependent variable for the regression analysis. The first set of models additively included time, and the two binary variables as predictors (and additional case mix measures for the observed rates models). Each facility independent variable (or sometimes a set) was then added and tested. The model adjusted R^2, the estimated coefficient of the variable being tested, the estimated coefficients of time, and the two dummy variables were assessed for each model. Variables tested in this manner included: hospital length of stay, region, staffing levels, hospital-based versus freestanding, urban versus rural, ownership, Dartmouth Atlas of Health Care variables, and state indicators. In subsequent multiple regression analyses, the Method 2 facility-level risk-adjusted outcome value (aggregated from the stay-level observed and expected values) was used as the sole dependent variable in the analysis.

Two final models (with region) were fitted using all tested variables together, first excluding the OSCAR-reported staffing for licensed nursing and CNA. The magnitude of the coefficient of a facility type variable can be influenced by variables associated with facility type, especially staffing levels. For example, hospital-based facilities generally have significantly higher staffing levels than freestanding SNFs. If the magnitude of the coefficient of hospital-based facilities drops significantly in the second model including the staffing variables, much of the effect of hospital-based facilities can be explained by differences in staffing levels. Because RNs represent a significant portion of licensed nursing staff, the RN and licensed nursing staff variables are highly correlated (r = .80)[8-12]. Thus, we included only licensed nursing in the final model. The staffing variable model was re-examined using The Dartmouth Atlas of Health Care variables and state indicators as geographic measures.

3 Results

3.1 Change in Observed and Adjusted Facility Outcomes from 2000 to 2008

Unadjusted facility observed rates and facility-level adjusted rates for the two outcome measures from 2000 through 2008 for various facility populations are presented in Tables 2A through 2H, Table 2A also shows the national observed rates and average facility expected rates. The average rate and the difference in average rate between years are shown for each outcome.

In Table 2A, the average facility observed rates are higher than the national observed rates at each time point, suggesting that the excluded (smaller) facilities had slightly lower rates for both outcome measures. One somewhat anomalous finding emerges, insofar as the average observed rate of community discharge is lower than the expected rate for each year. The difference between the observed and expected averages may be an artifact of the averaging process, since the averages are unweighted averages of facility rates rather than true national population rates. Both observed and expected rates for community discharge rose over time, but at a different rate of growth. This is reflected in the adjusted rate, which increased by a little more than half as much as the observed rate, using adjustment Method 2. While rehospitalization rates increased over time, the average expected rate of rehospitalization increased by almost the same amount, resulting in an adjusted rate (using method 2) that showed very little change. These results are consistent with the simulated results using hypothetical scenarios, lending further support to the choice of the current method (Method 2) for adjusting facility-level rates. The original method for calculating adjusted rates results in a significant overstatement of the amount of change over time.

The comparison of adjusted rates over time for hospital-based and freestanding facilities shown in Tables 2B and 2C indicates substantial improvement among free standing facilities in community discharge rates, although Hospital-based facilities started at a much higher level on community discharge and a lower (better) level for rehospitalization. Comparing proprietary, non-profit, and government facilities, shown in Tables 2D, 2E, and 2F, the for-profit facilities show greater improvement in community discharge rates, although they started at a lower rate than non-profit and government-owned facilities. For-profit facilities also had less favorable rates of rehospitalization. Finally, Tables 2G and 2H show that urban and rural facilities had comparable rates in 2000 and both groups experienced modest improvement in community discharge rates.

3.2 Changes in case mix and facility characteristics from 2000 to 2008

A comparison of all facility-level averages for selected resident case mix variables and facility characteristics between 2000 and 2008 is shown in Table 3. In past analyses, mean case mix values were used in a facility-level regression analysis to estimate the contribution of different facility characteristics to explaining variation in outcomes. However, there are some drawbacks to using this approach. Because community discharge and facility discharge are individual events the probability of which is influenced by prior health status and other characteristics of individual SNF residents, the preferred method of adjusting for risk is to do so at the stay level. Aggregated averages of case mix factors may not be as effective at predicting a facility's outcome rate, and effects may actually be distorted by using individual level attributes aggregated to the facility level, a phenomenon known as the "ecological fallacy"[17]. For this reason, the approach adopted in this report is to use risk-adjusted outcome rates as the dependent variable in the facility-level regression analysis, therefore eliminating the stay-level resident characteristics as facility-level independent variables, since the effect of these factors has already been taken into account in calculating the adjusted rates. The only exception is length of stay of the qualifying hospitalization, which is not a predictor in the stay-level risk models. The justification for using this measure in the facility regression analysis is that it may reflect local utilization patterns as much as individual variation in patient condition.

Among the facility characteristics presented in Table 3, the average length of stay of prior qualifying hospital stay declined by almost a day from 9.3 to 8.4 days, average staffing levels dropped slightly for RNs and increased for CNAs, and there were small shifts in the geographic distribution of facilities, with the South and Midwest experiencing slight increases and the Northeast and West experiencing slight decreases. The percentage of SNFs that were hospital-based dropped from 13.3% to 6.2% and urban facilities decreased from 73.7% to 71.0%. The rural/urban indicator is constrained to be the same for each individual facility regardless of time point. Therefore, any change is due to facility attrition over time or new facilities opening between 2000 and 2008 (the percent urban for 2000 is higher than presented in the earlier report[7] due to reclassification of facilities). The percentage of SNFs that were for-profit increased modestly. The number of primary care physicians per 100,000 residents on average was 71.62 in 2006. Data in other years were not available. For percent of Medicare decedents hospitalized at least once during the last six months of life there was a slight increase from 70.57% in 2000 to 71.20% in 2005 on average. Data from 2006 - 2008 were not available.

3.3 Facility Regression Analysis: Estimating Effects of Facility & Community Characteristics on Discharge to Community and Rehospitalization within 100 Days

3.3.1 Comparison of Models for Observed Outcomes with Models for Adjusted Outcomes

The results of a multi-step regression analysis to assess the contribution of facility characteristics to prediction of outcome rates for observed and adjusted measures are presented in Tables 4A, 4B, 6A, and 6B. While the models for observed outcome rates show a higher percentage of variance explained than the adjusted rate models, the primary reason for this is that there is quite a bit of variation explained by the facility-level case mix variables in the observed rate models. For the adjusted rates models, variation explained by resident health status and other resident characteristics has already been adjusted out. In the observed rate models these measures account for 50-64% of the variation, while facility characteristics, which are introduced to the model after the resident characteristics, accounted for very little additional

variance explained, a few percent at best. In the adjusted rates models, facility characteristics account for substantially more variance than in the observed rates models. While there are some differences in the coefficients of specific independent variables, the overall pattern of facility effects is generally consistent among the two types of models.

