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Understanding Temporal Changes in and Factors Associated with SNF Rates of Community Discharge and Rehospitalization

A study conducted by staff from the University of Colorado at Denver and Health Sciences Center for the Medicare Payment Advisory Commission

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Final Report

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1   Introduction

In 2004, Medicare beneficiaries experienced approximately 2.5 million admissions to post-acute skilled care in nearly 15,000 Medicare-certified skilled nursing facilities (SNFs), requiring Medicare expenditures of $16 billion[1-3]. Prior research conducted by the UCDHSC found that risk-adjusted facility rehospitalization rates for Medicare SNF residents in the first 100 days after SNF admission increased from 11.8% to 17.0% between calendar year 2000 and 2004[4]. These rates were based on hospitalizations for five conditions - heart failure, respiratory infection, urinary tract infection, sepsis, and electrolyte imbalance - which have been considered among the leading causes of potentially avoidable hospitalizations[5-7]. Although not all hospitalizations for these conditions are preventable, the previously reported rising risk-adjusted rate points to a significant trend occurring in post-acute care.

This trend raises questions about the resident, facility, and community factors that are associated with rehospitalization rates in SNFs and whether these explain the temporal changes in rates. To what extent are these increasing rehospitalization rates related to changes in the facilities that were in business in the year 2000 in comparison to those in business in the year 2004? Is prior acute hospital length of stay associated with SNF rehospitalization, suggesting that declining hospital length of stay may contribute to rising rehospitalization rates? How much geographic variation exists in rehospitalization rates for these causes? Are nurse staffing levels associated with rehospitalization rates, as found in previous studies[8;9]? How are facility characteristics (e.g., hospital-based vs. freestanding, ownership) associated with rehospitalization rates? To what extent are community characteristics (e.g., managed care penetration, hospital beds per capita) related to rehospitalization rates? And ultimately, does the association between rehospitalization and time persist after controlling for all these factors? These research questions are the basis for the present research on rehospitalization.

In prior work, we also found a decrease in risk-adjusted facility community discharge rates occurring within 30 days of admission from 27.6% to 23.9% between calendar year 2000 and 2004[4]. Risk-adjusted 100-day community discharge decreased only marginally between 2000 and 2004 suggesting a temporal trend of SNF patients returning to the community after longer SNF stays, but no change in the rate at which Medicare SNF patients ultimately returned home. Community discharge has clear implications for resident quality of life and cost of care, and is frequently used to measure rehabilitation success[10-18]. The previously reported trend of fewer SNF discharges within 30 days is potentially important in post-acute care warranting further investigation.

Similar questions arise about the resident, facility, and community factors that are associated with community discharge and whether these factors explain the temporal changes in rates. To what extent are these decreasing 30-day discharge rates related to changes in the facilities that were in business in the year 2000 in comparison to those in business in the year 2004? Is prior acute hospital length of stay associated with SNF discharge, suggesting that declining hospital length of stay may contribute to decreasing discharge rates? How much geographic variation exists in community discharge rates? Are nurse staffing levels associated with 30-day discharge rates, as found in previous research[18]? How are facility characteristics (e.g. hospital-based vs. freestanding, ownership) associated with discharge rates? To what extent are community characteristics (e.g.,

managed care penetration, SNF beds per capita) related to discharge rates? And ultimately, does the association between 30-day community discharge and time persist after controlling for all these factors? These research questions are the basis for the present research on community discharge.

The major objective of the current study is to understand both the factors associated with and the reasons for temporal changes in rates of community discharge and rehospitalization. A related objective is to examine the relationship between these two post-acute care performance measures and the publicly reported post-acute care quality measures (QMs)[19]. We hypothesize that good quality based on these performance measures (i.e., low rehospitalization rate or high community discharge rate) will be associated with poor quality on the QMs (higher rates of delirium, pain, and pressure sore). The reason we expect this association is that the QMs are based largely on the 14-day MDS and only about 50% of SNF admissions remain in the facility long enough to have a 14-day MDS due to death, rehospitalization, or discharge[20;21]. Facilities with the lowest rehospitalization rates are likely to have the worst (highest) QM scores - negative association - because more of their residents who experience decline are treated in the facility rather than being rehospitalized. Conversely, facilities with the highest community discharge rates discharge their healthiest patients and would be expected to have the worst (highest) QM scores - a positive association - because the sickest patients remain in the facility.

2 Methods

2.1 Data sources and sample

The national DataPRO SNF Stay File, containing information on Medicare-covered SNF stays linked with the preceding qualifying hospitalization and any rehospitalization was used in all analyses. This file contains information from Medicare claims, the MDS, and the Online Survey Certification and Reporting (OSCAR) system; file documentation is available elsewhere[4;22]. Additional data sources were used to supplement the DataPRO SNF Stay File for these analyses. OSCAR-reported staffing levels for 2000 through 2004, the Area Resource File market characteristics for 2000 through 2002, and the Nursing Home Quality Initiative (NHQI) post-acute care quality measures (QMs) for 2004 were also utilized. The OSCAR staffing data editing rules proposed by Abt Associates[23] were applied. These sources were combined at the facility level to create a single analytic file. Analysis of the stability and variability of the risk-adjusted rates indicated that a minimum sample of 25 or more stays (excluding deaths) over one year was required for estimates to be sufficiently stable[4]. The analytic file was therefore restricted to only those SNFs with at least 25 stays (excluding deaths) with known outcome for any year between 2000 and 2004, averaging approximately 13,000 facilities per year.

2.2 Measures

2.2.1 Facility characteristics

Resident characteristics were aggregated to the facility level to obtain facility case mix measures. The specific resident characteristics aggregated were the set of measures used previously for resident-level risk adjustment[4]. These included presence of advance directives, the Barthel Index (a measure of functional independence, ranging from 0 most dependent to 90 most independent), the

Cognitive Performance Scale (a measure of cognitive impairment, ranging from 0 least impaired to 6 most impaired), selected MDS items, a weighted comorbidity index[4], selected comorbid conditions (primary or secondary diagnoses from the qualifying hospitalization), and length of stay of the qualifying hospitalization. OSCAR-reported staffing levels for RN, licensed nursing (defined as RNs, LPNs, DONs, and nurses with administrative duties), and CNA hours per resident-day were also examined. Measures of facility characteristics included hospital-based/freestanding, urban/rural, chain membership, ownership, state, and region. Market characteristics included hospital, SNF, NF, and HHA providers, admissions, and beds were captured, as well as Medicare managed care penetration rate. Facility scores for the three NHQI post-acute care QMs (delirium, pain, and pressure sores) were also obtained for 2004.

2.2.2 Outcome measures

Two outcome measures were investigated: observed rate of community discharge and observed rate of rehospitalization for any of the following five conditions: heart failure, electrolyte imbalance, respiratory infection, sepsis, and UTI. Both measures were assessed at 30 days and 100 days after SNF admission, and excluded residents who died in the SNF before 30 days or 100 days, respectively.

Community discharge was defined as direct discharge from the SNF to home or assisted living. However, if a resident was discharged to community but then hospitalized within one day, the stay was reclassified as a rehospitalization and not a community discharge.

The rehospitalization measure was limited to hospitalizations with an ICD-9-CM code for heart failure, electrolyte imbalance, respiratory infection, sepsis, or UTI - conditions for which rehospitalization may be potentially avoidable. Rehospitalization was defined as an admission to an acute care or critical access hospital. Any such hospitalization that occurred within one day of SNF discharge (regardless of discharge location) was also considered a rehospitalization.

2.3 Univariate analyses

2.3.1 Changes in outcomes over time

For each of the four outcomes (community discharge and rehospitalization within 30 and within 100 days of SNF admission), simple descriptive statistics were computed by year at the facility level and at the resident level. For the subset of facilities that were present (i.e., had at least 25 stays) at all time points, repeated measures ANOVA was used to assess the differences in outcomes over time. Facility-level descriptive statistics were also computed for each outcome across year by facility type, state, region, and various market characteristics. Because of the previous findings that were confirmed by these results, it was decided to focus the remainder of the analysis on comparison of 2000 and 2004 for community discharge within 30 days and for rehospitalization within 100 days.

2.3.2 Which facilities experienced the largest changes

For the subset of facilities present at both time points, within-facility differences between 2000 and 2004 were calculated for both outcomes (community discharge within 30 days and rehospitalization

within 100 days). Facilities that changed by more than 5% (increase or decrease) were compared to facilities that did not experience that large a change. Additionally, facilities that increased by 5% or more on community discharge and decreased by 5% or more on rehospitalization ("good" changes in both measures) were compared to facilities that decreased by 5% or more on community discharge and increased by 5% or more on rehospitalization ("bad" changes in both measures).

2.3.3 Differences between facilities present at different time points

Initial results suggested that facilities that were present for the entire analysis period (2000 through 2004) had different outcome rates than facilities that were present only at 2000 or only at 2004. "Presence" required at least 25 observations (excluding deaths) for which the outcome was known (i.e., not missing). A facility might be "not present" if it had fewer than 25 stays or if it was not in business at all. For facilities present in 2000 but not in 2004, approximately 75% had no SNF admissions in 2004 (presumably out of business), and approximately 25% had fewer than 25 stays in 2004. Observed outcome rates and facility characteristics were compared between facilities present in only 2000, present in only 2004, and present at both time points. Additional unadjusted comparisons were made with the group of facilities present at 2000 regardless of status at 2004, and with the group of facilities present at 2004 regardless of status at 2000.

2.4 Multivariate analyses

2.4.1 Influence of staffing, facility characteristics, acute length of stay, geographic region, and community characteristics

The data were restricted to only year 2000 and 2004, and pooled so that each facility-year was a separate record. A dichotomous variable ("time") indicated whether the observation was from 2000 or 2004. Two dummy variables were constructed indicating whether the facility was present in the data file in 2000 but not in 2004 ("2000 only") or if the facility was present in the data file in 2004 but not in 2000 ("2004 only"). The reference group was facilities present at both time points. "Presence" required at least 25 observations (excluding deaths) for which the outcome was known (i.e., not missing).

A series of OLS regressions were run to assess the impact of various facility measures on outcome rates. The first regression model included only the time variable as an independent variable. The second model included time as well as the two dummy variables. The third model included time, the two dummy variables, and a set of case mix variables. Each subsequent model then added one variable (in some cases a set of variables) to the third model. The procedure is shown schematically below:

    Step 1: observed rate = f(time)
    Step 2: observed rate = f(time, 2000 only indicator, 2004 only indicator)
    Step 3: observed rate = f(time, 2000 only indicator, 2004 only indicator, case mix variables)
    Step 4: observed rate = f(time, 2000 only indicator, 2004 only indicator, case mix, hospital LOS)
    Step 5: observed rate = f(time, 2000 only indicator, 2004 only indicator, case mix, region)
    etc.

The model adjusted R^2, the estimated coefficient of the variable being tested, the estimated coefficient of time, and the estimated coefficient of the two dummy variables were assessed for each model. If the coefficient of time decreased as additional variables were added to the model, then the effect of time could be at least partially explained by the additional variable. Similarly, changes in the coefficients of the dummy variables indicated the influence of the added variable. Variables tested in this manner included: hospital length of stay, region, staffing levels, hospital-based versus freestanding, urban versus rural, ownership, chain membership, managed care penetration, and hospital, SNF, NF, and HHA providers, admissions, and beds. A final model was fit using all tested variables together.

Because RN hours are a large component of licensed nursing hours (correlation=0.81), an additional version of the final model was fit using only RN hours per resident-day and CNA hours per resident-day (i.e., leaving out licensed nursing hours per resident-day) as the staffing measures in the final model. This model was then compared with the model that included all three staffing level measures.

To investigate differences between states, the state with the lowest risk-adjusted outcome rate was identified, and dummy variables for the remaining states were then entered into the final model.

2.4.2 Relationship between rates of community discharge and rehospitalization

The unadjusted facility-level rates of community discharge within 30 days and rehospitalization within 100 days were compared to examine whether facilities that performed well on one outcome also performed well on the other outcome. A simple correlation of the two rates was conducted at the facility-level. In addition, the distribution of facility-level rates for each outcome was divided into quartiles, and facility quartile membership for the two outcomes was compared. This analysis was restricted to 2004 data to assess the relationship using the most recent data.

2.4.3 Relationship between the NHQI post-acute care QMs and rates of community discharge and rehospitalization

The relationship of the three NHQI post-acute care QMs (percent of resident with delirium, percent of resident with moderate to severe pain, percent of resident with new or worsening pressure sores) to both outcomes was assessed, restricted to only facilities present in 2004. A stepwise regression was run on the 2004 data to select from the full set of aggregated resident characteristics the facility case mix variables that most influenced the outcome. Each of the NHQI QMs was then added to the model in separate regressions, and an additional model containing all three together was also fit.

3 Results

3.1 Change in facility outcomes from 2000 to 2004

Unadjusted facility observed rates of the four outcome measures from 2000 through 2004 are presented in Table 1. The average rate, the difference in average rate between years, and the relative difference in average rate between years is shown for each outcome. In addition, the difference and relative difference in rates between 2000 and 2004 is shown.

Observed rates of community discharge within 30 days declined over time, while rates of community discharge within 100 days were more stable. Between 2000 and 2004, the average rate of community discharge within 30 days decreased by 1.8% (relative difference of 7.6%), while the average rate of community discharge within 100 days decreased by 0.3% (relative difference of 0.8%).

