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The Association Between Therapy Intensity and Discharge Outcomes in Aged Medicare Skilled Nursing Facilities Admissions

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Abstract

Objective—To determine the association between therapy intensity and discharge outcomes for aged Medicare skilled nursing facilities (SNFs) fee-for-service admissions. Second, to determine the association between intensity and time to community discharge.

Design—A retrospective, observational design. Year 2008 databases of the Minimum Data Set, Online Survey Certification and Reporting dataset, and Rural Urban Commuting Area Codes were linked.

Setting—SNFs in California, Florida, New York, Ohio, Texas.

Participants—There were 311,338 fee-for-service aged Medicare patients in 3,605 SNFs.

Interventions—Total minutes of physical therapy, occupational therapy, and speech therapy per day were divided into intensity groups: high (≥60 minutes), medium-high (45-<60 minutes), medium-low (30-<45 minutes), low (<30 minutes).

Main Outcome Measures—Four discharge outcomes (community, hospitalization, permanent placement, death) were examined using a multivariate competing hazards model. For those with community discharge, a Poisson multivariate model was employed to determine whether length of stay differed by intensity.

Results—High intensity therapy was associated with more community discharges, compared to remaining intensity groups (Hazard Ratio=0.84; 0.68; 0.433 for medium-high, medium-low, and low therapy intensity groups, respectively). More hospitalizations and deaths were found as

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therapy intensity declined. Only high intensity therapy was associated with a 2-day shorter LOS (Incident Rate Ratio=0.95).

Conclusions—High therapy intensity was associated with desirable discharge outcomes and may shorten SNF LOS. Despite growing reimbursements to SNFs for rehabilitation services, there may be desirable benefits to beneficiaries who receive high intensity therapy.

Keywords

Skilled Nursing Facility; therapy intensity; outcomes; length of stay

Medicare beneficiaries account for approximately 2.5 million skilled nursing facility (SNF) admissions each year, and most of these admissions will receive rehabilitation interventions. [1] Beneficiaries qualify for admission by having at least a 3-day long acute hospitalization within 30 days prior to SNF admission and by needing daily skilled nursing and/or rehabilitative care. [1] Provision of rehabilitation therapies, including physical therapy (PT), occupational therapy (OT), and speech therapy (ST), is intended to improve physical and cognitive functioning, with community discharge being the primary desired outcome. In recent years, concern has been growing about the cost of rehabilitative care delivered in SNFs with mounting evidence that financial margins in SNFs are increasing with concomitant allocation of residents to more intensive rehabilitation therapy. [2,3]

Under the prospective payment system (PPS), SNFs have a financial incentive to provide rehabilitation therapies, and they receive greater reimbursement as therapy intensity increases. [4–6] Studies focusing on the impact of PPS on the provision of rehabilitative SNF services have demonstrated post-PPS shifts in utilizations toward higher intensity rehabilitation categories found with the highest reimbursement rates. [3,7] While these studies have provoked the debate about incentives in the Medicare SNF payment model, to date there has been very little research as to whether Medicare beneficiaries benefit from allocation into high intensity rehabilitation therapies. Furthermore, little is currently known about the impact of SNF therapy intensity may have on discharge outcomes. Sizable studies conducted in the US, have found positive results with increased therapy intensity. For instance, Jette and colleagues[8] found that residents in facilities providing higher levels of therapy had higher odds of discharge to the community. Using the same convenience sample, but focusing specifically on patients with selected conditions, Jette et al. [9] demonstrated shorter LOS and functional status improvement at higher levels of therapy intensity. A more recent study[10] quantified that community discharge was increased 3.1% if one more hour of PT/OT/ST per week was provided in a sample of Medicare beneficiaries with hip fracture in SNFs. Lastly, in a study focusing specifically on SNF patients with stroke, Wodchis et al.,[11] showed that in certain subgroups, higher therapy intensity was associated with reduced time to community discharge.