3.3.2 Multivariable Analyses for Community Discharge

In the multiple regression models for adjusted rates (Tables 5A and 5B), which assess the adjusted effects of the predictor variables on community discharge rates, the coefficient of for-profit facilities is negative, indicating that non-profit facilities have higher rates of community discharge after adjusting for other facility and community characteristics. The difference indicated by the facility-level regression is not as large as the difference in rates shown in Tables 2D and 2E, due to the fact that for-profit status is related to other facility characteristics, such as whether a facility is hospital-based. Hospital-based facilities have a much higher rate of community discharge than free standing facilities, as indicated by the large regression coefficient shown in both tables, although the inclusion of staffing variables in the model reduces the size of the hospital-based coefficient by almost half. Urban facilities were associated with having a higher community discharge rate, by about 2% without staffing variables in the model, and 1% with staffing variables included. The use of alternative geographic variables (individual states instead of four regions) with staffing (Tables 5C and 5D) increased the explained variation by about 7%. All of the state coefficients shown in Table 5D are positive, because the state with the lowest community discharge rate (North Dakota) was chosen as the "reference" category. The state coefficients indicate that community discharge rates differ by 29% between the states with the lowest and highest rates. The coefficient of the Primary care physicians per 100,000 residents was not significant, so that variable has been omitted from the model. The coefficient for time indicates that there was a 3 percentage point rate increase from 2000 to 2008 before including the staffing variables, which dropped to 2.3 percent with staffing in the model (2.6 with all state indicators in the model).

3.3.3 Multivariable analyses for rehospitalization

In the multiple regression models for adjusted rates (Tables 7A and 7B) to assess the adjusted effects of predictor variables on rehospitalization rates, the coefficients indicate that hospital-based facilities have lower rehospitalization rates, controlling for other facility and community characteristics, compared to free standing facilities. The difference is about 5% without staffing variables in the model, and 3-4% with staffing variables included. The coefficient for the for-profit variable indicates that non-profit facilities had a lower rehospitalization rate, by about 2% in all three models. The coefficient for urban facilities is significant only in one of the three models, and the size of the coefficient indicates the difference in performance is insubstantial. The use of alternative geographic variables (state instead of four regions) (Tables 7C and 7D) increased the variation explained by the model from 16% to 20%. However, the magnitude of variation from state to state was only 5% between the state with the lowest rate (Hawaii), and the state with the highest rate (Connecticut). The coefficient of the percent of Medicare decedents hospitalized at least once during the last six months of life was significant only in the third model. The time effect was not significant, in any of the models, reflecting the fact that the risk-adjusted rehospitalization rate has been relatively constant from 2000 to 2008.

4 Discussion

The results of our trend analysis indicate that skilled nursing facilities have had very stable adjusted rehospitalization rates from 2000 through 2008, while community discharge rates have

increased over the same time period. A revised methodology for calculating adjusted rates for temporal comparisons produces a more accurate estimate of risk-adjusted changes in SNF outcome measures. Outcome differences continue to exist between hospital-based and free-standing facilities in community discharge and rehospitalization rates, although free-standing facilities have shown improvement over time in community discharge. For-profit facilities have lower rates of community discharge and higher rates for rehospitalization than non-profit and government facilities both before and after risk adjustment. Differences between rural and urban facilities are small, and both groups have shown increases in community discharge rates.

In addition to the refinement to the methodology for calculating adjusted outcome rates for comparisons across time, there are other potential modifications to the risk adjustment methodology that could be considered. While the adjusted rate calculation is consistent with the methodology used for Nursing Home Compare, there is a minor difference in the way the national rate is calculated. The Nursing Home Compare method uses a national stay level rate rather than an average of facility rate in the adjustment formula. This difference is unlikely to affect results to any significant extent, but it would be advantageous to use a consistent methodology.

The facility-level modeling approach used in this report helps to shed light on the contribution of different facility characteristics to differences in outcome rates, and helps to put in context the difference in outcomes among provider types described in the stay-level analyses. Using adjusted outcome rates in the facility-level modeling helps to clarify the distinction between person or stay-level modeling and facility-level modeling. Further refinement of this approach should be explored, including consideration of hierarchical modeling methods[18, 19].

Tables

Table 1:   Risk Adjustment Scenarios Using Alternate Methods

Scenario 1: Observed rises, Expected is steady

	2000	2008	Change
National Observed	31.0%	35.7%	4.7%
Facility Observed	31.0%	35.7%	4.7%
Facility Expected	30.8%	30.8%	0.0%
Adjusted, Method 1	31.2%	40.9%	9.7%
Adjusted, Method 2	31.2%	35.9%	4.7%

Scenario 2: Observed rises, Expected rises

	2000	2008	Change
National Observed	31.0%	35.7%	4.7%
Facility Observed	31.0%	35.7%	4.7%
Facility Expected	30.8%	33.8%	3.0%
Adjusted, Method 1	31.2%	37.6%	6.5%
Adjusted, Method 2	31.2%	32.8%	1.6%

Scenario 3: Observed rises, Expected declines

	2000	2008	Change
National Observed	31.0%	35.7%	4.7%
Facility Observed	31.0%	35.7%	4.7%
Facility Expected	30.8%	27.8%	-3.0%
Adjusted, Method 1	31.2%	44.4%	13.3%
Adjusted, Method 2	31.2%	39.3%	8.1%

Scenario 4: Observed rises, Expected rises more

	2000	2008	Change
National Observed	31.0%	33.0%	2.0%
Facility Observed	31.0%	33.0%	2.0%
Facility Expected	30.8%	34.8%	4.0%
Adjusted, Method 1	31.2%	31.2%	0.0%
Adjusted, Method 2	31.2%	29.3%	-1.9%

Scenario 5: National is steady

	2000	2008	Change
National Observed	31.0%	31.0%	0.0%
Facility Observed	31.0%	31.0%	0.0%
Facility Expected	30.8%	27.8%	-3.0%
Adjusted, Method 1	31.2%	34.4%	3.2%
Adjusted, Method 2	31.2%	34.4%	3.2%

Table 2A: Change in facility rates of outcome measures at 100 days for 2000-2008, All Skilled Nursing Facilities