In contrast, observed rates of rehospitalization within 30 days and within 100 days increased over time. Between 2000 and 2004, the average rate of rehospitalization within 30 days increased by 2.1% (relative difference of 18.2%), and the average rate of rehospitalization within 100 days increased by 2.8% (relative difference of 19.0%). The increase in rehospitalization rates was smallest in the most recent year.

Observed outcome rates for community discharge within 30 days and rehospitalization within 100 days for 2000 and 2004 by facility type are provided in Appendix Table A. Observed outcome rates for all four outcomes for 2000, 2004, and the difference between 2000 and 2004 are shown by state, region, and market characteristics in Appendix Table B.

3.2   Changes in resident outcome from 2000 to 2004

The observed rates of community discharge within 30 and 100 days in aggregate declined over time. In 2000, the aggregate community discharge rate within 30 days was 34.4%, which dropped to 29.2% in 2004, a decline of 5.2%. The aggregate rate of community discharge within 100 days dropped from 41.9% in 2000 to 39.0% in 2004, a decline of 2.9%.

The rates of rehospitalization within 30 and 100 days in aggregate increased over time. In 2000, the aggregate rehospitalization rate within 30 days was 10.8%, which rose to 13.7% in 2004, an increase of 2.9%. The aggregate rate of rehospitalization within 100 days rose from 13.5% in 2000 to 17.4% in 2004, an increase of 3.9%.

The length of time until residents were rehospitalized was also examined. Of those residents rehospitalized within 100 days, half (49%) were rehospitalized within 12 days of SNF admission, 32% within 7 days, and 15% within 3 days (Appendix Table C). These figures differed by no more than a percentage point when rehospitalizations in 2000 were assessed separately from rehospitalizations in 2004.

3.3   Changes in case mix and facility and market characteristics from 2000 to 2004

A comparison of all independent variables between 2000 and 2004 is shown in Table 2. The measures include case mix (e.g., average resident age, or percent of residents with DNR orders), staffing levels, facility characteristics, characteristics of the market in which the SNF is located (e.g., number of hospitals, number of home health agencies), and the 2004 NHQI post-acute care QMs.

In aggregate, changes in resident case mix between 2000 and 2004 appear somewhat modest. The larger changes include increases in the percent of residents with DNR orders, receiving parenteral IV feeding, with genitourinary conditions, with hypertension, or with musculoskeletal disorders, and

decreases in the percent of resident being tube-fed, or with fractures. Average length of stay of residents' prior qualifying hospital stay declined by half a day, from 9.3 to 8.7 days. Average staffing levels dropped for RN and licensed nursing, and increased slightly for CNAs. There were small shifts in geographic distribution, 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 by more than a third, from 13.3% to 8.7%, chain membership declined from 61.3% to 56.9%, and urban facilities decreased from 71.2% to 69.0%. The percentage of SNFs that were for-profit increased modestly. Market characteristics showed a significant decline in Medicare managed care penetration; other measures changed only modestly. The NHQI post-acute care QMs were either not reported in 2000 or were reported using a different algorithm, thus only 2004 values are shown in the table.

3.4 Facilities that experienced the largest changes in outcome rates

On average, SNFs in which observed community discharge rates decreased by 5% or more admitted more residents with significantly greater acuity in 2004 than in 2000 (Appendix Table D). SNFs in which observed community discharge rates increased by 5% or more admitted more residents with lower acuity. SNFs in which case mix did not change significantly over time had observed community discharge rates that were relatively unchanged over time. For example, the average Barthel Index decreased by 3 points (residents more dependent) in facilities with significant decline in community discharge, increased by .3 points in facilities with no change in community discharge, and increased by 3 points (residents more independent) in facilities with significant increase in community discharge.

On average, SNFs in which observed rehospitalization rates increased by 5% or more admitted more residents with significantly greater acuity in 2004 than they had in 2000 (Appendix Table E). SNFs in which observed rehospitalization rates decreased by 5% or more admitted more residents with less acuity. SNFs in which case mix did not change significantly over time had observed rehospitalization rates that were relatively unchanged over time. For example, the average Barthel Index increased by 3 points (residents more independent) in facilities with significant decline in rehospitalization, increased by .5 points in facilities with no change in rehospitalization, and declined by 1 point (residents more dependent) in facilities with significant increase in rehospitalization.

These associations between changes in case mix and both outcome measures would be expected affirming the importance of risk adjustment in examining temporal trends in outcome and the relationship between facility characteristics and outcome.

3.5 Community discharge within 30 days

Table 3 presents results from the sequence of regression models for community discharge within 30 days. In step 1, the only variable in the model was the time variable, indicating either 2000 or 2004. The coefficient of time was -0.0179, which is consistent with the earlier finding that observed rates of community discharge declined 1.79% between 2000 and 2004.

In step 2, the two dummy variables 2000 only and 2004 only were entered, and the model adjusted R^2 increased slightly. The coefficient of the 2000 only indicator was 0.1749, indicating that facilities present only in 2000 had community discharge rates in 2000 that were 17.5% higher than facilities present at both time points. The coefficient of the 2004 only indicator was -0.0739, indicating that facilities present in 2004 only had community discharge rates in 2004 that were 7.4% lower than facilities present at both time points. These findings are corroborated by the unadjusted differences in observed rates between these groups, shown in Appendix Table F. That the coefficient of time changed from -0.0179 to 0.009 indicates that the rate of community discharge actually increased by 0.9% for those facilities present at both time points, also shown in Appendix Table F.

In step 3, a set of facility case mix variables were entered, vastly increasing the model adjusted R^2 as expected. Controlling for facility case mix significantly affected the coefficients of the other three variables. The coefficients for both 2000 only and 2004 only decreased substantially in magnitude, indicating that there were substantial differences in case mix in these two groups. Indeed, Appendix Table F shows significant differences across facilities present only in 2000, present only in 2004, and present in both years in average Barthel scores, and the percentages of residents with DNR orders, with catheters, with dementia, and with nervous system disorders. The coefficient of time became negative, indicating that once differences in facility case mix are accounted for, the community discharge rates for facilities present at both time points declined.

In step 4, acute length of stay was entered, which had a negligible effect on the model adjusted R^2. The small coefficient and minimal impact on the other estimates suggests that acute length of stay does not explain much of the variance in community discharge rates after controlling for case mix.

In step 5, three dummy variables for Northeast, Midwest, and South region were entered, leaving out the Western region as the reference group (it had the highest community discharge rate). Adding region improved the model adjusted R^2 and showed that after adjusting for case mix, SNFs in the rest of the country had community discharge rates 4.3% to 7.6% lower than SNFs in the West.

Staffing levels were entered in steps 6 through 8, separately for RN hours/resident-day, licensed nursing hours/resident-day, and CNA hours/resident-day. Compared to the Step 3 model, RN and licensed nursing staffing levels had substantial effects on the model R^2; CNA staffing levels had a smaller effect. On average, for every one-hour increase in RN hours/resident-day, the community discharge rate increased by almost 8%; for licensed nursing the average increase was just over 5%; for CNA the average increase was less than 2%. The magnitude of the coefficient of 2000 only indicator dropped substantially with the addition of RN or licensed nursing staffing levels, suggesting that a large part of the differences in rates for facilities present in 2000 only versus both time points was associated with large differences in staffing. This is shown dramatically in Appendix Table F, where facilities present in 2000 only had RN and licensed nursing staffing levels 1.8 to 2.5 times higher than facilities present at both time points. The magnitude of the coefficient of time also dropped significantly, suggesting that much of the observed decrease in community discharge rates over time can be explained by differences in staffing levels. In step 9, all three staffing level variables were entered together, with consistent results.

In step 10, hospital-based versus freestanding was entered, with a significant increase in model adjusted R^2 as compared to the Step 3 model. Furthermore, the coefficient was 0.191, indicating that even after adjusting for case mix, hospital-based SNFs had community discharge rates 19.1% higher than freestanding SNFs. The magnitude of the coefficient of time dropped substantially, indicating that differences in community discharge rates over time were substantially related to the proportion of SNFs that were hospital-based. The coefficient of the 2000 only indicator also dropped significantly, suggesting that the differences in rates for facilities present in 2000 only versus both time points were associated with differences in the proportion of facilities that were hospital-based. As shown in Appendix Table F, more than half the facilities present only in 2000 were hospital-based, whereas only about 9% of facilities present at both time points and 5% of facilities present in 2004 only were hospital-based. (Facilities not present in 2004 could be no longer in business at that time or could have fewer than 25 stays in 2004.)

The magnitude of the hospital-based coefficient is influenced by significant differences between hospital-based and freestanding facilities on various important measures, as shown in Appendix Table G. Hospital-based facilities had significantly higher staffing levels than freestanding SNFs. Case mix measures were mixed, with some measures indicating more complex residents in hospital-based SNFs, and other measures indicating more complex residents in freestanding SNFs. Of note, the average acute length of stay was the same for residents in either type of facility.

Steps 11 through 13 tested the impact of ownership (for-profit versus not for-profit), urban versus rural setting, and chain membership. On average, for-profit SNFs had community discharge rates 3.7% lower than not for-profit SNFs, and urban facilities had community discharge rates 2.7% higher than those in rural areas. Chain membership had a modest effect. Market characteristics were assessed in steps 14 through 21 and had minimal effects on community discharge rates.

The final community discharge model is shown in Table 4. The model adjusted R^2 was 0.6951. The coefficient of time was -0.004, much smaller in magnitude that it was initially, suggesting that much of the decline in observed community discharge rates can be explained by variables in the model. That it remained significant indicates that there was still an independent effect of time. The coefficient of the 2000 only indicator was not significant in the final model, indicating that other variables in the model (most likely hospital-based and staffing) accounted for this effect. The coefficient of the 2004 only indicator was -0.02557, smaller in magnitude than it was initially, and somewhat smaller than it was when only case mix was in the model. This suggests that some, but not all, of the differences between facilities present in 2004 only versus at both time points can be explained by differences in case mix and other facility measures.

Based on the coefficients (for dichotomous variables) and standardized estimates (for continuous variables), the variables with the largest negative effect on the facility community discharge rate were: percentage of residents with DNR orders, mean Cognitive Performance Scale score (higher scores=more cognitive impairment), and mean bowel incontinence scale (higher scores=more frequent incontinence). Variables with the largest positive effect were: mean Barthel Index score (higher scores=more independent), licensed nursing hours/resident-day, and hospital-based.

When the final model was re-fit leaving out licensed nursing hours per resident-day, there was a slight decline in the model adjusted R^2 (from 0.6951 to 0.6920) and inconsequential changes to the magnitudes of the coefficients of other variables in the model. No variable changed sign or changed in significance. The coefficients for the staffing variables did change: RN hours per resident-day increased from 0.026 to 0.046 (with p-value<0.0001), and CNA hours per resident-day increased from 0.009 to 0.004 (with p-value<0.0001).

3.6 Rehospitalization within 100 days

Table 5 presents results from the sequence of regression models run for rehospitalization within 100 days. With only the time variable (indicating 2000 or 2004) in the model, the adjusted R^2 was low as expected. The coefficient of time was 0.02790, consistent with the earlier finding that observed rates of rehospitalization increased by 2.79% between 2000 and 2004.

In step 2, the two dummy variables 2000 only and 2004 only were entered, and the model adjusted R^2 increased slightly. The coefficient of the 2000 only indicator was -0.0402, indicating that facilities present only in 2000 had rehospitalization rates in 2000 that were 4.0% lower than facilities present at both time points. The coefficient of the 2004 only indicator was -0.0096, indicating that facilities present in 2004 only had rehospitalization rates in 2004 that were 0.96% lower than facilities present at both time points. These findings are corroborated by the unadjusted differences in observed rates between these groups, shown in Appendix Table F. That the coefficient of time changed from 0.028 to 0.026 indicates that the rate of rehospitalization increased by 2.6% for those facilities present at both time points, also seen in Appendix Table F.

In step 3, facility case mix variables were entered, vastly increasing the model adjusted R^2 as expected. Controlling for case mix substantially affected the coefficients of the other three variables. The coefficients for both the 2000 only indicator and the 2004 only indicator decreased substantially in magnitude, indicating that there were substantial differences in case mix between facilities in these two groups. Indeed, significant differences were found in average Barthel score, and the percentage of residents with DNR orders, with catheters, with dementia, and with nervous system disorders among these facilities (Appendix Table F). The coefficient of time dropped to 0.0205, indicating that even after accounting for differences in facility case mix, the rehospitalization rates for facilities present at both time points increased by approximately 2%.

In step 4, acute length of stay was entered, but was not significant and had minimal effect on model adjusted R^2 or the other estimates. This suggests that acute length of stay does not explain variance in rehospitalization rates after adjusting for case mix.

In step 5, three dummy variables for Northeast, Midwest, and South region were entered, leaving out the Western region as the reference group (it had the lowest rehospitalization rate). Adding region improved the model adjusted R^2 from step 3 and showed that after adjusting for case mix, SNFs in the rest of the country had rehospitalization rates 1.1% to 4.2% higher than SNFs in the West.