Despite these results, it remains unknown whether therapy intensity has **the** potential to affect other discharge outcomes that compete with community discharge in a Medicare sample of SNF residents. Risks for different types of discharge **outcomes** such as, **discharge to the community, to the** hospital, placement, or death, are present throughout any rehabilitative SNF stay, and therefore should be viewed as competing risks.[12]

Policy recommendations to reduce reimbursement to SNFs for rehabilitation interventions are currently being considered in absence of empirical evidence about the effectiveness of rehabilitation therapy intensity on patient outcomes. Increased costs to Medicare may have clinical justification; however, without such evidence, decisions to reduce reimbursements are based solely on costs. Thus, the goal of our study was to examine the efficiency of rehabilitation therapy on SNF residents' outcomes in a large national sample of Medicare admissions. In addition, the current literature on SNF discharge outcomes usually focused on one outcome, e.g., hospitalization, or home discharge, rather than all four possible discharges. Employing competing risk regression models, this study aimed to examine the association between therapy intensity with each of those four SNF discharge possibilities. Our objectives were two-fold: 1) To examine the association between therapy intensity and competing discharge outcomes to community, hospital, permanent nursing home placement or death; 2) To determine the association between therapy intensity and time to discharge to the community.

METHODS

Design and Data

A retrospective study of administrative databases was used to identify SNF Medicare admissions, and to obtain information on intensity of rehabilitative therapies; we employed the Minimum Data Set (MDS) for 2008. The MDS is a federally mandated assessment of SNF residents, containing comprehensive health status assessments of all residents, providing information on residents' socio-demographics, diagnoses, physical, psychological, and psychosocial functioning, as well as, information on rehabilitation therapies. The MDS is required for care planning and tracking, quality measurement, as well as for reimbursement purposes.[13] Studies have demonstrated validity and reliability of the MDS.[14,15]

Information on facility-level variables was obtained from the Online Survey Certification and Reporting (OSCAR) database through Brown University's Long Term Care (LTC) Facts website.[16] We used zip code level Rural-Urban Commuting Area Codes (RUCA) to characterize facilities as rural or urban.[17,18]

Study Population

The study sample includes nursing homes and their residents from 5 states - California, Florida, New York, Ohio, and Texas. We selected these states because they account for a large population of SNF residents (31.5% of all Medicare admissions per year[19]), and because they are diverse geographically and practice patterns. Overall, in 2008 we identified 4,975 SNFs in these states and a total of 742,282 MDS assessments. Medicare SNF admission criteria were met[1] and within each facility, we identified the first new admission[20] for aged 65 and older Medicare fee-for-service beneficiaries (n = 388,486). Several exclusions were made to this study population. First, discharges that could not be tracked to one of our discharges of interest were excluded. These included discharge to rehabilitation hospitals or to an unknown location (n=3,535). Second, missing zip codes in some MDS data prevented merging with OSCAR and RUCA databases (n=73,449). Third, we excluded

164 cases for errors in reporting therapy minutes and when discharge occurred on the day of admission. Our final analytical sample consisted of 311,338 admissions (80% of total) to 3,605 SNFs.

Outcome Measure

Our primary outcome measure is the SNF discharge outcomes, defined using a combination of admission, discharge, and quarterly assessments. When a discharge MDS assessment followed the admission assessment, the outcome could be identified if the SNF patient was discharged to community (private home or assisted living), acute care hospital, or death. Long-term nursing home placement, defined as a stay extended beyond Medicare A benefits or when transferred to another nursing facility, was identified on separate assessments. Long-term placement was identified if the next assessment after the admission was a quarterly assessment. Quarterly assessments are due within 90 days of admission, but can be completed as long as 104 days after initial admission, and indicate that the stay continues post-rehabilitation.[13]

The secondary outcome measure is the length of stay (LOS). The desirable SNF outcome is to discharge patients home. Hence, we intended to examine whether, and to what extent, the intensity of therapy may be associated with patients' timing to discharge to community.

Key Independent Variables

One of two key independent variables was therapy intensity per day. This variable was calculated as the total therapy minutes each for PT, OT, and ST divided by the number of days therapy provided in the first 7 days of the SNF stay. We categorized therapy intensity into 4 levels based on clinical relevance, [9] while also reflecting the observed empirical distribution of therapy intensity. The high intensity group consisted of 60 minutes or longer/day, with medium-high and medium-low intensity groups characterized by 45 to less than 60 minutes/day and, 30 to less than 45 minutes/day, respectively. The low intensity group included residents that received between zero to < 30 minutes of therapy per day.