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Change
Nat'l Avg Observed Rates[1]										
Community Discharge	29.08%	28.76%	29.08%	29.23%	29.79%	30.39%	31.11%	32.49%	33.27%	
Change from prior year		-0.32	0.31	0.16	0.55	0.60	0.73	1.37	0.78	4.19
Rehospitalized (Any Five)	14.23%	15.28%	15.93%	16.82%	17.09%	17.57%	17.82%	17.90%	18.08%	
Change from prior year		1.05	0.65	0.89	0.26	0.48	0.25	0.08	0.18	3.85
Avg Facility Observed Rates										
Community Discharge	31.14%	30.51%	30.43%	30.44%	30.95%	31.43%	32.19%	33.66%	34.39%	
Change from prior year		-0.64	-0.08	0.01	0.51	0.48	0.76	1.47	0.73	3.24
Rehospitalized (Any Five)	14.73%	15.82%	16.43%	17.26%	17.54%	18.04%	18.34%	18.39%	18.57%	
Change from prior year		1.09	0.61	0.83	0.28	0.49	0.30	0.05	0.18	3.84
Average Expected Rates										
Community Discharge	36.20%	35.29%	34.77%	34.74%	35.25%	35.80%	35.97%	37.07%	37.93%	
Change from prior year		-0.91	-0.52	-0.03	0.51	0.55	0.17	1.10	0.86	1.73
Rehospitalized (Any Five)	14.65%	15.62%	16.30%	17.11%	17.40%	17.94%	18.28%	18.38%	18.44%	
Change from prior year		0.98	0.68	0.81	0.29	0.54	0.33	0.11	0.05	3.79
Average Adjusted Rates										
Community Discharge										
Adjusted, Method 1	24.19%	24.07%	24.70%	24.88%	25.49%	25.99%	27.23%	28.90%	29.58%	
Change from prior year		-0.12	0.63	0.18	0.61	0.50	1.24	1.67	0.68	5.39
Adjusted, Method 2	24.19%	24.32%	24.70%	24.76%	24.92%	24.92%	25.53%	26.00%	26.00%	
Change from prior year		0.13	0.38	0.06	0.16	0.00	0.61	0.47	0.00	1.81
Rehospitalized (Any Five)										
Adjusted, Method 1	14.03%	15.19%	15.79%	16.72%	16.98%	17.42%	17.64%	17.70%	18.03%	
Change from prior year		1.15	0.60	0.93	0.26	0.45	0.22	0.05	0.34	4.00
Adjusted, Method 2	14.03%	14.17%	14.15%	14.21%	14.21%	14.19%	14.17%	14.15%	14.28%	
Change from prior year		0.14	-0.02	0.06	0.00	-0.02	-0.02	-0.02	0.13	0.24

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[1] Includes all facilities with no screening for facilities with fewer than 25 contributing stays. All other rates presented include only facilities with at least 25 contributing stays on a measure-specific basis.

Table 2B: Trends in facility rates of outcome measures at 100 days for 2000-2008, Hospital-Based Skilled Nursing Facilities

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Change
Observed Rates										
Community Discharge	60.84%	59.43%	59.16%	58.56%	57.56%	57.20%	58.05%	58.55%	58.69%	
Change from prior year		-1.41	-0.27	-0.60	-1.01	-0.36	0.86	0.50	0.14	-2.15
Rehospitalized (Any Five)	7.51%	8.03%	8.51%	8.88%	9.15%	9.44%	9.57%	9.75%	9.60%	
Change from prior year		0.51	0.48	0.37	0.26	0.29	0.13	0.18	-0.15	2.09
Adjusted Rates										
Community Discharge										
Adjusted, Method 2	42.35%	41.76%	42.02%	41.92%	41.24%	40.72%	41.60%	41.65%	41.59%	
Change from prior year		-0.59	0.25	-0.10	-0.67	-0.52	0.88	0.05	-0.07	-0.77
Rehospitalized (Any Five)										
Adjusted, Method 2	8.54%	8.48%	8.59%	8.40%	8.38%	8.33%	8.34%	8.39%	8.26%	
Change from prior year		-0.07	0.11	-0.18	-0.02	-0.05	0.01	0.05	-0.12	-0.28

Note: All rates presented are restricted to facilities with at least 25 contributing stays on a measure-specific basis.

Table 2C: Change in facility rates of outcome measures at 100 days for 2000-2008, Free Standing Skilled Nursing Facilities

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Change
Observed Rates										
Community Discharge	26.58%	26.51%	26.99%	27.51%	28.43%	29.25%	30.12%	31.84%	32.77%	
Change from prior year		-0.07	0.47	0.53	0.92	0.82	0.87	1.72	0.94	6.19
Rehospitalized (Any Five)	15.84%	16.90%	17.38%	18.13%	18.34%	18.77%	19.04%	19.02%	19.17%	
Change from prior year		1.06	0.48	0.76	0.21	0.43	0.27	-0.01	0.15	3.33
Adjusted Rates										
Community Discharge										
Adjusted, Method 2	21.39%	21.91%	22.62%	22.97%	23.37%	23.58%	24.24%	24.85%	24.96%	
Change from prior year		0.52	0.71	0.35	0.40	0.21	0.66	0.61	0.11	3.57
Rehospitalized (Any Five)										
Adjusted, Method 2	14.88%	14.96%	14.82%	14.81%	14.76%	14.69%	14.63%	14.57%	14.68%	
Change from prior year		0.08	-0.14	0.00	-0.05	-0.07	-0.05	-0.07	0.11	-0.20

Note: All rates presented are restricted to facilities with at least 25 contributing stays on a measure-specific basis.

Table 2D: Change in facility rates of outcome measures at 100 days for 2000-2008, For-Profit Ownership Skilled Nursing Facilities

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Change
Observed Rates										
Community Discharge	27.26%	26.90%	27.07%	27.33%	28.13%	28.81%	29.59%	31.24%	32.10%	
Change from prior year		-0.36	0.17	0.26	0.79	0.68	0.78	1.65	0.86	4.84
Rehospitalized (Any Five)	16.46%	17.59%	18.17%	18.99%	19.25%	19.74%	20.07%	20.09%	20.17%	
Change from prior year		1.13	0.58	0.82	0.26	0.49	0.34	0.02	0.08	3.71
Adjusted Rates										
Community Discharge										
Adjusted, Method 2	21.86%	22.18%	22.69%	22.85%	23.20%	23.33%	23.86%	24.45%	24.45%	
Change from prior year		0.32	0.50	0.16	0.35	0.13	0.53	0.59	0.00	2.58
Rehospitalized (Any Five)										
Adjusted, Method 2	15.21%	15.31%	15.25%	15.26%	15.23%	15.20%	15.17%	15.13%	15.22%	
Change from prior year		0.10	-0.06	0.01	-0.02	-0.04	-0.02	-0.04	0.09	0.01

Note: All rates presented are restricted to facilities with at least 25 contributing stays on a measure-specific basis.