Staffing levels were entered in steps 6 through 8, separately for RN hours/resident-day, licensed nursing hours/resident-day, and CNA hours/resident-day. Compared to the Step 3 model, RN and

licensed nursing staffing levels had significant effects on the model adjusted R^2; CNA staffing levels had a smaller effect. On average, for every one hour increase in RN hours/resident-day, the rehospitalization rate decreased by almost 2%; for licensed nursing the average decrease was be just over 1%; for CNA the average decrease was less than 1%. The magnitude of the coefficient of the 2000 only indicator dropped by more than half with the addition of RN and licensed nursing levels, suggesting that a large part of the differences in rates for facilities present in 2000 only versus both time points was associated with large differences in staffing. As shown in Appendix Table F, facilities present in 2000 only had RN and licensed nursing staffing levels 1.8 to 2.5 times higher than facilities present at both time points. The magnitude of the coefficient of time also dropped, suggesting that much of the observed increase in rehospitalization rates over time can be explained by differences in RN and licensed nursing staffing levels. In step 9, all three staffing level variables were entered together, with consistent results.

In step 10, hospital-based versus freestanding was entered, with a significant increase in model adjusted R^2 compared to the Step 3 model. Furthermore, the coefficient was -0.057, indicating that even after adjusting for case mix, hospital-based SNFs had rehospitalization rates that were 5.7% lower than freestanding SNFs. The magnitude of the coefficient of time dropped, indicating that differences in rehospitalization rates over time were related to the proportion of SNFs that were hospital-based. The coefficient of the 2000 only indicator dropped substantially, suggesting that the differences in rates for facilities present in 2000 only versus both time points were associated with differences in the proportion of facilities that were hospital-based. Appendix Table F shows that more than half of the facilities present only in 2000 were hospital-based, while only approximately 9% of facilities present at both time points and 5% of facilities present in 2004 only were hospital-based. Facilities not present in 2004 could be no longer in business at that time or could have fewer than 25 stays in 2004.

The magnitude of the hospital-based coefficient is influenced by significant differences between hospital-based and freestanding facilities on various important measures, as shown in Appendix Table G. Hospital-based facilities had significantly higher staffing levels than freestanding SNFs. Case mix differences were mixed, with some measures indicating more complex residents in hospital-based SNFs, and other measures indicating more complex residents in freestanding SNFs. Of note, the average acute length of stay was the same for residents in either type of facility.

Steps 11 through 13 tested the impact of ownership (for-profit versus not for-profit), urban versus rural setting, and chain membership. On average, for-profit facilities had a 2.3% higher rate of rehospitalization than non-profit facilities; urban versus rural and chain membership had little to no effect on the model. Market characteristics were assessed in steps 14 through 17 and had no impact on rehospitalization rates.

The final rehospitalization model is shown in Table 6; the model adjusted R^2 was 0.5363. The coefficient of time was 0.0203, about a third lower in magnitude that it had been initially, suggesting that some of the increase in observed rehospitalization rates can be explained by variables in the model. That it remained significant indicates that there was still an independent effect of time. The coefficient of 2000 only was -0.0057, substantially lower than it was initially, indicating that other variables in the model (most likely hospital-based and staffing) accounted for this effect. The

coefficient of 2004 only was -0.0078, smaller in magnitude than it was initially, and approximately the same as it was when only case mix was in the model. This suggests that some, but not all, of the differences between facilities present at 2004 only versus at both time points can be explained by differences in case mix and facility characteristics.

Based on the coefficients (for dichotomous variables) and standardized estimates (for continuous variables), the variables with the largest inverse association with facility rehospitalization rate were: percentage of residents with DNR orders, average Barthel Index score (higher scores=more independence), and percentage of residents with fractures. Variables with the largest positive association with rehospitalization were: average bowel incontinence score (higher scores=more frequent incontinence), percentage of residents being tube fed, and average resident comorbidity index. The time variable also was positively associated with rehospitalization rate, suggesting that differences in time are not fully explained by variables present in the model.

When the final model was re-fit leaving out licensed nursing hours per resident-day, there was a slight decline in the model adjusted R^2 (from 0.5363 to 0.5356) and inconsequential changes to the magnitudes of the coefficients of other variables in the model. No variable changed sign or changed in significance. The coefficients and significance of the staffing variables did change: RN hours per resident-day changed from -0.002 to -0.007 (with p-value<0.0001), and CNA hours per resident-day changed from -0.0007 with p-value=0.1572 to -0.001 with p-value=0.0370.

3.7   Variation by state

Table 7 shows the differences between states in the risk-adjusted rate of community discharge within 30 days. Alaska had the lowest risk-adjusted rate of community discharge (Note that Alaska had the lowest risk-adjusted rate; the observed rate for SNFs in Alaska is shown in Appendix Table B) and therefore was used as the reference state. After adjusting for case mix, SNFs in Hawaii had an average rate of community discharge 25.1% greater than SNFs in Alaska. South Carolina, Oregon, and Montana also had average rates more than 20% greater. South Dakota's average risk-adjusted rate was only 5.4% higher than Alaska's; Oklahoma's (6.0%) and North Dakota's (6.6%) rates were also within 7% of Alaska's rate.

A similar graph for risk-adjusted rates of rehospitalization within 100 days is given in Table 8. In this case, Hawaii had the lowest risk-adjusted rate of rehospitalization and was used as the reference state. The range of risk-adjusted rehospitalization rates was much smaller than for community discharge. Generally, SNFs in Western states had lower risk-adjusted rates of rehospitalization, while higher rates were seen in Eastern and Midwestern states. SNFs in Utah, Oregon, California, and Washington all had rates within 3% of Hawaii's rates, while SNFs in Connecticut had a rehospitalization rate 7.5% higher than Hawaii's, with rates in Illinois, New York and West Virginia also more than 7% higher.

3.8   Relationship between rates of community discharge and rehospitalization

Unadjusted facility rates of community discharge within 30 days and rehospitalization within 100 days for year 2004 had a correlation of -0.483 (p<0.0001). The inverse correlation means that facilities with higher rates of community discharge generally had lower rates of rehospitalization, and

facilities with lower rates of community discharge generally had higher rates of rehospitalization. Comparison of the quartiles gave similar results. Half of the facilities in the highest quartile for community discharge were also in the lowest quartile for rehospitalization, and 43% of the facilities in the lowest quartile for community discharge were also in the highest quartile for rehospitalization. These rates and comparisons were not risk-adjusted.

3.9 Nursing Home Quality Initiative (NHQI) post-acute care QMs

The relationship between the NHQI post-acute care QMs and both community discharge and rehospitalization is shown in Table 9. The quality measures are constructed such that higher values indicate poorer facility quality.

The adjusted R^2 for the community discharge model containing only case mix variables was 0.5847. After adjusting for case mix, each of the three quality measures was positively associated with community discharge. Such an association indicates that low values of the quality measures (indicating better facility quality) were associated with low rates of community discharge (an poor outcome), whereas high values of the quality measures (indicating poorer facility quality) were associated with high rates of community discharge (a good outcome). When all three quality measures were tested simultaneously, the relationships of pain and pressure sores with rehospitalization were preserved, but delirium became insignificant.

The adjusted R^2 for the rehospitalization model containing only case mix variables was 0.4865. After accounting for aggregate resident characteristics, each of the three quality measures was inversely associated with rehospitalization. An inverse relationship indicates that low values of the quality measure (better quality) were associated with high rates of rehospitalization (poor outcome), and high values of the quality measures (poorer quality) were associated with low rates of rehospitalization (good outcome). These relationships persisted when all three quality measures were tested simultaneously.

4 Discussion

Community discharge and potentially avoidable rehospitalization rates are SNF outcomes that are gaining traction as performance measures. With 78% of SNF patients receiving rehabilitation services[20] and 43% expected to be discharged within 90 days[4], discharge is clearly a major goal of SNF care. Community discharge has been widely used in studies of rehabilitation and has been shown to be related to process quality measures in SNFs[14;15;18;24]. For many other SNF patients, the goal is to stabilize, monitor, and prevent complications following acute medical or surgical care, avoiding the need for rehospitalization. Hospitalization has been used to measure quality of ambulatory care using ambulatory care sensitive conditions[25-27], as a publicly reported measure for home health care[28-30], and will be used in the CMS nursing home value based purchasing demonstration[31]. Thus, these two outcome measures correspond to two of the major goals of SNF care and are used for multiple purposes.

This study was prompted by prior research that found increases in risk-adjusted SNF rehospitalization rates for potentially avoidable causes and decreases in risk-adjusted SNF community discharge rates between calendar year 2000 and calendar year 2004[4]. In this previous

research, the rehospitalization rate measure included hospitalizations for five conditions: heart failure, respiratory infection, urinary tract infection, sepsis, and electrolyte imbalance. The risk-adjusted measures were calculated at 30 days and 100-days after SNF admission. About 10% of residents were excluded from the measures due to death before the end point or missing admission MDS data. The measures were found to be stable with a denominator of at least 25 admissions, so facilities with less than 25 admissions in a year were excluded. About 90% of facilities had 25 or more SNF admissions and these facilities were responsible for about 99% of the SNF stays.

To better understand these trends, we studied the resident, facility, and community factors that were associated with SNF rehospitalization and community discharge rates during this time period, and the extent to which these explained the temporal changes in rates. We also examined the relationship among these two outcome measures and between these two outcome measures and the three publicly reported QMs for post-acute care that are based on 14-day MDS data. In this study, we began with facility observed rates and then adjusted for facility case mix and other variables in the model to assess the effect of facility case mix and other factors on these rates. The initial trend analysis used rates that were risk adjusted using the method that is used by CMS to risk adjust for Nursing Home Compare[4;32]. This method is designed to compare rates among facilities at the same point in time and does not lend itself well to studying temporal trends or the association of rates with other factors. We focused on 100-day rehospitalization and 30-day community discharge in the present analysis because these measures changed the most between 2000 and 2004.

For community discharge, the rate declined in part because facilities in business and with 25 SNF admissions only in 2000 had higher community discharge rates than facilities present in both time periods or only in 2004. As expected, case mix was strongly associated with community discharge rates particularly ADL functional independence, cognitive functioning, and the percentage of residents with DNR orders (negatively associated). After case mix adjustment, hospital-based facilities had community discharge rates that were 19% higher on average, which may result in part from unaccounted for case mix differences. After adjusting for other facility characteristics that are highly associated with being hospital-based (i.e., hospital-based facilities tend to be non-profit and have much higher staffing levels), the hospital-based effect was reduced to 11%. However, facilities present only in 2000, which had higher case mix-adjusted community discharge rates, were much more likely to be hospital-based than were facilities present in both periods or 2004 only. For-profit facilities had lower community discharge rates, and urban facilities had higher community discharge rates after case mix adjustment.

Staffing levels were strongly associated with case mix-adjusted community discharge rates: on average, rates increased by 8% for every additional hour of RN time, 5% for every additional licensed staff hour, and 1.6% for every additional CNA hour. As expected, these effects were diminished in the final model after adjusting for characteristics such as hospital-based that are highly associated with staffing; however, we emphasize staffing without adjusting for other facility characteristics because the underlying reasons that facilities staff differently are secondary. Our findings are consistent with previous research on the relationship between nurse staffing levels and community discharge[18]. In addition, SNFs that were present only in 2000, which had higher case-mix adjusted community discharge rates, had substantially higher staffing levels. In fact, after controlling for staffing, hospital-based, and other facility characteristics there was no longer an

independent effect of presence only in 2000. Thus, part of the reason for the temporal decline in community discharge rates is that facilities that either went out of business or treated fewer SNF residents over time were disproportionately hospital-based and higher staffed facilities.

SNFs in the Western region had 3-5% higher case-mix adjusted community discharge rates on average than other regions of the country, after adjusting for facility and community characteristics. The western states where this was most pronounced were Hawaii, Oregon and Montana. By adjusting for case mix, facility characteristics, staffing, geographic region, and community characteristics (model adjusted R^2=0.69), the temporal change in community discharge rates was almost fully explained.

For rehospitalization, the rate increased in part because facilities in business and with 25 SNF admissions only in 2000 had lower rehospitalization rates than facilities in both time periods or only in 2004. As expected, case mix was strongly associated with rehospitalization rates, particularly ADL functional independence (negatively associated), DNR orders (negatively associated), feeding tube, comorbidity, bowel incontinence, and fracture diagnosis (negatively associated). After case mix adjustment, hospital-based facilities had rehospitalization rates that were 6% lower on average, which may result in part from unaccounted for case mix differences. However, facilities present only in 2000, which had lower case mix-adjusted rehospitalization rates, were much more likely to be hospital-based than facilities present in both periods or 2004 only. For-profit facilities had higher rehospitalization rates after case mix adjustment.

Staffing levels were associated with case mix-adjusted rehospitalization rates: on average, rates decreased by 1.9% for every additional hour of RN time, 1.2% for every additional licensed staff hour, and 0.5% for every additional CNA hour. These effects were diminished in the final model after controlling for characteristics that are highly associated with staffing (e.g., hospital-based and for profit); however, we emphasize staffing without adjusting for other facility characteristics because of the underlying reasons that facilities staff differently are secondary. This is consistent with previous research on the relationship between nurse staffing levels and hospitalizations for SNF patients where staffing data were obtained from Medicaid cost reports[8;9]. In addition SNFs that were present only in 2000, which had lower case mix-adjusted rehospitalization rates, had substantially higher staffing levels. In fact, after controlling for staffing, hospital-based, and other facility characteristics there was only a negligible independent effect of presence only in 2000. Thus, part of the reason for the temporal increase in rehospitalization rates is that facilities that either went out of business or treated fewer SNF patients over time were disproportionately hospital-based and higher staffed facilities.