The second key independent variable was LOS or time to discharge. For this group, LOS was calculated as number of days in the SNF from admission to discharge date from the discharge assessment, or to the date of the first quarterly assessment if no discharge assessment was found. Though a quarterly assessment is normally due within 90 days of admission, LOS for the permanent placement group could have been as long as 104 days due to a rule allowing up to a 14 day window to complete an initial assessment. Expanding the timeframe for LOS ensured that those with permanent placement were appropriately categorized into that type of discharge and not misidentified.

Other Control Variables

Individual-Level Risk Factors—Individual risk factors were obtained from residents' initial admission assessments. These variables included demographic characteristics, such as: age (continuous variable); race/ethnicity (categorical variable); and gender (dichotomous variable). We also included health status characteristics (continuous variables): a functional score using resource utilization group (RUG)-III category scoring,[21] which measured the

need for assistance with activities of daily living (ADLs); Cognitive Performance Scale (CPS)[22–24]; and a depressive symptoms scale used by CMS.[25] For all health status characteristics, higher scores indicated worse status or symptoms. To control for a patient's condition at admission to a SNF, the total number of active diagnoses were included in the model.

Based on MDS assessments from the last quarter of 2007, we also examined each new 2008 admission for a prior recent nursing home stay (dichotomous variable) as such prior experience may be a risk factor for permanent placement, and therefore, was added to the model.

Facility-Level Characteristics—Several variables reflecting facility characteristics that may be independently associated with the outcomes of interest were included. Facility occupancy rate, a measure of the volume of patients has been shown to affect care in SNFs.[8,26,27] Nursing hours to patient ratio, a measure of the hours of nursing care provided, has been found to affect outcomes of rehabilitation patients in SNFs.[28] Case-mix indicates the relative severity of patients in a facility. Other nursing home characteristics have been found to affect the use of rehabilitation therapies[26,29] - facility ownership (for-profit or not), chain membership, and hospital affiliation - were also included.

Environmental Factors—SNFs were designated as urban or rural as differences in outcomes have been shown depending on location.[30] Furthermore, SNFs in different states may have different practice patterns and state regulations may affect SNF care delivery. These characteristics, however, are not included in our datasets. Therefore, we included state fixed effects in all models to control for unobserved characteristics.[14]

Analytical Approach

We examined the prevalence of four SNF discharge outcomes across patients groups with various intensity of total therapy minutes. Next, to examine the association between therapy intensity and the four different discharge outcomes, we model the outcome as a competing risks regression model using SAS phreg command. This model is common in biomedical research, particularly where the need to deal with more than two potential outcomes. Specifically, competing risks regression model is applied when study subjects may experience one of several different types of events over the follow-up period, and when survival times are subject to competing risks when the occurrence of one event type prevents other event types from occurring.[31–33] For example, when a resident was discharged to the community, the other three events (i.e., hospitalization, placement, or death) cannot occur. In other words, the total risk for exit from a SNF can be partitioned into the sum of risks for these four discharge outcomes. Residents who had no discharge assessment and no quarterly assessment were censored in the model. Residents who were permanently placed in the nursing home were the reference group for discharge. The high intensity group was the reference group for therapy intensity. Hazard ratios were obtained to interpret the intensity of therapy, as well as, individual and facility characteristics predicted the likelihood of each competing discharge outcome. Since SNF patients may be correlated within clusters, owing to unobserved characteristics (e.g., management team) and shared factors (e.g., facility and

environmental characteristics) across individuals, competing risks regression models included random effects in order to control for these clustering effects. We tested cumulative incident functions based on therapy intensity, and used log-rank test to examine whether any group effect existed: i.e., whether hazard ratio across groups with different therapy intensity were statistically significantly different. No issues were identified.