Table 2E: Change in facility rates of outcome measures at 100 days for 2000-2008, Non-Profit Ownership Skilled Nursing Facilities

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Change
Observed Rates										
Community Discharge	39.90%	38.64%	38.08%	37.71%	37.70%	37.85%	38.81%	40.15%	40.90%	
Change from prior year		-1.26	-0.56	-0.38	0.00	0.15	0.96	1.34	0.75	1.00
Rehospitalized (Any Five)	11.24%	12.25%	12.87%	13.63%	13.97%	14.48%	14.60%	14.58%	14.77%	
Change from prior year		1.01	0.62	0.76	0.34	0.51	0.12	-0.02	0.19	3.54
Adjusted Rates										
Community Discharge										
Adjusted, Method 2	29.30%	28.99%	29.19%	29.11%	28.88%	28.63%	29.61%	29.94%	30.25%	
Change from prior year		-0.31	0.20	-0.08	-0.23	-0.25	0.99	0.33	0.31	0.95
Rehospitalized (Any Five)										
Adjusted, Method 2	11.74%	12.00%	12.01%	12.09%	12.13%	12.16%	12.07%	12.01%	12.09%	
Change from prior year		0.27	0.00	0.08	0.05	0.03	-0.10	-0.06	0.08	0.36

Note: All rates presented are restricted to facilities with at least 25 contributing stays on a measure-specific basis.

Table 2F: Change in facility rates of outcome measures at 100 days for 2000-2008, Government Ownership Skilled Nursing Facilities

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Change
Observed Rates										
Community Discharge	33.49%	33.42%	33.80%	33.32%	32.68%	32.43%	31.96%	32.74%	32.32%	
Change from prior year		-0.07	0.38	-0.48	-0.64	-0.25	-0.47	0.79	-0.42	-1.17
Rehospitalized (Any Five)	11.19%	11.81%	12.07%	13.07%	13.20%	13.61%	14.05%	14.27%	14.86%	
Change from prior year		0.62	0.25	1.01	0.13	0.41	0.45	0.22	0.59	3.67
Adjusted Rates										
Community Discharge										
Adjusted, Method 2	26.39%	26.99%	27.36%	27.18%	26.81%	26.63%	26.31%	26.79%	25.89%	
Change from prior year		0.60	0.37	-0.18	-0.37	-0.18	-0.32	0.48	-0.90	-0.50
Rehospitalized (Any Five)										
Adjusted, Method 2	11.15%	10.91%	10.81%	11.19%	11.13%	11.09%	11.30%	11.34%	11.76%	
Change from prior year		-0.24	-0.09	0.38	-0.06	-0.03	0.20	0.05	0.41	0.61

Note: All rates presented are restricted to facilities with at least 25 contributing stays on a measure-specific basis.

Table 2G: Change in facility rates of outcome measures at 100 days for 2000-2008, Urban Skilled Nursing Facilities

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Change
Observed Rates										
Community Discharge	31.73%	31.18%	31.24%	31.26%	31.85%	32.48%	33.18%	34.54%	35.32%	
Change from prior year		-0.55	0.05	0.03	0.59	0.62	0.70	1.36	0.78	3.58
Rehospitalized (Any Five)	15.14%	16.33%	16.88%	17.86%	18.11%	18.70%	18.99%	19.09%	19.20%	
Change from prior year		1.18	0.56	0.97	0.25	0.59	0.29	0.11	0.10	4.05
Adjusted Rates										
Community Discharge										
Adjusted, Method 2	24.46%	24.65%	25.11%	25.18%	25.37%	25.40%	25.96%	26.35%	26.38%	
Change from prior year		0.20	0.46	0.07	0.19	0.04	0.56	0.39	0.03	1.93
Rehospitalized (Any Five)										
Adjusted, Method 2	14.15%	14.35%	14.27%	14.41%	14.39%	14.43%	14.35%	14.36%	14.42%	
Change from prior year		0.19	-0.08	0.14	-0.02	0.04	-0.08	0.01	0.06	0.26

Note: All rates presented are restricted to facilities with at least 25 contributing stays on a measure-specific basis.

Table 2H: Change in facility rates of outcome measures at 100 days for 2000-2008, Rural Skilled Nursing Facilities

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Change
Observed Rates										
Community Discharge	29.40%	28.62%	28.22%	28.25%	28.53%	28.70%	29.31%	30.73%	31.27%	
Change from prior year		-0.78	-0.40	0.03	0.28	0.17	0.61	1.42	0.54	1.87
Rehospitalized (Any Five)	13.64%	14.50%	15.26%	15.77%	16.12%	16.43%	16.80%	16.78%	17.19%	
Change from prior year		0.86	0.77	0.50	0.36	0.31	0.37	-0.02	0.41	3.55
Adjusted Rates										
Community Discharge										
Adjusted, Method 2	23.39%	23.41%	23.57%	23.63%	23.69%	23.63%	24.26%	24.84%	24.77%	
Change from prior year		0.02	0.16	0.07	0.06	-0.06	0.64	0.58	-0.07	1.38
Rehospitalized (Any Five)										
Adjusted, Method 2	13.70%	13.69%	13.83%	13.69%	13.74%	13.59%	13.72%	13.66%	13.95%	
Change from prior year		-0.01	0.14	-0.14	0.05	-0.15	0.13	-0.06	0.29	0.24

Table 3: Comparison of Mean Facility Case Mix and Facility Characteristics, 2000 to 2008