SNFs in the Western region had 1.6-2.5% lower case-mix adjusted rehospitalization rates on average than in other regions of the country, after adjusting for facility and community characteristics. The western states where this was most pronounced were Hawaii, Utah, Oregon, California and Washington. Even after adjusting for case mix, facility characteristics, staffing, and geographic region, and community characteristics (model adjusted R^2=0.54), the temporal increase in rehospitalization rates was about 2.0%.

The relationship that we found between good quality on these performance measures (i.e., low rehospitalization rate or high community discharge rate) and poor quality on the publicly reported post-acute care QMs is concerning. Only about 50% of SNF admissions have a 14-day MDS completed, so half of SNF admissions are not included in the post-acute care QMs[20;21]. If a facility discharges their healthiest patients to the community and/or provides treatment in the facility rather than the hospital for patients who have severe pain, delirium, or pressure sores, they will score worse on the post-acute care QMs. The QMs provide an incomplete picture of quality that does not address two of the major goals of SNF care. Thus, we recommend that community discharge and rehospitalization for potentially avoidable causes be added to the post-acute care QMs for public reporting. Furthermore, we recommend that revisions to the post-acute care measures be considered such as adding discharge MDS data for residents who are discharged or rehospitalized, refining the measure definitions, and improving risk adjustment procedures.

In summary, community discharge and rehospitalization for potentially avoidable causes appear to be robust performance measures for Medicare SNFs. They are correlated with one another at the facility level, as you would expect among different quality constructs. After controlling for case mix, these measures are strongly associated with whether a facility is hospital-based and licensed staffing levels, as well as geographic factors. The temporal decline in community discharge rates appears to be explained largely by these factors, particularly the loss of hospital-based and higher staffed facilities. The temporal increase in rehospitalization rates appears to be partially explained by loss of hospital-based and higher staffed facilities and changes in these factors. The loss of better performing facilities on both of these measures between 2000 and 2004 is concerning.

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TABLES

Table 1: Change in mean facility observed rates[1] of outcome measures for 2000 - 2004 SNF admissions

	2000 (n=12,247)[2]	2001 (n=12,650)	2002 (n=12,973)	2003 (n=13,245)	2004 (n=13,373)	2000 to 2004[3]
Community discharge in 30 days	23.66	22.81	22.30	21.79	21.87	
Difference[4]		-0.85	-0.51	-0.51	0.08	-1.79
Relative difference[5]		-3.59	-2.24	-2.29	0.37	-7.57
Community discharge in 100 days	31.17	30.52	30.45	30.44	30.92	
Difference		-0.65	-0.07	-0.01	0.48	-0.25
Relative difference		-2.09	-0.23	-0.03	1.58	-0.80
Rehospitalization in 30 days	11.35	12.19	12.64	13.27	13.42	
Difference		0.84	0.45	0.63	0.15	2.07
Relative difference		7.40	3.69	4.98	1.13	18.24
Rehospitalization in 100 days	14.69	15.79	16.40	17.23	17.48	
Difference		1.10	0.61	0.83	0.25	2.79
Relative difference		7.49	3.86	5.06	1.45	18.99

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[1] Rates shown are percentages. Rates are not adjusted of differences in case mix.

[2] Slight differences in sample size for each outcome. Sample size shown for each year is the maximum of any of the four outcomes for that year.

[3] Repeated measures ANOVA conducted on the subset of facilities present at all time points (n=10,812). All comparisons between 2000 and 2004 have p-values <0.0001. All comparisons between sequential years have p-values <0.0001 except: community discharge in 30 days 2000 vs. 2001 (0.1816), community discharge in 30 days 2001 vs. 2002 (0.0039), community discharge in 30 days 2002 vs. 2003 (0.0196), community discharge in 100 days 2000 vs. 2001 (0.0004), rehospitalization in 30 days 2003 vs. 2004 (0.001).

[4] Given year's rate minus previous year's rate.

[5] Given year's rate minus previous year's rate, divided by previous year's rate, multiplied by 100.

Table 2: Comparison of mean facility measures between 2000 and 2004

	2000 (n=12,206)[1]		2004 (n=13,332)[2]	
	Mean[3]	(Stdev)	Mean	(Stdev)
Case mix indicators[4]				
Age (years)	80.39	(3.3)	79.68	(3.9)
DNR orders	38.45	(22.9)	41.10	(22.2)
Do not hospitalize orders	1.85	(6.1)	1.78	(5.3)
Barthel Index (0-90)[5]	36.70	(9.5)	36.51	(8.6)
Cognitive Performance Scale (0-6)[6]	2.02	(0.7)	1.94	(0.7)
Bowel incontinence scale (1-4) (MDS item H1a)[6]	1.37	(0.7)	1.33	(0.7)
Indwelling catheter (MDS item H3d)	22.06	(11.3)	22.99	(11.4)
Feeding tube (MDS item K5b)	9.40	(8.7)	7.20	(6.9)
Parenteral/IV feeding (MDS item K5a)	6.94	(12.6)	11.33	(16.7)
Pressure ulcer (MDS item M2a, any stage)	23.36	(11.4)	22.99	(10.8)
Rehabilitation RUG	76.25	(17.2)	77.43	(16.8)
Community discharge comorbidity index (-3.5 to 3.3)	-0.48	(0.1)	-0.49	(0.1)
Rehospitalization comorbidity index (-3.3 to 3.1)	0.38	(0.1)	0.41	(0.1)
Cardiac arrhythmia	25.89	(7.5)	27.40	(7.6)
COPD	22.53	(7.7)	24.04	(7.7)
Dementia	24.01	(11.2)	24.88	(10.9)
Fluid/Electrolyte disorder	29.64	(8.8)	32.28	(8.2)
Fracture	16.21	(7.4)	14.30	(6.8)
Genitourinary condition	33.20	(8.3)	38.30	(8.3)
Uncomplicated hypertension	37.60	(8.7)	43.03	(8.5)
Musculoskeletal disease	27.93	(9.6)	30.35	(9.6)
Nervous system disorder	25.27	(7.8)	25.92	(7.7)
Respiratory disease	25.53	(7.6)	26.99	(7.4)
Skin disorder	12.44	(6.3)	13.25	(6.0)
Valvular disease	7.76	(5.0)	8.80	(5.3)
LOS of qualifying hospital stay (days)	9.25	(2.7)	8.74	(2.3)
Staffing levels				
RN hours/resident-day	0.59	(0.8)	0.45	(0.6)
Licensed nursing hours/resident-day	1.75	(1.2)	1.62	(1.0)
CNA hours/resident-day	2.30	(0.8)	2.42	(0.8)
Facility characteristics				
Northeast	20.84	-	19.23	-
Midwest	30.75	-	31.89	-
South	32.89	-	34.11	-
West	15.51	-	14.77	-
Hospital-based	13.33	-	8.66	-
Freestanding	86.67	-	91.34	-
Urban	71.15	-	68.95	-
Rural	28.85	-	31.05	-
For-profit	67.00	-	68.26	-
Non-profit	28.38	-	27.40	-
Chain	61.32	-	56.92	-
Not chain	38.68	-	43.08	-

Table 2: Comparison of mean facility measures between 2000 and 2004 (continued)

	2000 (n=12,206)[1]		2004 (n=13,332)[2]	
	Mean[3]	(Stdev)	Mean	(Stdev)
Market characteristics				
Medicare managed care penetration rate in SNF's county	14.75	(14.8)	10.26	(12.8)
Number of hospitals[7]	2.60	(3.0)	2.68	(3.3)
Number of hospital admissions[7]	12,654.57	(7580.8)	12,712.18	(7945.2)
Number of hospital beds[7]	373.80	(281.5)	362.39	(290.7)
Number of SNFs[7]	7.27	(5.47)	7.42	(6.0)
Number of SNF certified beds[7]	711.74	(400.3)	717.01	(410.9)
Number of NF total beds[7]	69.0	(174.4)	62.24	(166.6)
Number of home health agencies[7]	3.12	(3.4)	3.07	(3.5)
NHQI post-acute care QMs				
Delirium score[6]	-	-	3.23	(4.7)
Pain score[6]	-	-	22.00	(19.0)
Pressure sores score[6]	-	-	20.70	(9.9)

[1] Sample for 2000 is facilities with non-missing data in 2000 for rehospitalization in 100 days and community discharge in 30 days

[2] Sample for 2004 is facilities with non-missing data in 2004 for rehospitalization in 100 days and community discharge in 30 days

[3] Values are percentages unless otherwise noted

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

[5] Higher values indicate better status

[6] Lower values indicate better status

[7] In SNF's county, per 100,000 population. Data for 2004 were not available; 2002 data were substituted.

Table 3: Community discharge within 30 days regression model series

Step	Variables in model	Model adj R^2	Coefficient of tested variable	Coefficient of time	Coefficient of 2000 only	Coefficient of 2004 only
1	Time	.0022	-	-.01792	-	-
2	Time, presence at 2000 only and 2004 only indicators	.0457	-	.00922	.17487	-.07389
3	Time, presence at 2000 only and 2004 only indicators, case mix	.6058	-	-.01316	.07342	-.02974
4	Step 3 and hospital LOS	.6059	.00085	-.01223	.07374	-.02950
5	Step 3 and region (Northeast, Midwest, South)	.6209	-.05355 NE -.07579 MW -.04318 S	-.01607	.07221	-.03010
6	Step 3 and RN hours/resident-day	.6486	.07977	-.00188	.01493	-.02838
7	Step 3 and licensed nursing hours/resident-day	.6514	.05036	-.00689	.01115	-.02951
8	Step 3 and CNA hours/resident-day	.5919	.01600	-.01489	.05586	-.02963
9	Step 3 and RN hours/resident-day, licensed nursing hours/resident-day, CNA hours/resident-day	.6584	.04127 RN .02955 lic nsg .00598 CNA	-.00458	.00779	-.02891
10	Step 3 and hospital-based	.6730	.19099	-.00909	.02209	-.03082
11	Step 3 and for-profit	.6130	-.03693	-.01312	.06798	-.03069
12	Step 3 and urban	.6093	.02667	-.01047	.07309	-.02768
13	Step 3 and chain	.6072	-.01466	-.01348	.07302	-.03171
14	Step 3 and Medicare managed care penetration rate	.6139	.00131	-.00751	.07187	-.02891
15	Step 3 and # hospitals	.6101	-.00449	-.00983	.07488	-.02745
16	Step 3 and # hospital admissions	.6054	<.00001	-.01283	.07329	-.03004
17	Step 3 and # hospital beds	.6058	-.00001	-.01286	.07376	-.03008
18	Step 3 and # SNFs	.6162	-.00374	-.00998	.07476	-.02588
19	Step 3 and # SNF certified beds	.6189	-.00006	-.01109	.07186	-.02846
20	Step 3 and # NF beds	.6080	-.00006	-.01269	.07483	-.02633
21	Step 3 and # home health agencies	.6094	-.00358	-.01116	.07400	-.02858
22	Final model	.6921	See Table 4	-.00416	non-signif., dropped	-.02578

Table 4: Community discharge within 30 days final regression model

Variable	Coefficient	Standardized coefficient[1]	p-value
Intercept	0.20505	-	<0.0001
Time	-0.00363	-	0.0367
2000 only indicator	0.00127	-	0.7416
2004 only indicator	-0.02557	-	<0.0001
Age (years)	0.00096	0.01939	0.0008
Female	-0.05018	-0.02799	<0.0001
DNR orders	-0.09405	-0.11696	<0.0001
Do not hospitalize orders	0.00522	0.00165	0.6631
Barthel Index score (0-90)[2]	0.00248	0.12245	<0.0001
Cognitive Performance Scale score (0-6)[3]	-0.03088	-0.12113	<0.0001
Bowel incontinence scale (1-4) (MDS item H1a)[3]	-0.03233	-0.11971	<0.0001
Indwelling catheter (MDS item H3d)	0.03507	0.02194	<0.0001
Feeding tube (MDS item K5b)	-0.04621	-0.02052	0.0003
Parenteral/IV feedings (MDS item K5a)	0.05411	0.04532	<0.0001
Pressure ulcer (MDS item M2a, any stage)	0.00728	0.00445	0.3370
Rehabilitation RUG	0.06019	0.05665	<0.0001
Community discharge comorbidity index (-3.5 to 3.3)	0.08637	0.05870	<0.0001
Cardiac arrhythmia	0.03394	0.01426	0.0017
COPD	-0.04745	-0.02036	<0.0001
Dementia	-0.15164	-0.09265	<0.0001
Fluid/Electrolyte disorder	0.01091	0.00518	0.2442
Fracture	0.03454	0.01354	0.0060
Genitourinary condition	-0.10929	-0.05220	<0.0001
Uncomplicated hypertension	0.07783	0.03870	<0.0001
Musculoskeletal disease	0.16787	0.08825	<0.0001
Nervous system disorder	-0.02246	-0.00974	0.0417
Respiratory disease	-0.02409	-0.01011	0.0217
Skin disorder	-0.09578	-0.03277	<0.0001
Valvular disease	0.07363	0.02112	<0.0001
LOS of qualifying hospital stay (days)	0.00084	0.01166	0.0018
RN hours/resident-day	0.02550	0.09550	<0.0001
Licensed nursing hours/resident-day	0.01899	0.11408	<0.0001
CNA hours/resident-day	0.00208	0.00910	0.0190
Northeast	-0.04200	-	<0.0001
Midwest	-0.05513	-	<0.0001
South	-0.02616	-	<0.0001
Hospital-based	0.11493	-	<0.0001
Urban	0.00231	-	0.2383
For-profit	0.00141	-	0.4099
Chain	-0.00064	-	0.6614

Table 4: Community discharge within 30 days final regression model (continued)

Variable	Coefficient	Standardized coefficient[1]	p-value
Medicare managed care penetration rate in SNF's county	0.00051	0.03922	<0.0001
Number of hospitals[4]	-0.00079	-0.01383	0.0216
Number of hospital admissions[4]	<0.00001	0.02134	0.0001
Number of hospital beds[4]	-0.00002	-0.03650	<0.0001
Number of SNFs[4]	-0.00075	-0.02424	0.0103
Number of SNF certified beds[4]	-0.00001	-0.02158	0.0127
Number of NF total beds[4]	-0.00003	-0.02400	<0.0001
Number of home health agencies[4]	-0.00061	-0.01186	0.0133

Model adjusted R^2 = 0.6951

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[1] Coefficient of the standardized (mean=0, variance=1) variable
[2] Higher values indicate better status
[3] Lower values indicate better status
[4] In SNF's county, per 100,000 population. Data for 2004 were not available; 2002 data were substituted.