Finally, among patients who were discharged to community, a Poisson regression was employed to examine whether an association between LOS and therapy intensity existed (n = 162,792). Estimates that resulted from analysis were used to obtain incident rate ratios (IRR) to ease interpretation.[34] The reference group for this analysis was the low intensity group to improve clarity of results. Poisson assumptions were met (i.e., lack of evidence of over-dispersion) and model fit checked. We applied PHREG for the competing hazards model and GENMOD for the Poisson model in SAS 9.2 (Cary, NC). Approval for the conduct of this study was granted by the Institutional Review Board office of the University of Rochester.

RESULTS

Table 1 depicts the characteristics of the study sample by therapy intensity group. Mean SNF LOS increased as intensity decreased from 35.6 days (SD=24.2) for high intensity group, to 45.3 days (SD=31.7) for low intensity group. Compared to total sample, patients receiving high intensity therapy had a slightly smaller proportion of males (33.9% to 35%), similar proportion of Hispanics (6.4% to 6.3%), a smaller proportion of Blacks (6.6% to 8.1%), and a slightly larger proportion of Whites (84.9% to 83.9%). Higher proportions of non-White patients were present in the low intensity category. Clinical characteristics were comparable across intensity groups. The frequency of a prior SNF stay was slightly lower in high (5.0%) and medium-high groups (5.9%), compared to medium-low (6.5%) and low groups (6.7%). SNF characteristics are also presented in Table 1, showing the analytical sample was nationally representative.

Table 2 presents the proportion of discharge types by intensity groups. The proportion of patients who were discharged to the community appears to decline with decreased intensity: 63% of the high intensity group, 52.9% for medium-high, 45.1% for medium-low, and 27.4% for the low intensity group. On the other hand, the proportions of hospitalizations, placements, and deaths increased for patients as intensity decreased. The proportions of those without a discharge, which were censored during analysis, are presented in Table 2.

Therapy Intensity and Competing Discharge Outcomes

Table 3 displays hazard ratios (HR) of competing risks regression for each discharge outcome by therapy intensity group. For discharge outcomes, nursing home placement was the reference group; for therapy intensity, high intensity was the reference group. Compared to the high intensity group, the medium-high group, medium-low and low intensity groups had 15% lower (HR=0.85, 95% CI (0.83–0.85)), 32% lower (HR=0.68 (0.67–0.69)), and 57% lower (HR=0.43 (0.42–0.45)) likelihood of community discharge, respectively, than becoming permanently placed in a nursing home. The hazard of hospital readmission became increased with decreased therapy intensity. Compared to high intensity group, the

medium-high, medium-low, and low intensity groups had a 8% (HR=1.08 (1.06–1.12)), 25% (HR=1.25 (1.19–1.27)) and 29% (HR=1.29 (1.19–1.27)) higher risk for hospital discharge, respectively, than for permanent nursing home placement. The risk of death also increased significantly as therapy intensity declined (HR= 1.407 (1.32–1.45), 2.299 (2.15–2.46), and 4.198 (3.89–4.52), for medium-high, medium-low, and low intensity groups, respectively). Estimations for all remaining covariates are presented in Appendix.

Length of Stay and Therapy Intensity in Those Discharged Home

Table 4 displays IRRs for time to community discharge by therapy intensity group. Controlling for all covariates (Appendix 2), and compared to the low intensity group, LOS was 5% shorter for the high intensity group ($p<.001$). To improve understanding of this result, multiplying mean LOS for the sample of 39.5 days (Table 1) by the high intensity group IRR, resulted in the high intensity group averaging 2 days less in the SNF compared to the other intensity groups. LOS in the medium-high and medium-low groups were not different from the low intensity group.

DISCUSSION

This study examines whether, and to what extent, there exists an association between SNF discharges and therapy intensity. To our best knowledge, this is the first study that examines the association between intensity of therapy and discharge outcomes among SNF patients, and differentiating association among different types of therapy (i.e., physical therapy, speech therapy, and occupational therapy). Unlike previous studies[8,10,11] which often dichotomized discharges into community or not community, we modeled the discharges as a competing risks regression model, which allowed all 4-discharge outcomes for direct comparison. Competing risks methods are common in biomedical research, particularly in cancer, as the need to deal with multiple potential outcomes is nearly ubiquitous. However, this method is not commonly used in nursing home research, while we believe that this is the most appropriate statistical model in examining SNF discharges, a set of more than 2 multiple mutually exclusive possibilities. Broadening the scope of discharge types associated with therapy intensity improved the understanding of the effectiveness of therapy interventions in SNFs where little understanding existed previously.