	Used in Obs Rate Regression[8]	Used in Adj Rate Regression[9]	2000 Mean[1]	2000 StdDev	2008 Mean[2]	2008 StdDev
Case mix indicators[3]						
Age (years)	Y	N	80.53	3.2	79.45	4.4
Female	Y	N	66.11%	9.6	63.47%	10.5
Married	Y	N	25.47%	8.9	27.43%	9.0
Do Not Resuscitate orders	Y	N	39.80%	22.7	40.38%	21.3
Do Not Hospitalize orders	Y	N	2.14%	6.3	1.86%	4.8
Barthel Index (0 to 90)[4]	Y	N	35.59	9.3	34.06	8.3
Cognitive Performance Scale (0 to 6)[5]	Y	N	2.11	0.7	1.90	0.7
Bowel incontinence Scale (1 to 4)[5]	Y	N	1.44	0.7	1.36	0.6
Indwelling catheter	Y	N	23.39%	11.4	21.78%	11.9
Feeding tube	Y	N	10.00%	8.9	6.28%	6.6
Parenteral/IV feeding	Y	N	7.44%	12.9	13.14%	16.9
Pressure ulcer	Y	N	24.47%	11.5	21.55%	10.9
Rehabilitation						
Rehabilitation RUG – Ultra High	Y	N	3.12%	7.7	18.95%	20.3
Rehabilitation RUG – Very High	Y	N	12.03%	14.3	19.69%	14.0
Rehabilitation RUG – High	Y	N	40.96%	19.0	12.57%	11.5
Rehabilitation RUG – Medium	Y	N	18.23%	13.8	35.18%	17.7
Rehabilitation RUG – Low	Y	N	0.30%	1.5	0.09%	0.7
Community Discharge Comorbidity Index (-1.28 to -0.02 for all years)	Y	N	-0.45	0.1	-0.43	0.1
Rehospitalization Comorbidity Index (-2.26 to -1.10 for all years)	Y	N	-1.87	0.1	-1.50	0.1
Hospital Stay ICD-9 Based Disease Conditions						
Cardiac arrhythmia	Y	N	26.25%	7.4	24.55%	7.3
COPD	Y	N	22.74%	7.6	19.44%	6.6
Dementia	Y	N	24.14%	11.1	25.11%	10.6
Fluid/Electrolyte disorder	Y	N	30.33%	8.8	31.48%	7.6
Fracture	Y	N	15.76%	7.1	13.49%	6.3
Genitourinary condition	Y	N	33.57%	8.2	48.31%	9.1
Uncomplicated hypertension	Y	N	37.08%	8.5	40.36%	8.6
Musculoskeletal disease	Y	N	27.34%	9.3	30.45%	9.5
Nervous system disorder	Y	N	25.22%	7.7	31.99%	8.0
Respiratory disease	Y	N	26.36%	7.6	30.69%	7.8
Skin disorder	Y	N	12.60%	6.3	14.47%	6.3
Valvular disease	Y	N	7.80%	4.9	5.56%	3.6
MDS Based Disease Conditions						
Depression (MDS)	Y	N	27.14%	11.7	38.45%	12.9
Schizophrenia (MDS)	Y	N	1.93%	4.0	3.03%	6.1
Congestive Heart Failure (CHF) (MDS)	Y	N	29.54%	9.8	28.69%	9.5
LOS of Covered Qualifying Hospitalization (days)	N	Y	9.28	2.8	8.36	2.3

Table 3: Comparison of Mean Facility Case Mix and Facility Characteristics, 2000 to 2008 (cont'd)

	Used in Obs Rate Regression[8]	Used in Adj Rate Regression[9]	2000 Mean[1]	2000 StdDev	2008 Mean[2]	2008 StdDev
Staffing levels						
RN hours/resident-day	Y	Y	0.59	0.8	0.45	0.6
Licensed nursing hours/resident-day	Y	Y	1.75	1.2	1.74	0.9
CNA hours/resident-day	Y	Y	2.30	0.8	2.54	0.8
Dartmouth Atlas of Health Care						
# of Primary Care Physicians per 100,000 Residents	Y	Y	N/A	-	71.62[6]	18.8
% of Decedents Hospitalized in Last 6 Months of Life	Y	Y	70.57%	4.3	71.20%[7]	4.2
Geographic Region						
Northeast	Y	Y	20.74%	-	18.59%	-
Midwest	Y	Y	30.65%	-	32.14%	-
South	Y	Y	33.17%	-	34.99%	-
West	Y	Y	15.44%	-	14.28%	-
Facility characteristics						
Hospital-based	Y	Y	13.33%	-	6.23%	-
Freestanding	Y	Y	86.67%	-	93.77%	-
Urban	Y	Y	73.74%	-	70.98%	-
Rural	Y	Y	26.26%	-	29.02%	-
For-profit	Y	Y	67.00%	-	69.54%	-
Non-profit	Y	Y	28.39%	-	25.87%	-
Government	Y	Y	4.61%	-	4.00%	-

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[1] Sample (n=12,200) for 2000 is facilities with non-missing data in 2000 for rehospitalization in 100 days and community discharge in 100 days with 25 or more SNF stays

[2] Sample (n=13,596) for 2008 is facilities with non-missing data in 2008 for rehospitalization in 100 days and community discharge in 100 days with 25 or more SNF stays

[3] Values are interpreted as "Mean % of residents in the facility with this condition," or as "Mean average resident value in the facility for this item"

[4] Higher values indicate better functional status.

[5] Lower values indicate better functional status.

[6] Data for 2006 used due to 2008 data not available.

[7] Data for 2005 used due to 2008 data not available.

[8] Used in regression model for observed rates.

[9] Used in regression model for adjusted rates.

Table 4A: Community Discharge within 100 Days Regression Model (Observed Rates Models)

Step	Variables in model	Model adj R^2	Coefficient of tested variable	Coefficient of time	Coefficient of 2000 only	Coefficient of 2008 only
1	Time	.0064	-	.03242	-	-
2	Time, presence at 2000 only and 2008 only indicators	.0457	-	.06576	.15562	-.05759
3	Time, presence at 2000 only and 2008 only indicators, case mix	.6462	-	.03844	.04908	-.03170
4	Step 3 and hospital LOS	.6467	-.00212	.03648	.04835	-.03168
5	Step 3 and region (Northeast, Midwest, South)	.6520	-.02462 NE -.05338 MW -.03272 S	.03496	.04915	-.03050
6	Step 3 and hospital-based	.6643	.11798	.03070	.01551	-.03068
7	Step 3 and ownership (for-profit, government)	.6473	-.01527 profit -.01203 gov	.03697	.04681	-.03175
8	Step 3 and urban	.6486	.03217	.04395	.04857	-.03106
9	Step 3 and RN hours/resident-day	.6539	.04467	.03584	.01901	-.02918
10	Step 3 and licensed nursing hours/resident-day	.6576	.03177	.03055	.01357	-.03191
11	Step 3 and CNA hours/resident-day	.6419	.01348	.03335	.04391	-.03211
12	Step 3 and RN hours/resident-day, licensed nursing hours/resident-day, CNA hours/resident-day	.6592	.01591 RN .02298 lic nsg .00733 CNA	.02993	.01201	-.03126
13	Step 3 and primary care physicians per 100,000 residents	.6308	.00126	.03866	.02091	-.02946
14	Step 3 and state indicators	.6790	Largest effect: .24971 MT (W) vs. ND (MW)	.04595	.05155	-.02102

Table 4B: Community Discharge within 100 Days Regression Model (Adjusted Rates Models)