Table 5: Rehospitalization within 100 days regression model series

Step	Variables in model	Model adj R^2	Coefficient of tested variable	Coefficient of time	Coefficient of 2000 only	Coefficient of 2004 only
1	Time	.0296	-	.02790	-	-
2	Time, presence at 2000 only and 2004 only indicators	.0399	-	.02595	-.04022	-.00956
3	Time, presence at 2000 only and 2004 only indicators, case mix	.4945	-	.02049	-.02560	-.00664
4	Step 3 and hospital LOS	.4945	.00008 (non-signif.)	.02039	-.02561	-.00659
5	Step 3 and region (Northeast, Midwest, South)	.5028	.02806 NE .02291 MW .01872 S	.02198	-.02467	-.00661
6	Step 3 and RN hours/resident-day	.5082	-.01896	.01794	-.01216	-.00928
7	Step 3 and licensed nursing hours/resident-day	.5101	-.01228	.01912	-.01079	-.00912
8	Step 3 and CNA hours/resident-day	.4925	-.00484	.02093	-.02211	-.00868
9	Step 3 and RN hours/resident-day, licensed nursing hours/resident-day, CNA hours/resident-day	.5119	-.00857 RN -.00777 lic nsg -.00237 CNA	.01881	-.01017	-.00920
10	Step 3 and hospital-based	.5278	-.05691	.01916	-.00986	-.00675
11	Step 3 and for-profit	.5095	.02269	.01967	-.02223	-.00608
12	Step 3 and urban	.4949	-.00363	.02019	-.02557	-.00686
13	Step 3 and chain	.4960	.00660	.02047	-.02548	-.00564
14	Step 3 and Medicare managed care penetration rate	.4959	-.00035	.01915	-.02516	-.00711
15	Step 3 and # hospital beds	.4928	<.00001 (non-signif.)	.02024	-.02571	-.00687
16	Step 3 and # SNFs	.4934	.00040	.02019	-.02581	-.00732
17	Step 3 and # SNF certified beds	.4954	.00001	.02037	-.02534	-.00722
18	Final model	.5362	See Table 6	.01982	-.00591	-.00788

Table 6: Rehospitalization within 100 days final regression model

Variable	Coefficient	Standardized coefficient[1]	p-value
Intercept	0.03077	-	0.0224
Time	0.02029	-	<0.0001
2000 only indicator	-0.00569	-	0.0071
2004 only indicator	-0.00783	-	<0.0001
Age (years)	0.00014	0.00630	0.3745
Female	0.00468	0.00586	0.3059
DNR orders	-0.03779	-0.10504	<0.0001
Do not hospitalize orders	-0.01621	-0.01135	0.0153
Barthel Index (0-90)[2]	-0.00096	-0.10617	<0.0001
Cognitive Performance Scale (0-6)[3]	-0.00266	-0.02325	0.0059
Bowel incontinence scale (1-4) (MDS item H1a)[3]	0.01381	0.11406	<0.0001
Indwelling catheter (MDS item H3d)	-0.00691	-0.00962	0.0600
Feeding tube (MDS item K5b)	0.18704	0.18124	<0.0001
Parenteral/IV feeding (MDS item K5a)	-0.00441	-0.00824	0.1062
Pressure ulcer (MDS item M2a, any stage)	0.05610	0.07659	<0.0001
Rehabilitation RUG	0.02540	0.05340	<0.0001
Rehospitalization case mix index (-3.3 to 3.1)	0.15930	0.15770	<0.0001
Cardiac arrhythmia	0.01832	0.01728	0.0023
COPD	0.00805	0.00774	0.1459
Dementia	0.00610	0.00834	0.2788
Fluid/Electrolyte disorder	0.06856	0.07307	<0.0001
Fracture	-0.10042	-0.08852	<0.0001
Genitourinary condition	0.03653	0.03920	<0.0001
Uncomplicated hypertension	0.01038	0.01157	0.0294
Musculoskeletal disease	-0.03566	-0.04214	<0.0001
Nervous system disorder	-0.05016	-0.04877	<0.0001
Respiratory disease	0.03812	0.03561	<0.0001
Skin disorder	0.06683	0.05118	<0.0001
Valvular disease	-0.06245	-0.04018	<0.0001
LOS of qualifying hospital stay (days)	0.00013	0.00398	0.3872
RN hours/resident-day	-0.00224	-0.01877	0.0399
Licensed nursing hours/resident-day	-0.00410	-0.05506	<0.0001
CNA hours/resident-day	-0.00069	-0.00678	0.1572
Northeast	0.02426	-	<0.0001
Midwest	0.01940	-	<0.0001
South	0.01569	-	<0.0001
Hospital-based	-0.03325	-	<0.0001
Urban	-0.00290	-	0.0073
For-profit	0.01429	-	<0.0001
Chain	0.00260	-	0.0012

Table 6: Rehospitalization within 100 days final regression model (continued)

Variable	Coefficient	Standardized coefficient[1]	p-value
Medicare managed care penetration rate in SNF's county	-0.00012	-0.02048	0.0010
Number of hospitals[4]	0.00004	0.00151	0.8394
Number of hospital admissions[4]	<0.00001	0.00564	0.4152
Number of hospital beds[4]	<0.00001	0.00995	0.1809
Number of SNFs[4]	-0.00065	-0.04658	<0.0001
Number of SNF certified beds[4]	0.00001	0.04150	0.0001
Number of NF total beds[4]	<-0.00001	-0.00651	0.1821
Number of home health agencies[4]	0.00008	0.00328	0.5785

Model adjusted R^2 = 0.5363

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[1] Coefficient of the standardized (mean=0, variance=1) variable
[2] Higher values indicate better status
[3] Lower values indicate better status
[4] In SNF's county, per 100,000 population. Data for 2004 were not available; 2002 data were substituted.

Table 7: Differences between states in adjusted rates of community discharge within 30 days[1]
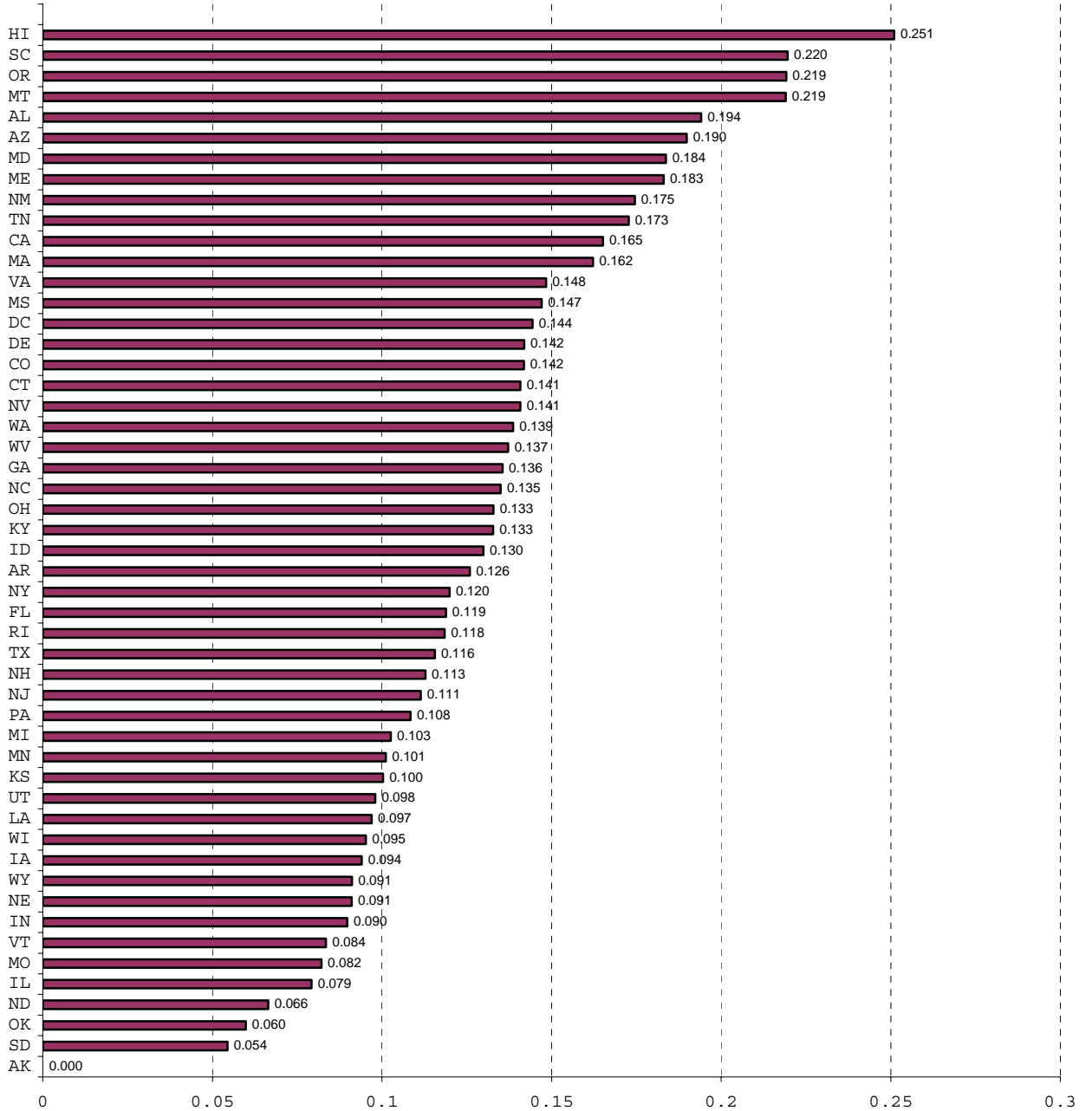
State	Value
HI	0.251
SC	0.220
OR	0.219
MT	0.219
AL	0.194
AZ	0.190
MD	0.184
ME	0.183
NM	0.175
TN	0.173
CA	0.165
MA	0.162
VA	0.148
MS	0.147
DC	0.144
DE	0.142
CO	0.142
CT	0.141
NV	0.141
WA	0.139
WV	0.137
GA	0.136
NC	0.135
OH	0.133
KY	0.133
ID	0.130
AR	0.126
NY	0.120
FL	0.119
RI	0.118
TX	0.116
NH	0.113
NJ	0.111
PA	0.108
MI	0.103
MN	0.101
KS	0.100
UT	0.098
LA	0.097
WI	0.095
IA	0.094
WY	0.091
NE	0.091
IN	0.090
VT	0.084
MO	0.082
IL	0.079
ND	0.066
OK	0.060
SD	0.054
AK	0.000

[1] Values shown are the coefficients of each state's dummy variable forced into the risk-adjusted model. Values can be interpreted as the difference between each state's rate and Alaska's rate, after risk-adjustment for variables found in Table 4 with the exception of region.