The most favorable outcome pattern occurred in residents allocated to high intensity group, which received therapy intensities of at least 60 minutes/day. This group had significantly higher risk for home discharge and reduced risk of hospitalization and death. In their 2004 report, Jette and colleagues[8] reached a similar conclusion, noting a threshold of total therapy (PT/OT/ST) at 60 minutes per day to increase the likelihood of community discharge. A preference for community discharge has been supported in the literature[35] and this outcome has been the benchmark of successful SNF rehabilitation.[36] Furthermore, the discharge pattern was consistent but reversed for the remaining intensity groups; with reduced home discharge, while leaving placement, hospitalization, or death as more likely outcomes.

Results also indicated a consistent dose-response to rehabilitation therapies across discharges. As intensity increased, risk for home discharge increased, while risk for hospitalization and death decreased. Wodchis, et al.,[11] also reported a greater likelihood for

community discharge was present as dose increased, though a dose response to therapy was not present when the prognosis for community discharge was positive. More study of the effect therapy intensity may have upon altering expectations at admission could benefit the Medicare program by potentially preventing permanent placement, rehospitalizations, or death.

Our study also found for those discharged home, LOS was associated with therapy intensity. In this group, high intensity therapy reduced LOS by 2 days, an advantage for patients who end their inpatient stays sooner, and for SNFs, which can increase the volume of admissions. Jung, et al.,[10] reported marginal increases in likelihood of community discharge with increases of at least 1 hour of PT and OT per week. In addition, Jette, et al., [9] evaluated time to discharge and found differences by resident diagnosis. For instance, in residents with stroke, shorter LOS only occurred between groups that received greater than 1 hour/day and the group that received less than 1hour/day.

Severity of patients' conditions could limit tolerance for therapy interventions, and therefore limit effectiveness, although in studies of frail elderly[37] and those with Alzheimer's' Disease,[38,39] exercise interventions have been shown to improve functional outcomes. Furthermore, Wodchis et al.,[11] reported with some surprise that a large segment of their sample in groups with poorer prognosis for home discharge still received higher intensities of therapy. Assigning high intensity therapy to those with poor prognosis may be counter-intuitive, though we report evidence of this practice as well. While our Table 1 shows little range among patient-level characteristics across the intensity groups, there is not clear indication for assignment of therapy minutes. Studies into the factors used by clinicians for assignment of therapy intensities may help clarify how allocation of therapy minutes occurs at SNF admission.

Policy Implications

Fewer than 30% of our sample received at least 60 minutes of therapy/day, placing the majority of patients in Resource Utilization Groups (RUGs) with more modest reimbursements. The appropriateness of high intensity rehabilitative therapies has been questioned in a number of studies largely on the grounds of financial incentives associated with higher payment.[2,3] However, our results seem to counter this concern, since there did not seem to be an overuse of high reimbursement RUGs. Furthermore, our results suggest that allocation of Medicare SNF admissions to higher therapy intensities may pay off both in terms of better outcomes, as well as, shorter LOS. For SNF admissions, such as those under the Medicare rehabilitation benefit, time spent in a SNF may also be a good indicator of quality, though at this time, LOS is not a quality indicator used by Medicare for SNFs.[40] Further study of therapy intensity, LOS, and discharge outcomes following admission to a SNF is warranted and could enhance quality measurement in the future.