Step	Variables in model	Model adj R^2	Coefficient of tested variable	Coefficient of time	Coefficient of 2000 only	Coefficient of 2008 only
1	Time	.0041	-	.01811	-	-
2	Time, presence at 2000 only and 2008 only indicators	.0347	-	.03903	.09197	-.03951
3	Step 2 and hospital LOS	.0778	-.01138	.02871	.08723	-.04327
4	Step 2 and region (Northeast, Midwest, South)	.0576	-.04489 NE -.04810 MW -.06555 S	.03905	.09002	-.03659
5	Step 2 and hospital-based	.1737	.19118	.04020	.00640	-.03461
6	Step 2 and ownership (for-profit, government)	.0716	-.06108 profit -.03522 gov	.03914	.07849	-.04189
7	Step 2 and urban	.0379	.01096	.03903	.09195	-.04477
8	Step 2 and RN hours/resident-day	.1673	.08143	.04120	.00494	-.03040
9	Step 2 and licensed nursing hours/resident-day	.1683	.05216	.03036	.00068	-.03394
10	Step 2 and CNA hours/resident-day	.0455	.02338	.03403	.07477	-.03965
11	Step 2 and RN hours/resident-day, licensed nursing hours/resident-day, CNA hours/resident-day	.1853	.04391 RN .02770 lic nsg .01081 CNA	.03279	-.00383	-.03190
12	Step 2 and primary care physicians per 100,000 residents	.0379	.00152	.03901	.03987	-.04024
13	Step 2 and state indicators	.1341	Largest effect: .31804 MT (W) vs. LA (S)	.03905	.09422	-.02568

Table 5A: Community discharge within 100 days final regression model without staffing variables (adjusted rates models)

Variable	Coefficient	p-value
Intercept	0.35139	<0.0001
Time	0.03052	<0.0001
2000 only indicator	0.00432	0.2183
2008 only indicator	-0.03852	<0.0001
LOS of covered qualifying hospitalization (days)	-0.01054	<0.0001
Northeast	-0.02848	<0.0001
Midwest	-0.04645	<0.0001
South	-0.05142	<0.0001
Hospital-based	0.17606	<0.0001
For-profit	-0.01933	<0.0001
Government	-0.04230	<0.0001
Urban	0.02192	<0.0001

Adjusted R^2 = 0.2356

Table 5B: Community discharge within 100 days final regression model with staffing variables (adjusted rates models)

Variable	Coefficient	p-value
Intercept	0.28373	<0.0001
Time	0.02289	<0.0001
2000 only indicator	-0.01516	<0.0001
2008 only indicator	-0.03603	<0.0001
LOS of covered qualifying hospitalization (days)	-0.01010	<0.0001
Northeast	-0.02863	<0.0001
Midwest	-0.04439	<0.0001
South	-0.05454	<0.0001
Hospital-based	0.09783	<0.0001
For-profit	-0.01275	<0.0001
Government	-0.03571	<0.0001
Urban	0.01333	<0.0001
Licensed nursing hours/resident-day	0.03155	<0.0001
CNA hours/resident-day	0.00889	<0.0001

Adjusted R^2 = 0.2509

Table 5C: Community discharge within 100 days final regression model with staffing plus alternative geographic variables (adjusted rates models)

<u>Variable</u>	<u>Coefficient</u>	<u>p-value</u>
Intercept	0.14979	<0.0001
Time	0.02606	<0.0001
2000 only indicator	-0.01282	0.0005
2008 only indicator	-0.02616	<0.0001
LOS of covered qualifying hospitalization (days)	-0.00870	<0.0001
States (see Table 5D)		
Hospital-based	0.10196	<0.0001
For-profit	-0.01407	<0.0001
Government	-0.03965	<0.0001
Urban	0.01251	<0.0001
Licensed nursing hours/resident-day	0.03142	<0.0001
CNA hours/resident-day	0.00338	0.0014

Adjusted R^2 = 0.3205

Table 5D: Community discharge within 100 days final regression model with staffing plus alternative geographic variables (adjusted rates models) – state variation

State (North Dakota as reference)	Coefficient	p-value
Louisiana	0.00490	0.7085
Mississippi	0.02755	0.0439
Illinois	0.04354	0.0003
Texas	0.04461	0.0002
Oklahoma	0.04851	0.0003
Kentucky	0.05259	<0.0001
Georgia	0.05753	<0.0001
Arkansas	0.06159	<0.0001
Kansas	0.06323	<0.0001
Indiana	0.06812	<0.0001
Nebraska	0.06907	<0.0001
Missouri	0.07023	<0.0001
Rhode Island	0.07294	<0.0001
Pennsylvania	0.07637	<0.0001
Alabama	0.08218	<0.0001
New Jersey	0.08657	<0.0001
Iowa	0.08685	<0.0001
North Carolina	0.08950	<0.0001
Florida	0.09424	<0.0001
California	0.09488	<0.0001
Michigan	0.10344	<0.0001
Minnesota	0.10546	<0.0001
New York	0.10594	<0.0001
South Dakota	0.10644	<0.0001
Delaware	0.10664	<0.0001
West Virginia	0.10777	<0.0001
District of Columbia	0.10817	<0.0001
Wisconsin	0.11326	<0.0001
Tennessee	0.11538	<0.0001
Massachusetts	0.11921	<0.0001
Colorado	0.12594	<0.0001
Maryland	0.12709	<0.0001
Wyoming	0.12729	<0.0001
Nevada	0.13125	<0.0001
Ohio	0.13775	<0.0001
Virginia	0.13817	<0.0001
Connecticut	0.13862	<0.0001
New Mexico	0.13941	<0.0001
Idaho	0.14550	<0.0001
New Hampshire	0.15340	<0.0001
Arizona	0.16807	<0.0001
South Carolina	0.16894	<0.0001
Washington	0.16940	<0.0001
Vermont	0.17955	<0.0001
Maine	0.19420	<0.0001
Utah	0.19522	<0.0001
Alaska	0.19701	<0.0001
Hawaii	0.21725	<0.0001
Oregon	0.23771	<0.0001
Montana	0.28502	<0.0001

Table 6A: Rehospitalization within 100 days regression model series (observed rates models)