Table 8: Differences between states in adjusted rates of rehospitalization within 100 days[1]
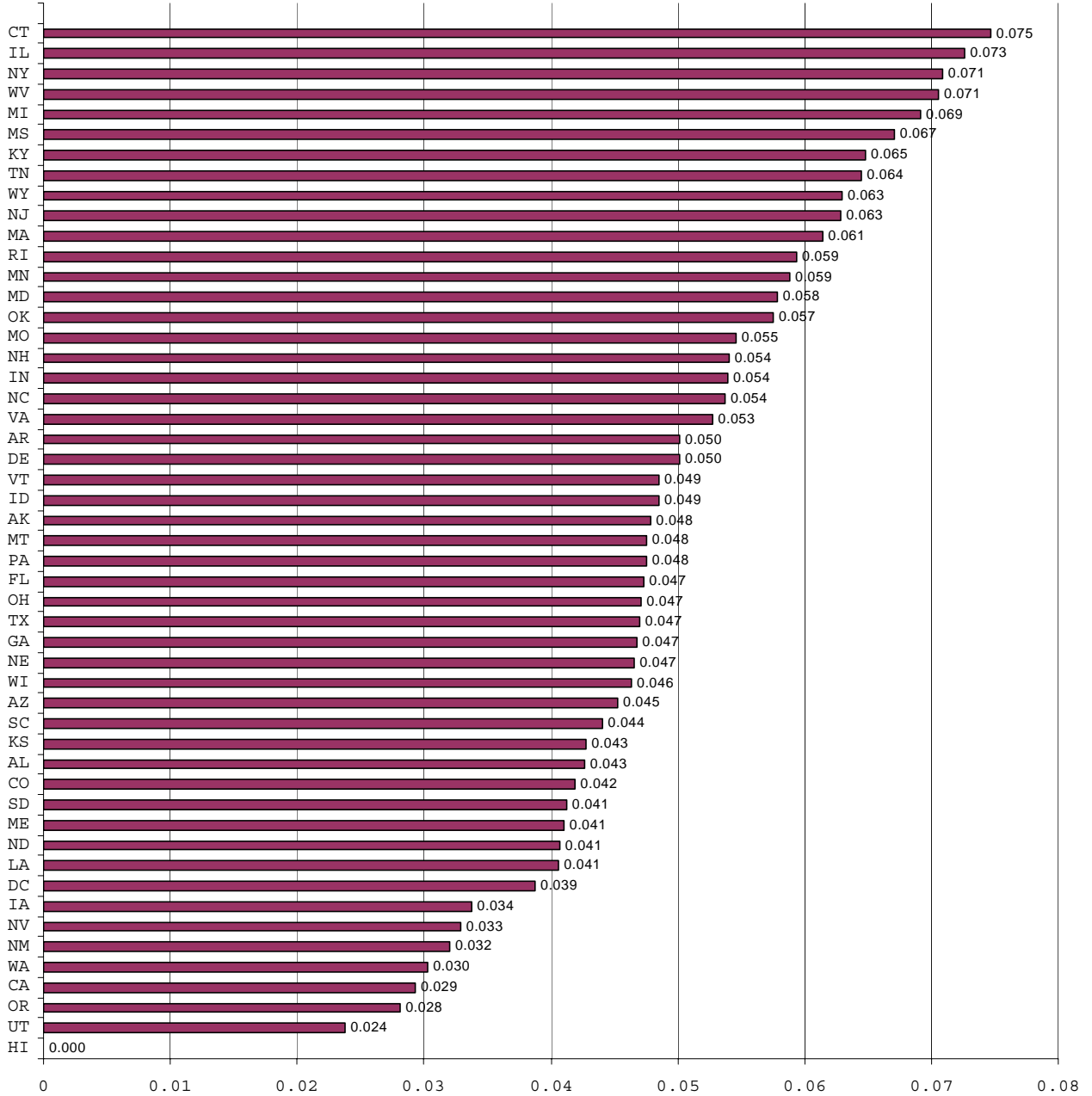
State	Value
CT	0.075
IL	0.073
NY	0.071
WV	0.071
MI	0.069
MS	0.067
KY	0.065
TN	0.064
WY	0.063
NJ	0.063
MA	0.061
RI	0.059
MN	0.059
MD	0.058
OK	0.057
MO	0.055
NH	0.054
IN	0.054
NC	0.054
VA	0.053
AR	0.050
DE	0.050
VT	0.049
ID	0.049
AK	0.048
MT	0.048
PA	0.048
FL	0.047
OH	0.047
TX	0.047
GA	0.047
NE	0.047
WI	0.046
AZ	0.045
SC	0.044
KS	0.043
AL	0.043
CO	0.042
SD	0.041
ME	0.041
ND	0.041
LA	0.041
DC	0.039
IA	0.034
NV	0.033
NM	0.032
WA	0.030
CA	0.029
OR	0.028
UT	0.024
HI	0.000

[1] Values shown are the coefficients of each state's dummy variable forced into the risk-adjusted model. Values can be interpreted as the difference between each state's rate and Hawaii's rate, after risk-adjustment for variables found in Table 6 with the exception of region.

Table 9: Relationship of 2004 NHQI post-acute care QMs[1] to 2004 risk-adjusted[2] outcome rates

Outcome	NHQI quality measure	Coefficient	Model Adj R^2
Community discharge in 30 days (n=10,561)			
	Delirium	.00051	.6308
	Pain	.00111	.6358
	Pressure sore	.00122	.6434
	Delirium, pain, and pressure sore	.00030 Delirium (non-signif.)	.6495
		.00109 Pain	
		.00115 Pressure sore	
Rehospitalization in 100 days (n=10,554)			
	Delirium	-.00045	.5162
	Pain	-.00040	.5186
	Pressure sore	-.00067	.5238
	Delirium, pain, and pressure sore	-.00029 Delirium	.5271
		-.00037 Pain	
		-.00062 Pressure sore	

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[1] Higher values indicate worse performance

[2] Case mix variables in the model for community discharge were: DNR orders, do not hospitalize orders, Barthel Index, Cognitive Performance Scale, bowel incontinence scale, catheter, feeding tube, parenteral/IV feeding, pressure ulcer, rehabilitation RUG, community discharge comorbidity index, cardiac arrhythmia, COPD, dementia, fracture, genitourinary condition, uncomplicated hypertension, musculoskeletal disease, nervous system disorder, skin disorder, and valvular disease.
Case mix variables in the model for rehospitalization were: DNR orders, do not hospitalize orders, Barthel Index, Cognitive Performance Scale, bowel incontinence scale, feeding tube, parenteral/IV feeding, pressure ulcer, rehabilitation RUG, rehospitalization comorbidity index, cardiac arrhythmia, fluid/electrolyte disorder, fracture, genitourinary condition, uncomplicated hypertension, musculoskeletal disease, nervous system disorder, respiratory disease, skin disorder, and valvular disease.

APPENDIX

Table A: Change in mean facility observed rates[1] of outcome measures for 2000 - 2004 SNF admissions, by facility type

	2000 (n=12,225)[2]	2004 (n=13,373)	Difference 2000 to 2004[3]	Relative difference 2000 to 2004[4]
Community discharge in 30 days				
Hospital-based	56.10	52.38	-3.72	-6.63
Freestanding	18.67	18.98	0.31	1.66
Urban	24.44	22.80	-1.64	-6.71
Rural	21.75	19.81	-1.94	-8.92
For-profit	19.40	18.67	-0.73	-3.76
Non-profit	33.15	29.35	-3.80	-11.46
Chain	22.51	20.81	-1.70	-7.55
Not chain	25.49	23.27	-2.22	-8.71
Northeast	22.14	23.16	1.02	4.61
Midwest	23.07	20.99	-2.08	-9.02
South	21.64	19.15	-2.49	-11.51
West	31.09	28.47	-2.62	-8.43
Rehospitalization in 100 days				
Hospital-based	7.44	9.05	1.61	21.64
Freestanding	15.81	18.28	2.47	15.62
Urban	15.12	18.08	2.96	19.58
Rural	13.66	16.15	2.49	18.23
For-profit	16.43	19.19	2.76	16.80
Non-profit	11.18	13.89	2.71	24.24
Chain	15.15	18.05	2.90	19.14
Not chain	13.97	16.74	2.77	19.83
Northeast	15.73	17.71	1.98	12.59
Midwest	13.52	16.18	2.66	19.67
South	16.38	19.37	2.99	18.25
West	11.91	15.45	3.54	29.72

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[1] Values shown are percentages.
[2] Slight differences in sample size for each outcome. Sample size shown for each year is the maximum of the two outcomes for each year.
[3] 2004 rate minus 2000 rate.
[4] 2004 rate minus 2000 rate, divided by 2000 rate, multiplied by 100.

Table B: Mean outcome rates[1] for 2000, 2004, and within-facility change[2] by state, region, and market characteristics

	Community discharge in 30 days			Community discharge in 100 days			Rehospitalization in 30 days			Rehospitalization in 100 days		
	2000	2004	Change	2000	2004	Change	2000	2004	Change	2000	2004	Change
Alabama	19.64	23.10	4.15	23.95	28.09	4.95	12.50	14.79	2.43	17.07	19.29	2.55
Alaska	34.30	36.46	7.24	50.16	51.87	4.76	6.17	7.37	1.11	7.99	10.49	2.18
Arizona	41.33	36.87	-0.68	49.33	47.49	1.40	8.84	12.85	3.97	10.44	15.38	4.65
Arkansas	18.87	15.24	-1.43	25.73	21.95	-1.72	11.42	13.88	2.26	14.88	17.72	2.37
California	26.84	24.01	0.46	32.68	32.41	3.08	11.01	13.71	2.53	14.24	18.14	3.58
Colorado	29.14	28.92	4.05	37.67	40.40	6.75	7.56	10.10	2.69	9.46	12.64	3.31
Connecticut	25.89	28.85	2.66	37.17	41.55	4.12	11.43	12.73	1.45	15.65	17.34	1.90
Delaware	26.79	24.33	-2.04	35.32	32.95	-1.83	9.86	14.96	5.11	13.03	18.31	5.21
District of Columbia	27.87	24.54	0.37	32.83	31.30	1.49	15.84	16.34	0.71	21.30	20.06	-0.63
Florida	29.70	26.66	-0.24	38.19	37.62	1.75	11.84	14.35	2.27	15.05	18.41	2.88
Georgia	13.12	13.55	0.86	17.77	19.05	1.77	13.92	15.21	1.54	18.43	19.76	1.63
Hawaii	30.69	31.02	2.37	41.27	41.71	3.21	6.94	8.05	0.79	9.95	10.62	0.45
Idaho	29.14	29.09	2.12	40.26	42.39	3.53	6.65	7.16	0.57	9.61	10.16	0.51
Illinois	22.03	19.01	0.52	28.24	26.59	1.88	12.99	15.56	2.48	16.28	20.06	3.60
Indiana	21.73	18.72	0.19	30.63	30.10	2.62	10.03	11.77	1.49	13.55	16.46	2.45
Iowa	25.53	21.25	-1.57	32.09	25.88	-3.50	7.98	8.91	1.06	9.28	10.36	1.24
Kansas	24.14	20.83	2.05	30.72	30.50	4.44	9.34	10.23	0.66	11.04	13.39	1.80
Kentucky	17.32	16.98	2.20	22.42	24.10	4.24	13.10	14.46	1.49	17.26	19.96	2.63
Louisiana	16.52	10.01	0.18	19.89	14.71	1.44	13.80	15.95	1.01	18.11	21.07	1.28
Maine	39.42	33.50	-2.75	49.28	43.46	-1.91	8.06	10.24	1.86	9.61	12.88	2.84
Maryland	28.90	29.01	2.56	35.73	37.65	4.01	13.68	16.56	2.75	16.88	20.06	2.95
Massachusetts	26.59	27.32	2.24	33.55	36.36	4.34	10.90	12.43	1.44	13.73	16.00	2.25
Michigan	16.75	18.27	1.53	27.35	30.14	2.50	12.28	14.89	2.74	16.80	19.70	3.13
Minnesota	21.80	25.06	3.53	29.42	34.48	5.14	8.67	10.68	2.02	11.33	13.35	2.08
Mississippi	19.14	13.54	-0.10	24.26	19.58	0.73	13.45	14.84	0.04	18.72	20.45	0.17
Missouri	22.87	17.93	-1.13	29.76	25.83	-0.55	10.80	12.95	2.14	13.31	16.71	3.34
Montana	47.22	45.33	-2.54	59.85	58.66	-2.60	6.51	6.89	0.11	7.75	8.96	0.73
Nebraska	22.54	21.58	2.93	29.22	29.53	4.24	8.51	9.12	0.94	10.43	12.03	1.66
Nevada	28.38	21.47	1.55	37.11	31.80	2.40	9.21	12.29	2.74	12.65	17.37	4.61
New Hampshire	29.81	25.72	0.54	42.39	37.77	0.59	8.12	8.98	1.28	10.85	11.95	1.39

Table B: Mean outcome rates[1] for 2000, 2004, and within-facility change[2] by state, region, and market characteristics (continued)