Limitations—A few limitations should be noted. Using existing data can have pitfalls and this study could have error from limitations in MDS data. There is a possibility that therapy minutes and days coded on the MDS were not accurate; however, as each nursing home is at risk for CMS audit and potential penalties associated with such discrepancies any

discrepancies should be fairly small. Another issue with using MDS data is that identifying the primary diagnosis for the SNF admission is not possible. In the risk adjustment for this study, all the active diagnoses were included, which may have created some error, however, including all active diagnoses in our analyses provided a comprehensive record of potential issues that may have affected therapy. Without a specific admitting diagnosis, generalizability of our results to specific diagnoses is difficult. Further studies should investigate how therapy minutes may affect discharge outcomes in specific diagnoses. In addition, the amount of therapy may be influenced by sickness of the SNF patients with different diagnoses, medical needs and functional dependence. This study was unable to directly address this selection bias. Our models included random effects to control for clustering effects and were risk adjusted. Table 1 also shows small, clinically non-significant differences ranges in characteristics among the therapy intensities. For instance, ADL score, CPS score, mood scale, number of diagnoses, and prior SNF stay were clinically similar. Furthermore, the exclusion of cases made during development of the analytic sample may have affected the results, however, 80% of the sample remained for analysis and representativeness of the SNF population remained. The difficulty tracking the quarterly assessments for long-term placement group may have been a source of error for this group. Similar to other observational studies, causation cannot be assumed and this study is also subject to omitted variable bias. Although we adjusted for a comprehensive profile of resident and facility factors, some other variables might be influencing the amount of therapy. For instance, an on-site physical therapist may increase therapy intensity, however, it is not available in the datasets employed in this study. Lastly, while the nursing home population in these 5 states represented approximately 32% of all Medicare admissions and approximately 28% of SNFs in 2008, [18] it may, nevertheless, not be generalizable to other states if patterns of therapy and SNF care practices vary across different geographic areas.

CONCLUSIONS

In an aged Medicare fee-for service sample, high intensity therapy, provided at a minimum of 60 minutes per day of physical therapy, occupational therapy, and speech therapy, was associated with more community discharges. The 60-minute threshold was also associated with a reduction in risk of hospitalizations and deaths. For those discharged to the community, intensity at or above the 60-minute threshold was also associated with shorter SNF LOS by two days.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

SNF	skilled nursing facility

LOS	length of stay
PPS	prospective payment system
MDS	Minimum Data Set
OSCAR	Online Survey Certification and Reporting Dataset
HR	hazard ratio
IRR	incident rate ratio

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Appendix 1. Hazard Ratios Estimates for Individual and Facility Characteristics by Discharge Destination

	Discharge Type (HR/(95% CI)*		
Variables	**Home (n=162,792)**	**Hospital (n=61,381)**	**Death (n=11,179)**
Individual Level			
Male	0.961 (0.951, 0.971)	1.348 (1.321, 1.376)	1.646 (1.584, 1.711)
Age (years)	0.991 (0.99, 0.991)	0.994 (0.993, 0.995)	1.036 (1.033, 1.038)
Race†			
Hispanic	0.816 (0.798, 0.835)	1.167 (1.123, 1.213)	0.568 (0.516,0.625)
Black	0.737 (0.723, 0.752)	1.243 (1.20, 1.286)	0.613 (0.564,0.666)
Other	0.81 (0.776, 0.846)	1.173 (1.098, 1.253)	0.604 (0.514, 0.71)
Clinical Characteristics			
ADL Score	0.926 (0.924, 0.927)	1.050 (1.0456, 1.054)	1.141 (1.132, 1.15)
CPS Score	0.785 (0.782, 0.788)	0.981 (0.975, 0.988)	1.144 (1.13, 1.158)
Depressive Symptoms	0.923 (0.914, 0.933)	1.125 (1.101, 1.149)	1.772 (1.696, 1.852)
Number of Diagnoses	0.962 (0.96, 0.964)	1.056 (1.052, 1.06)	0.998 (0.991, 1.005)§§
Prior NH stay	0.795 (0.777, 0.813)	0.978 (0.939, 1.02)§§	0.991 (0.92, 1.066)§§
Facility Level			
RN Hours/Patient/Day	1.28 (1.264, 1.297)	1.002 (0.964, 1.041)§§	0.85 (0.782, 0.922)§
For-Profit Facility	0.888 (0.877, 0.899)	1.077 (1.049, 1.107)	1.025 (0.977, 1.076)§§
Rural Facility	0.791 (0.772, 0.811)	0.930 (0.887, 0.974)//	1.058 (0.981, 1.14)§§
Chain Facility	1.002 (0.991, 1.014)§§	0.97 (0.948, 0.992)//	1.079 (1.034, 1.126)§
Hospital Based Facility	1.357 (1.322, 1.392)	0.944 (0.885, 1.008)§§	1.181 (1.06, 1.316)//
Occupancy Rate (%)	1.001 (1.00, 1.001)//	0.999 (0.998, 1.00)**	1.003 (1.001, 1.005)††
Case Mix Index	5.855 (5.418, 6.328)	0.979 (0.842, 1.138)§§	0.182 (0.138, 0.239)
State‡			
Texas	0.997 (0.955, 0.998)‡‡	1.251 (1.199, 1.305)	1.26 (1.164, 1.364)
California	0.985 (0.965, 1.006)§§	1.069 (1.028, 1.111)§	1.484 (1.377, 1.598)
Florida	1.331 (1.31, 1.352)	1.034 (1.00, 1.069)§§	1.132 (1.061, 1.208)§
Ohio	1.246 (1.225, 1.226)	0.954 (0.921, 0.989)//	1.122 (1.054, 1.194)§