Step	Variables in model	Model adj R^2	Coefficient of tested variable	Coefficient of time	Coefficient of 2000 only	Coefficient of 2008 only
1	Time	.0563	-	.03840	-	-
2	Time, presence at 2000 only and 2008 only indicators	.0702	-	.03465	-.03967	-.00699
3	Time, presence at 2000 only and 2008 only indicators, case mix	.5075	-	-.02844	-.02112	.00414
4	Step 3 and hospital LOS	.5076	.00047	-.02793	-.02096	.00415
5	Step 3 and region (Northeast, Midwest, South)	.5147	.02217 NE .02193 MW .01765 S	-.02483	-.02046	.00433
6	Step 3 and hospital-based	.5289	-.05016	-.02441	-.00609	.00320
7	Step 3 and ownership (for-profit, government)	.5189	.01837 profit -.00971 gov	-.02384	-.01739	.00454
8	Step 3 and urban	.5084	-.00431	-.02833	-.02108	.00349
9	Step 3 and RN hours/resident-day	.5126	-.01526	-.02602	-.01010	.00286
10	Step 3 and licensed nursing hours/resident-day	.5127	-.00966	-.02555	-.00928	.00371
11	Step 3 and CNA hours/resident-day	.5034	-.00409	-.02615	-.01898	.00406
12	Step 3 and RN hours/resident-day, licensed nursing hours/resident-day, CNA hours/resident-day	.5144	-.00850 RN -.00524 lic nsg -.00216 CNA	-.02473	-.00842	.00332
13	Step 3 and decedents hospitalized in last 6 months of life	.5145	.00177	-.02946	-.02151	.00268
14	Step 3 and state indicators	.5300	Largest effect: .07343 CT (NE) vs. HI (S)	-.02654	-.01969	.00443

Table 6B: Rehospitalization within 100 days regression model series (adjusted rates models)

Step	Variables in model	Model adj R^2	Coefficient of tested variable	Coefficient of time	Coefficient of 2000 only	Coefficient of 2008 only
1	Time	.0004	-	.00242	-	-
2	Time, presence at 2000 only and 2008 only indicators	.0187	-	-.00248	-.03242	.00258
3	Step 2 and hospital LOS	.0496	.00388	.00104	-.03083	.00385
4	Step 2 and region (Northeast, Midwest, South)	.0386	.02053 NE .01789 MW .02449 S	-.00249	-.03152	.00196
5	Step 2 and hospital-based	.1097	-.06222	-.00286	-.00491	.00099
6	Step 2 and ownership (for-profit, government)	.0866	.03113 profit -.00488 gov	-.00262	-.02462	.00410
7	Step 2 and urban	.0202	.00475	-.00248	-.03243	.00337
8	Step 2 and RN hours/resident-day	.0753	-.02232	-.00309	-.00883	-.00052
9	Step 2 and licensed nursing hours/resident-day	.0670	-.01328	-.00030	-.00914	.00055
10	Step 2 and CNA hours/resident-day	.0220	-.00728	-.00090	-.02756	.00203
11	Step 2 and RN hours/resident-day, licensed nursing hours/resident-day, CNA hours/resident-day	.0808	-.01589 RN -.00441 lic nsg -.00411 CNA	-.00113	-.00753	-.00018
12	Step 2 and decedents hospitalized in last 6 months of life	.0597	.00271	-.00423	-.03230	.00271
13	Step 2 and state indicators	.0796	Largest effect: .07159 OK (S) vs. HI (S)	-.00249	-.03197	.00160

Table 7A: Rehospitalization within 100 days final regression model without staffing variables (adjusted rates models)

Variable	Coefficient	p-value
Intercept	0.08905	<0.0001
Time	-0.00026	0.7115
2000 only indicator	-0.00438	0.0027
2008 only indicator	0.00253	0.0177
LOS of covered qualifying hospitalization (days)	0.00286	<0.0001
Northeast	0.01908	<0.0001
Midwest	0.02162	<0.0001
South	0.02162	<0.0001
Hospital-based	-0.04699	<0.0001
For-profit	0.02076	<0.0001
Government	-0.00165	0.3212

Adjusted R^2 = 0.1725

Table 7B: Rehospitalization within 100 days final regression model with staffing variables (adjusted rates models)

Variable	Coefficient	p-value
Intercept	0.1008	<0.0001
Time	0.00091	0.2281
2000 only indicator	-0.00134	0.4169
2008 only indicator	0.00216	0.0544
LOS of covered qualifying hospitalization (days)	0.00279	<0.0001
Northeast	0.01746	<0.0001
Midwest	0.02052	<0.0001
South	0.02160	<0.0001
Hospital-based	-0.03379	<0.0001
For-profit	0.01969	<0.0001
Government	-0.00333	0.0610
Urban	0.00293	0.0002
Licensed nursing hours/resident-day	-0.00497	<0.0001
CNA hours/resident-day	-0.00189	<0.0001

Adjusted R^2 = 0.1607

Table 7C: Rehospitalization within 100 days final regression model with staffing plus alternative geographic variables (adjusted rates models)

Variable	Coefficient	p-value
Intercept	-0.03349	0.0026
Time	-0.00099	0.1843
2000 only indicator	-0.00132	0.4128
2008 only indicator	0.00235	0.0401
LOS of covered qualifying hospitalization (days)	0.00223	<0.0001
States (see Table 7D)		
Hospital-based	-0.03551	<0.0001
For-profit	0.01762	<0.0001
Government	-0.00379	0.0306
Licensed nursing hours/resident-day	-0.00521	<0.0001
CNA hours/resident-day	-0.00112	0.0165
Decedents hospitalized in last 6 months of life	0.00182	<0.0001

Adjusted R^2 = 0.2009

Table 7D: Rehospitalization within 100 days final regression model with staffing plus alternative geographic variables (adjusted rates models) – state variation

State (Hawaii as reference)	Coefficient	p-value
Iowa	0.01217	0.1418
Utah	0.01347	0.1421
North Dakota	0.01568	0.0974
Alabama	0.01589	0.0598
Washington	0.01590	0.0560
Maine	0.01706	0.0531
Arkansas	0.01717	0.0432
Nevada	0.01723	0.0871
Oregon	0.01863	0.0328
New Mexico	0.01872	0.0464
California	0.01912	0.0177
South Dakota	0.02058	0.0244
Vermont	0.02106	0.0415
Montana	0.02163	0.0210
Pennsylvania	0.02166	0.0076
South Carolina	0.02255	0.0079
Delaware	0.02382	0.0191
New Jersey	0.02560	0.0020
Nebraska	0.02647	0.0021
Colorado	0.02703	0.0015
Kansas	0.02728	0.0012
Florida	0.02742	0.0008
Georgia	0.02747	0.0009
Idaho	0.02887	0.0020
Louisiana	0.02897	0.0006
Ohio	0.02905	0.0003
District of Columbia	0.02989	0.0164
Wisconsin	0.03090	0.0002
Massachusetts	0.03135	0.0001
Virginia	0.03244	<0.0001
Texas	0.03298	<0.0001
West Virginia	0.03381	0.0001
North Carolina	0.03396	<0.0001
Arizona	0.03506	<0.0001
New York	0.03539	<0.0001
Indiana	0.03578	<0.0001
Missouri	0.03591	<0.0001
New Hampshire	0.03671	<0.0001
Kentucky	0.03673	<0.0001
Maryland	0.03821	<0.0001
Alaska	0.03940	0.0417
Minnesota	0.03941	<0.0001
Tennessee	0.03943	<0.0001
Wyoming	0.04003	0.0002
Rhode Island	0.04067	<0.0001
Michigan	0.04582	<0.0001
Oklahoma	0.04722	<0.0001
Mississippi	0.04738	<0.0001
Illinois	0.05232	<0.0001
Connecticut	0.05391	<0.0001