	Community discharge in 30 days			Community discharge in 100 days			Rehospitalization in 30 days			Rehospitalization in 100 days		
	2000	2004	Change	2000	2004	Change	2000	2004	Change	2000	2004	Change
New Jersey	23.24	24.12	0.96	28.48	31.42	2.65	15.63	17.30	1.91	19.21	21.06	2.04
New Mexico	28.89	29.81	4.62	38.03	41.03	6.57	7.43	9.46	1.43	9.55	12.31	2.16
New York	13.50	17.88	4.47	22.00	27.42	5.54	13.22	15.25	2.13	18.37	20.26	2.03
North Carolina	19.21	19.84	2.21	27.14	29.16	3.40	11.76	13.14	1.40	16.15	18.11	2.11
North Dakota	10.78	12.51	1.68	15.25	19.38	3.84	9.12	8.94	-0.15	11.20	11.66	0.20
Ohio	27.69	23.96	-1.90	37.05	35.34	-0.28	12.02	14.16	2.26	14.78	17.76	3.01
Oklahoma	20.45	15.06	2.52	25.25	21.64	4.40	12.00	14.59	1.76	15.94	19.44	1.98
Oregon	45.30	42.15	-1.03	52.49	54.86	4.35	7.02	10.00	2.53	7.98	11.78	3.46
Pennsylvania	22.27	21.15	1.29	28.90	29.65	2.96	11.30	13.03	1.66	14.42	16.52	1.94
Rhode Island	20.24	23.16	4.91	25.28	29.87	6.77	13.04	13.61	0.78	15.85	16.85	1.24
South Carolina	24.81	21.76	0.29	38.25	34.45	-0.68	11.96	14.10	2.25	16.21	19.35	3.21
South Dakota	22.87	19.11	-2.43	32.56	26.61	-4.47	8.20	8.96	0.91	10.33	10.81	0.45
Tennessee	22.65	20.03	1.88	31.26	29.08	2.54	12.00	15.08	2.68	16.40	20.31	3.09
Texas	18.43	14.96	1.05	23.50	21.43	2.14	12.11	14.88	2.31	15.98	19.97	3.25
Utah	36.31	32.96	-0.53	52.02	50.64	1.26	6.42	7.91	1.61	8.69	11.02	2.44
Vermont	26.59	26.77	2.93	38.29	39.22	4.79	7.98	8.91	1.18	11.44	12.18	1.13
Virginia	25.68	24.07	0.75	36.39	35.77	1.84	12.22	14.12	1.69	16.14	18.48	1.85
Washington	34.51	31.10	-2.45	42.58	43.07	1.52	7.79	10.72	2.81	9.65	13.65	3.93
West Virginia	26.93	23.20	0.00	35.70	31.52	-0.17	12.81	13.31	0.01	16.67	17.84	0.43
Wisconsin	24.31	24.33	-0.44	33.28	35.36	1.76	7.95	10.04	2.27	10.15	12.94	3.13
Wyoming	31.03	28.15	-0.57	41.79	41.51	2.80	7.71	8.66	0.89	10.45	12.12	1.99
Northeast	22.14	23.16	2.28	29.76	32.36	3.80	12.09	13.76	1.72	15.73	17.71	2.01
Midwest	23.08	20.99	0.13	31.20	30.51	1.48	10.66	12.57	2.01	13.51	16.19	2.75
South	21.65	19.15	1.10	28.50	27.14	2.22	12.41	14.64	1.96	16.37	19.37	2.49
West	31.10	28.45	0.34	38.66	38.73	3.01	9.32	11.87	2.41	11.91	15.48	3.33
Rural	21.75	19.81	0.63	29.41	28.34	1.67	10.44	12.20	1.59	13.63	16.16	2.22
Urban	24.44	22.80	1.04	31.88	32.08	2.74	11.71	13.98	2.16	15.12	18.09	2.75
Number of hospitals[3] - low[4]	23.60	23.61	1.33	31.26	33.36	3.21	11.97	14.56	2.41	15.42	18.70	3.00
Number of hospitals - mid[4]	24.72	23.90	0.83	32.24	33.33	2.43	11.35	13.62	2.06	14.70	17.74	2.69
Number of hospitals - high[4]	21.56	20.93	0.73	28.87	29.43	1.70	10.64	12.27	1.40	13.88	16.20	1.96
Number of hospital beds[3] - low	23.33	23.44	1.39	31.17	33.33	3.23	10.89	13.13	2.03	14.09	17.10	2.70
Number of hospital beds - mid	24.13	23.19	0.59	31.68	32.51	2.08	11.39	13.77	2.15	14.79	17.94	2.79
Number of hospital beds - high	23.01	22.56	1.17	30.08	31.15	2.38	11.64	13.45	1.62	15.02	17.46	2.08

Table B: Mean outcome rates[1] for 2000, 2004, and within-facility change[2] by state, region, and market characteristics (continued)

	Community discharge in 30 days			Community discharge in 100 days			Rehospitalization in 30 days			Rehospitalization in 100 days		
	2000	2004	Change	2000	2004	Change	2000	2004	Change	2000	2004	Change
Number of SNFs[3] - low	24.63	23.82	1.04	31.99	33.37	2.96	12.39	15.19	2.51	16.09	19.65	3.07
Number of SNFs - mid	24.00	23.58	1.12	31.57	32.89	2.57	11.28	13.43	1.96	14.60	17.48	2.59
Number of SNFs - high	21.97	21.41	0.46	29.49	30.36	1.67	10.37	12.07	1.51	13.41	15.81	2.11
Number of SNF certified beds[3] - low	26.49	25.11	0.97	33.67	34.55	2.93	11.29	14.10	2.45	14.63	18.43	3.20
Number of SNF certified beds - mid	23.57	23.26	1.12	31.23	32.60	2.52	11.56	13.73	1.97	14.98	17.79	2.49
Number of SNF certified beds - high	20.94	20.77	0.52	28.43	29.78	1.82	10.89	12.55	1.57	14.08	16.42	2.18
Number of NFs[3] - low	23.10	23.22	1.28	31.01	32.80	2.77	11.10	13.14	1.90	14.47	17.13	2.41
Number of NFs - mid	24.46	23.67	1.10	31.46	32.82	2.92	11.95	14.38	2.15	15.47	18.71	2.79
Number of NFs - high	23.91	22.27	0.04	31.12	31.06	1.28	11.16	13.46	2.00	14.27	17.47	2.77
Number of NF total beds[3] - low	23.10	23.22	1.28	31.01	32.80	2.77	11.10	13.14	1.90	14.47	17.13	2.41
Number of NF total beds - mid	24.85	24.17	1.12	31.93	33.43	2.98	11.84	14.21	2.10	15.30	18.43	2.72
Number of NF total beds - high	23.52	21.77	0.02	30.66	30.46	1.23	11.27	13.63	2.05	14.45	17.77	2.84
Number of home health agencies[3] - low	22.73	22.63	1.18	30.07	32.02	3.09	12.02	14.46	2.18	15.58	18.78	2.80
Number of home health agencies - mid	24.73	24.10	0.90	32.48	33.72	2.46	11.35	13.52	2.01	14.66	17.58	2.65
Number of home health agencies - high	22.40	21.53	0.75	29.59	30.03	1.76	10.59	12.59	1.73	13.79	16.47	2.25
Medicare managed care penetration rate in SNF's county - low	20.80	20.58	0.86	28.77	29.75	1.86	10.53	12.39	1.69	13.99	16.52	2.24
Medicare managed care penetration rate in SNF's county - mid	23.49	23.09	0.96	31.27	32.73	2.55	11.76	13.89	1.93	15.18	18.05	2.54
Medicare managed care penetration rate in SNF's county - high	26.89	25.79	0.95	33.35	34.43	2.85	11.25	13.97	2.43	14.32	17.83	3.08

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[1] Entries in cell are the value of the observed rate for facilities in that stratum and have not been adjusted for differences in case mix. Values shown are percentages.

[2] "Change" is *within facility* change (not the simple subtraction of the two columns) and is defined only for the subset of facilities present at both 2000 and 2004
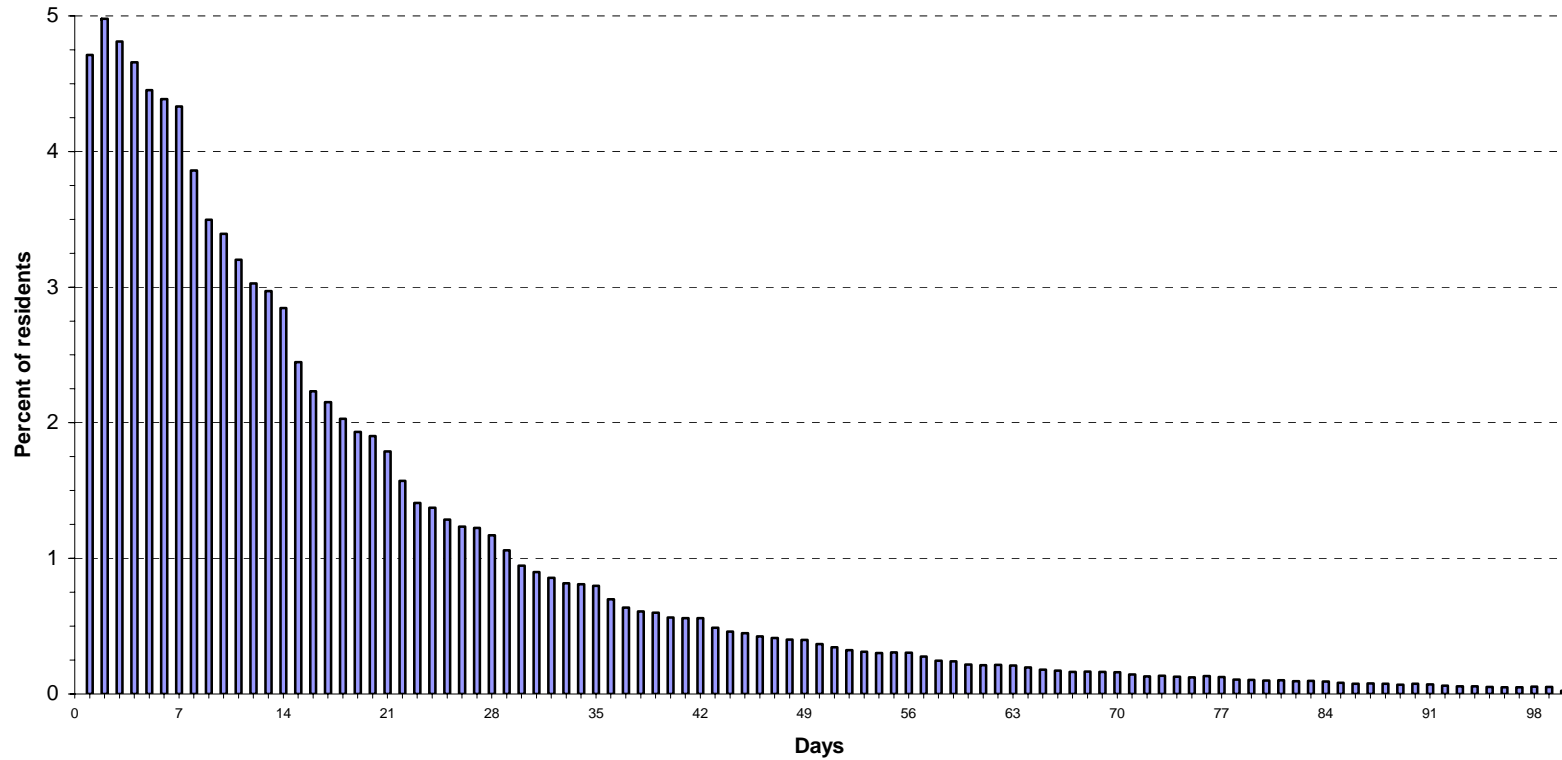
[3] In SNF's county, per 100,000 population

[4] "low" indicates the market characteristic's bottom 25th percentile in 2000, "mid" indicates the 26th to 74th percentile in 2000, "high" indicates the top 25th percentile in 2000

Table C: Distribution of days until rehospitalization within 100 days of SNF admission for years 2000 through 2004

Table D: Comparison of mean facility measures[1] for facilities that experienced large decreases, large increases, or were unchanged in rate of community discharge within 30 days between 2000 and 2004

Characteristic	Decreased more than 0.05 (n=2665)	Changed 0.05 or less (n=4977)	Increased more than 0.05 (n=3534)
Observed community discharge in 30 days for 2000	34.07	19.73	16.61
Observed community discharge in 30 days for 2004	21.56	19.93	28.68
Difference in community discharge in 30 days 2000 to 2004	-12.51	0.20	12.07
Northeast	18.13	20.74	24.01
Midwest	33.50	30.31	29.80
South	29.98	35.34	31.45
West	18.39	13.62	14.74
Hospital-based	10.81	9.48	9.28
Non-profit	0.26	0.24	0.31
Number of NFs[2] for 2000	0.92	0.82	0.74
Number of NF beds[2] for 2000	75.97	68.27	56.03
RN hours/resident-day for 2000	0.57	0.52	0.52
RN hours/resident-day for 2004	0.50	0.48	0.45
Difference in RN hours/resident-day 2000 to 2004	-0.07	-0.05	-0.05
Age (years) for 2000	80.32	80.27	81.09
Age (years) for 2004	79.61	79.25	80.01
Difference in age 2000 to 2004	-0.72	-1.03	-1.09
DNR orders for 2000	37.10	38.39	43.08
DNR orders for 2004	40.37	39.06	40.97
Difference in DNR orders 2000 to 2004	3.24	0.65	-2.14
Barthel Index (0-90)[3] for 2000	39.57	35.20	35.10
Barthel Index (0-90)[3] for 2004	36.89	35.54	37.83
Difference in Barthel Index 2000 to 2004	-2.70	0.33	2.74
Cognitive Performance Scale (0-6)[4] for 2000	1.80	2.14	2.12
Cognitive Performance Scale (0-6)[4] for 2004	1.86	2.02	1.80
Difference in Cognitive Performance Scale 2000 to 2004	0.06	-0.12	-0.33
Bowel incontinence scale (1-4)[4] for 2000	1.17	1.49	1.42
Bowel incontinence scale (1-4)[4] for 2004	1.27	1.43	1.21
Difference in bowel incontinence scale 2000 to 2004	0.10	-0.06	-0.21
Rehabilitation RUG for 2000	80.69	74.86	75.62
Rehabilitation RUG for 2004	78.83	75.84	79.93
Difference in rehabilitation RUG 2000 to 2004	-1.85	0.97	4.32
Dementia for 2000	21.48	25.42	25.70
Dementia for 2004	23.52	25.62	23.02
Difference in dementia 2000 to 2004	2.05	0.20	-2.70
Genitourinary disease for 2000	32.01	33.90	33.93
Genitourinary disease for 2004	38.11	38.84	37.51
Difference in genitourinary disease 2000 to 2004	6.10	4.95	3.58
Musculoskeletal disease for 2000	29.48	26.98	27.70
Musculoskeletal disease for 2004	30.67	29.28	32.05
Difference in musculoskeletal disease 2000 to 2004	1.19	2.29	4.37