Note.

*Reference group = placement (n=42,230),

†reference group = Whites.

‡ Reference group = New York State.

Abbreviations: ADL, activities of daily living, CPS, cognitive performance scale, NH, nursing home. p-values for estimates without a symbol are p>.0001.

§ p<.001;

// p<.01;

** p=.03;

†† p=.01;

‡‡ p=.04;

§§ not significant.

Appendix 2: Incident Rate Ratios (IRR) of Individual and Facility Characteristics for the Association of Therapy Intensity on LOS: Group Discharged Home

Variables	IRR (95% CI)
Individual Level	
Male	0.978 (0.972, 0.985)‡
Age (years)	1.00 (1.00, 1.00)‡
Race *	
Hispanic	1.05 (1.04, 1.07)‡
Black	1.07 (1.06, 1.08)‡
Other	1.07 (1.04, 1.09)‡
Clinical Characteristics	
ADL Score	1.048 (1.047, 1.049)‡
CPS Score	1.028 (1.026, 1.030)‡
With Depressive	1.02 (1.01, 1.03)‡
Symptoms	
Number of Diagnoses	1.01 (1.01, 1.01)‡
Prior NH Stay	1.06 (1.05, 1.07)‡
Facility Characteristics	
RN hours/patient/day	0.91 (0.90, 0.93)‡
For-Profit	1.06 (1.05, 1.07)‡
Urban	1.03 (1.01, 1.05)§
Chain	0.988 (0.982, 0.994)§
Hospital based	0.87 (0.85, 0.88)‡
Occupancy Rate	1.00 (1.00, 1.001)//
Case Mix	0.53 (0.50, 0.55)‡
State †	
Texas	0.95 (0.94, 0.96)‡
California	0.99 (0.99, 1.01)
Florida	0.945 (0.937, 0.954)‡
Ohio	0.987 (0.984, 0.996)//

NOTE.

* Reference group, Whites.

† Reference group, New York State.

Abbreviations: LOS, length of stay; ADL, activities of daily living; CPS, cognitive performance scale; NH, nursing home; IRR, incident rate ratio.

‡ p>.0001;

§ p<.001;

/ p<.01.

Highlights

- Sixty minutes/week of combined therapy was associated with community discharge. (82)
- Less than 60 minutes of therapy was associated with hospital discharge, nursing home (NH) placement, and death. (95)
- A minimum of 60 minutes of therapy was associated with 2 fewer days in a SNF. (80)

Table 1

Characteristics of the Study Sample: Medicare Admissions by Therapy Intensity Group, in CY2008.