Table 8A: Coefficient Estimates for Community Discharge Resident Level Comorbidity Index

	2000	2001	2002	2003	2004	2005	2006	2007	2008
00 Intercept	0.001*	-0.026	-0.049	-0.056	-0.038	-0.004*	0.021	0.069	0.075
01 Myocardial Infarction	0.109	0.070	0.070	0.062	0.053	0.040	0.043	0.039	-0.003*
02 Congestive Heart Failure	-0.345	-0.358	-0.362	-0.371	-0.388	-0.416	-0.400	-0.409	-0.390
03 Peripheral Vascular Disease	-0.140	-0.152	-0.159	-0.173	-0.173	-0.172	-0.178	-0.180	-0.182
04 Cerebrovascular Disease	-0.376	-0.372	-0.358	-0.349	-0.345	-0.363	-0.345	-0.343	-0.355
05 Dementia	-1.251	-1.248	-1.246	-1.230	-1.197	-1.188	-1.176	-1.156	-1.098
06 Chronic Pulmonary Disease	-0.040	-0.069	-0.072	-0.088	-0.104	-0.116	-0.124	-0.138	-0.128
07 Rheumatologic Disease	0.185	0.181	0.175	0.150	0.154	0.157	0.143	0.178	0.179
08 Peptic Ulcer Disease	-0.196	-0.211	-0.223	-0.195	-0.181	-0.200	-0.194	-0.182	-0.185
09 Mild Liver Disease	-0.072	-0.071	-0.071	-0.073	-0.091	-0.117	-0.128	-0.157	-0.117
10 Diabetes, Mild to Moderate	-0.098	-0.114	-0.124	-0.143	-0.144	-0.129	-0.129	-0.125	-0.116
11 Hemiplegia or Paraplegia	-0.393	-0.430	-0.431	-0.466	-0.505	-0.540	-0.566	-0.591	-0.606
12 Renal Disease	-0.407	-0.416	-0.423	-0.421	-0.433	-0.414	-0.371	-0.369	-0.369
13 Diabetes w/ Chronic Comp.	-0.049	-0.086	-0.099	-0.105	-0.118	-0.138	-0.144	-0.137	-0.152
14 Any Malignancy (Lymp/ Leuk)	0.002*	-0.015	-0.016	-0.015	-0.037	-0.026	-0.046	-0.060	-0.083
15 Moderate/Severe Liver Disease	-0.361	-0.355	-0.368	-0.392	-0.423	-0.450	-0.424	-0.414	-0.442
16 Metastatic Solid Tumor	-0.151	-0.167	-0.184	-0.242	-0.261	-0.295	-0.310	-0.350	-0.350
17 HIV/AIDS	-0.298	-0.474	-0.463	-0.504	-0.488	-0.470	-0.648	-0.538	-0.679
Logistic Model c-index	*0.62*	*0.62*	*0.62*	*0.62*	*0.62*	*0.63*	*0.63*	*0.63*	*0.62*

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Note: These models were based on all SNF stays for each year 2000 to 2008.

* Coefficients with probabilities greater than .05 excluded that coefficient from the comorbidity construct.

Table 8B: Coefficient Estimates for Rehospitalization Resident Level Comorbidity Index

Comorbidity	2000	2001	2002	2003	2004	2005	2006	2007	2008
00 Intercept	-2.310	-2.202	-2.124	-2.057	-2.028	-1.990	-1.970	-1.941	-1.869
01 Myocardial Infarction	0.102	0.112	0.108	0.110	0.114	0.111	0.108	0.113	0.139
02 Congestive Heart Failure	0.611	0.604	0.595	0.604	0.615	0.614	0.597	0.599	0.585
03 Peripheral Vascular Disease	0.154	0.155	0.152	0.155	0.169	0.134	0.137	0.133	0.137
04 Cerebrovascular Disease	0.148	0.145	0.123	0.117	0.106	0.123	0.104	0.110	0.113
05 Dementia	0.154	0.125	0.105	0.064	0.013	0.003*	-0.017	-0.030	-0.046
06 Chronic Pulmonary Disease	0.222	0.224	0.219	0.218	0.217	0.225	0.214	0.205	0.178
07 Rheumatologic Disease	-0.001*	-0.007*	0.011*	0.013*	0.016*	0.018*	0.015*	-0.008*	-0.028
08 Peptic Ulcer Disease	0.170	0.150	0.149	0.142	0.117	0.134	0.101	0.115	0.136
09 Mild Liver Disease	0.215	0.193	0.190	0.181	0.175	0.201	0.202	0.224	0.136
10 Diabetes, Mild to Moderate	0.145	0.126	0.111	0.107	0.088	0.065	0.044	0.028	0.011
11 Hemiplegia or Paraplegia	0.183	0.203	0.204	0.214	0.233	0.233	0.245	0.282	0.325
12 Renal Disease	0.534	0.517	0.517	0.528	0.533	0.518	0.482	0.446	0.392
13 Diabetes w/ Chronic Comp.	0.177	0.168	0.174	0.166	0.144	0.148	0.148	0.121	0.119
14 Any Malignancy (Lymp/ Leuk)	0.166	0.154	0.165	0.161	0.186	0.194	0.196	0.208	0.219
15 Moderate/Severe Liver Disease	0.373	0.370	0.367	0.396	0.377	0.409	0.370	0.387	0.465
16 Metastatic Solid Tumor	0.100	0.115	0.131	0.177	0.185	0.188	0.250	0.263	0.237
17 HIV/AIDS	0.258	0.414	0.473	0.445	0.405	0.330	0.428	0.346	0.444
Logistic Model c-index	*0.62*	*0.62*	*0.62*	*0.62*	*0.62*	*0.62*	*0.63*	*0.62*	*0.61*

Note: These models were based on all SNF stays for each year 2000 to 2008.

*   Coefficients with probabilities greater than .05 excluded that coefficient from the comorbidity construct.

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