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[1] Values are interpreted as "Mean % of residents in the facility with this condition", or as "Mean resident value for this item"
[2] In SNF's county, per 100,000 population
[3] Higher values indicate better status
[4] Lower values indicate better status

Table E: Comparison of mean facility measures[1] for facilities that experienced large decreases, large increases, or were unchanged in rate of rehospitalization within 100 days between 2000 and 2004

Characteristic	Decreased more than 0.05 (n=1428)	Changed 0.05 or less (n=5818)	Increased more than 0.05 (n=3908)
Observed rehospitalization in 100 days for 2000	23.84	14.80	12.19
Observed rehospitalization in 100 days for 2004	14.35	15.39	22.19
Difference in rehospitalization in 100 days 2000 to 2004	-9.49	0.59	10.00
Northeast	22.30	22.65	18.67
Midwest	30.70	30.21	32.05
South	34.86	32.34	32.72
West	12.14	14.80	16.55
Hospital-based	4.14	14.88	4.18
Number of hospital beds[2] for 2000	383.80	373.55	360.77
Number of SNFs[2] for 2000	7.88	7.17	7.08
Number of SNF certified beds[2] for 2000	759.16	713.74	696.98
Medicare managed care penetration rate in SNF's county for 2000	13.76	14.27	15.34
RN hours/resident-day for 2000	0.39	0.65	0.42
RN hours/resident-day for 2004	0.34	0.58	0.37
Difference in RN hours/resident-day 2000 to 2004	-0.04	-0.06	-0.05
Qualifying hospital LOS (days) for 2000	9.37	9.25	9.30
Qualifying hospital LOS (days) for 2004	8.74	8.78	8.80
Difference in qualifying hospital LOS 2000 to 2004	-0.64	-0.47	-0.50
Barthel Index (0-90)[3] for 2000	32.54	37.63	36.03
Barthel Index (0-90)[3] for 2004	35.73	38.17	34.99
Difference in Barthel Index 2000 to 2004	3.20	0.54	-1.03
Cognitive Performance Score (0-6)[4] for 2000	2.37	1.93	2.08
Cognitive Performance Score (0-6)[4] for 2004	2.12	1.78	2.00
Difference in Cognitive Performance Score 2000 to 2004	-0.25	-0.15	-0.09
Bowel incontinence scale (1-4)[4] for 2000	1.66	1.29	1.41
Bowel incontinence scale (1-4)[4] for 2004	1.44	1.21	1.42
Difference in bowel incontinence scale 2000 to 2004	-0.22	-0.08	0.01
Catheter for 2000	23.41	21.66	20.34
Catheter for 2004	21.33	23.52	23.35
Difference in catheter 2000 to 2004	-2.08	1.86	3.02
Pressure ulcer for 2000	25.54	22.71	23.16
Pressure ulcer for 2004	22.33	22.42	24.73
Difference in pressure ulcer % 2000 to 2004	-3.22	-0.30	1.56
Dementia for 2000	27.53	23.06	25.62
Dementia for 2004	27.88	22.85	24.96
Difference in dementia 2000 to 2004	0.36	-0.21	-0.67
Genitourinary disease for 2000	35.94	32.72	33.42
Genitourinary disease for 2004	38.25	37.10	39.74
Difference in genitourinary disease 2000 to 2004	2.30	4.37	6.32
Musculoskeletal disease for 2000	24.77	28.85	27.68
Musculoskeletal disease for 2004	28.90	32.03	28.99
Difference in musculoskeletal disease 2000 to 2004	4.12	3.19	1.32
Respiratory disease for 2000	27.28	25.04	25.12
Respiratory disease for 2004	26.31	26.16	28.01
Difference in respiratory disease 2000 to 2004	-0.99	1.11	2.88

[1] Values are interpreted as "Mean % of residents in the facility with this condition", or as "Mean resident value for this item"
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Table F: Differences between facilities present in 2000[1] versus 2004[2]

	Present in 2000 regardless of 2004 status (n=12,224)	Present in 2004 regardless of 2000 status (n=13,351)	Present in both 2000 & 2004 (n=11,118)		Present ONLY in 2000 (n=1040)	Present ONLY in 2004 (n=2162)
	Means for 2000	Means for 2004	Means for 2000	Means for 2004	Means for 2000	Means for 2004
Observed outcome rates						
Community discharge in 30 days	23.66	21.87	22.18	23.09	39.88	15.72
Rehospitalization in 100 days	14.69	17.48	15.05	17.64	10.91	16.72
Mean resident characteristics[3]						
Age (years)	80.39	79.68	80.54	79.57	78.72	80.27
DNR orders	38.48	41.11	39.56	39.94	26.68	46.87
Do not hospitalize orders	1.86	1.78	1.93	1.79	1.03	1.77
Barthel Index (0-90)[4]	36.70	36.50	36.22	36.58	41.97	36.12
Cognitive Performance Scale (0-6)[5]	2.02	1.94	2.05	1.91	1.69	2.10
Bowel incontinence scale (1-4) (MDS item H1a)[5]	1.37	1.33	1.39	1.32	1.14	1.39
Indwelling catheter (MDS item H3d)	22.05	23.00	21.66	23.36	26.21	21.11
Feeding tube (MDS item K5b)	9.41	7.21	9.47	7.18	8.62	7.34
Parenteral/IV feeding (MDS item K5a)	6.94	11.34	6.70	11.53	9.50	10.39
Pressure ulcer (MDS item M2a, any stage)	2.33	22.99	23.52	23.42	21.38	20.75
Rehabilitation RUG	76.23	77.42	76.50	77.85	73.54	75.32
Community discharge comorbidity index (-3.5 to 3.3)	-0.48	-0.49	-0.49	-0.48	-0.43	-0.50
Rehospitalization comorbidity index (-3.3 to 3.1)	0.38	0.41	0.38	0.41	0.37	0.40
Cardiac arrhythmia	25.89	27.41	26.02	27.56	24.51	26.59
COPD	22.53	24.04	22.45	24.17	23.46	23.37
Dementia	24.02	24.88	24.57	24.29	18.00	27.90
Fluid/Electrolyte disorder	29.63	32.28	29.76	32.21	28.32	32.60
Fracture	16.21	14.30	16.33	14.19	14.89	14.86
Genitourinary condition	33.20	38.30	33.46	38.24	30.45	38.59
Uncomplicated hypertension	37.60	43.03	37.69	42.97	36.76	43.36
Musculoskeletal disease	27.92	30.34	27.81	30.49	29.18	29.64
Nervous system disorder	25.27	25.93	25.57	25.68	21.90	27.14
Respiratory disease	25.54	27.00	25.46	26.91	26.29	27.41
Skin disorder	12.44	13.25	12.37	13.37	13.22	12.64
Valvular disease	7.76	8.8	7.81	8.98	7.18	7.89
LOS of qualifying hospital stay (days)	9.25	8.74	9.28	8.78	8.90	8.53

	Present in 2000 regardless of 2004 status (n=12,224)	Present in 2004 regardless of 2000 status (n=13,351)	Present in both 2000 & 2004 (n=11,118)		Present ONLY in 2000 (n=1040)	Present ONLY in 2004 (n=2162)
	Means for 2000	Means for 2004	Means for 2000	Means for 2004	Means for 2000	Means for 2004
Staffing levels						
RN hours/resident-day	0.59	0.45	0.53	0.47	1.33	0.33
Licensed nursing hours/resident-day	1.75	1.62	1.65	1.66	2.99	1.44
CNA hours/resident-day	2.30	2.42	2.29	2.43	2.39	2.40
Facility characteristics						
Northeast	20.81	19.21	21.20	21.20	17.17	9.24
Midwest	30.79	31.90	30.93	30.94	29.49	36.61
South	32.89	34.10	32.80	32.82	33.66	40.86
West	15.51	14.79	15.07	15.04	19.69	13.29
Hospital-based	13.33	8.66	9.75	9.36	51.83	5.13
Urban	71.11	68.91	71.02	71.02	72.60	58.60
For-profit	67.01	68.24	68.77	68.50	47.98	66.95
Chain	61.31	56.89	61.57	59.11	58.65	45.65
Market characteristics						
Medicare managed care penetration rate in SNF's county	14.74	10.25	14.58	10.61	16.46	8.52
Number of hospitals[6]	2.60	2.68	2.56	2.52	3.03	3.62
Number of hospital admissions[6]	12,651.62	12,710.49	12,549.24	12,846.28	13,803.36	11,645.14
Number of hospital beds[6]	374.01	362.52	290.58	370.43	408.92	367.66
Number of SNFs[6]	7.28	7.42	7.23	7.12	7.75	9.50
Number of SNF certified beds[6]	712.07	717.11	713.61	706.36	691.38	808.68
Number of NF total beds[6]	69.10	62.22	66.23	50.07	99.36	94.12
Number of home health agencies[6]	3.12	3.07	3.09	2.93	3.42	3.72

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[1] Sample for 2000 is facilities with non-missing data in 2000 for rehospitalization in 100 days and community discharge in 30 days

[2] Sample for 2004 is facilities with non-missing data in 2004 for rehospitalization in 100 days and community discharge in 30 days

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

[4] Higher values indicate better status

[5] Lower values indicate better status

[6] In SNF's county, per 100,000 population. Data for 2004 were not available; 2002 data were substituted.

Table G: Comparison of mean facility measures[1] for freestanding and hospital-based SNFs

	Freestanding (n=12,176)	Hospital-based (n=1154)	p-value
Mean resident characteristics[2]			
DNR orders	42.12	26.34	<0.0001
Barthel Index (0-90)[3]	35.84	45.40	<0.0001
Cognitive Performance Scale (0-6)[4]	2.00	1.19	<0.0001
Bowel incontinence scale (1-4) (MDS item H1a)[4]	1.37	0.79	<0.0001
Indwelling catheter (MDS item H3d)	22.26	28.76	<0.0001
Feeding tube (MDS item K5b)	7.32	4.86	<0.0001
Parenteral/IV feeding (MDS item K5a)	10.65	18.02	<0.0001
Pressure ulcer (MDS item M2a, any stage)	22.96	20.93	<0.0001
Rehabilitation RUG	77.73	75.14	0.0117
Cardiac arrhythmia	27.40	26.75	0.0002
COPD	23.98	24.47	0.0080
Dementia	25.98	12.69	<0.0001
Fluid/Electrolyte disorder	32.57	28.19	<0.0001
Fracture	14.19	15.74	<0.0001
Genitourinary condition	38.80	32.16	<0.0001
Uncomplicated hypertension	42.94	44.97	<0.0001
Musculoskeletal disease	29.78	37.24	<0.0001
Nervous system disorder	26.48	19.97	<0.0001
Respiratory disease	26.98	26.11	0.0001
Skin disorder	13.23	12.74	<0.0001
Valvular disease	8.75	9.17	0.0031
LOS of qualifying hospital stay (days)	8.75	8.7	0.4678
Staffing levels			
RN hours/resident-day	0.35	1.72	<0.0001
LPN/LVN hours/resident-day	0.82	1.40	<0.0001
CNA hours/resident-day	2.40	2.66	<0.0001
Licensed nursing hours/resident-day	1.44	3.72	<0.0001
Total nursing hours/resident-day	4.09	6.54	<0.0001
PT hours/resident-day	0.09	0.42	<0.0001
OT hours/resident-day	0.11	0.39	<0.0001
Speech therapy hours/resident-day	0.03	0.07	<0.0001
Total therapy hours/resident-day	0.23	0.88	<0.0001
Facility characteristics			
Northeast	19.56	15.69	0.0013
Midwest	32.00	30.78	0.4074
South	34.05	34.79	0.6251
West	14.39	18.74	0.0001
Urban	69.68	61.27	<0.0001
For-profit	73.45	13.52	<0.0001
Non-profit	23.36	69.93	<0.0001
Chain	58.95	35.53	<0.0001
Total beds in facility	120.98	77.01	<0.0001

Table G: Comparison of mean facility measures[1] for freestanding and hospital-based SNFs (continued)

	Freestanding (n=12,176)	Hospital-based (n=1154)	p-value
Market characteristics			
Medicare managed care penetration rate in SNF's county	10.32	9.95	0.1426
Number of hospitals[5]	2.60	3.42	<0.0001
Number of hospital admissions[5]	12,531.89	14,168.15	<0.0001
Number of hospital beds[5]	348.10	498.04	<0.0001
Number of SNFs[5]	7.42	7.76	0.0017
Number of SNF certified beds[5]	721.59	708.83	0.3771
Number of NFs[5]	0.71	0.72	0.9765
Number of NF total beds[5]	54.99	67.26	0.6719
Number of home health agencies[5]	2.99	3.55	<0.0001
NHQI post-acute care QMs			
Delirium score	3.09	4.39	<0.0001
Pain score	20.81	34.26	<0.0001
Pressure sores score	20.12	26.40	<0.0001

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[1] Values are percentages unless otherwise noted
[2] Values are interpreted as "Mean % of residents in the facility with this condition", or as "Mean resident value for this item"
[3] Higher values indicate better status
[4] Lower values indicate better status
[5] In SNF's county, per 100,000 population. Data for 2004 were not available; 2002 data were substituted.