Variables	High	Medium High	Medium Low	Low	All Intensities
	28.9%	**39.4%**	**25.0%**	**6.7%**	**100.0%**
	n=89,891	**n=122,784**	**n=77,916**	**n=20,747**	**n=311,338**
Key Independent Variables [mean (sd)]					
LOS	35.6 (24.2)	40.2 (26.7)	41.7 (28.3)	45.3 (31.7)	39.5 (26.9)
Therapy Intensity minutes/day (sd)	68.0 (6.7)	51.4 (3.8)	36.4 (4.3)	12.2 (12.7)	49.8 (16.4)
Other Covariates:					
Individual Characteristics					
Male (%)	33.9	35.7	34.4	36.7	35.0
Age- years (sd)	81.1 (7.8)	82.1 (7.8)	82.4 (7.9)	81.9 (8.2)	81.9 (7.9)
Race (%)					
Other	2.0	1.3	1.5	2.1	1.8
Hispanic	6.4	3.4	5.5	7.4	6.3
Black	6.6	8.0	9.3	10.9	8.1
White	84.9	83.9	83.6	79.6	83.9
Clinical Characteristics [mean(sd)]					
ADL Score (range, 0–18)	12.8 (3.2)	12.9 (3.4)	13.0 (3.6)	13.4 (4.2)	12.9 (3.5)
CPS Score (range, 1–7)	2.0 (1.4)	2.6 (1.6)	2.8 (1.7)	3.4 (2.0)	2.5 (1.6)
Mood Scale (range, 0–8)	0.73 (1.1)	0.98 (1.4)	1.05 (1.4)	1.1 (1.5)	0.94 (1.3)
Number of Diagnoses	5.4 (2.5)	5.7 (2.5)	5.6 (2.6)	5.7 (2.7)	5.6 (2.5)
Prior SNF stay (%)	5.0	5.9	6.5	6.7	5.9
Facility Characteristics (n= 3,905)					
Mean RN hrs/resident day	0.35 (0.39)	0.35 (0.39)	0.35 (0.39)	0.35 (0.39)	0.35 (0.39)
Mean Occupancy (%/sd)	88.1 (11.3)	88.1 (11.3)	88.1 (11.3)	88.1 (11.3)	88.1 (11.3)
Mean Case Mix	1.09 (0.07)	1.09 (0.07)	1.09 (0.07)	1.09 (0.07)	1.09 (0.07)
For-Profit (%)	72.4	72.4	72.4	72.4	72.4
Rural (%)	5.2	5.2	5.2	5.2	5.2
Chain (%)	49.5	49.5	49.5	49.5	49.5
Hospital Based (%)	5.3	5.3	5.3	5.3	5.3

Note. sd = standard deviation, LOS = length of stay, ADLs = Activities of Daily Living, CPS = Cognitive Performance Scale, NH = nursing home, RN = registered nurse.

Table 2

Proportion of Discharge Types by Therapy Intensity Group *

Variables	Intensity Group (%)			
	High	**Medium- High**	**Medium- Low**	**Low**
	n=89,891	**n=122,784**	**n=77,916**	**n=20,747**
Discharge				
Home (n=162,829)	63.5	52.9	45.1	27.4
Hospital (n=61,334)	16.1	20.2	22.0	24.2
Long-term Placement (n=42,342)	8.4	13.3	17.1	24.4
Death (n=11,208)	1.6	3.0	4.9	10.9
No Discharge † (n=33,625)	10.4	10.7	10.9	13.1

Note:

* Total sample = 311,338.

† Censored = residents without a discharge.

Table 3

Association between Therapy Intensity Group and Discharge Type*: Hazard Ratios (HR) and Confidence Intervals (95% CI))

	Discharge Outcome†		
Variables	**Home**	**Hospital**	**Death**
Intensity Group (reference group = high intensity (60 minutes/day or greater))			
Medium-High≠	0.85 (0.83, 0.85)	1.08 (1.06, 1.12)	1.39 (1.32, 1.45)
Medium-Low≠	0.68 (0.67, 0.69)	1.25 (1.19, 1.27)	2.29 (2.15, 2.46)
Low≠	0.43 (0.42, 0.45)	1.28 (1.23, 1.34)	4.19 (3.89, 4.52)

Note.

*Full model estimates are contained in Appendix 1

†Reference group for discharge outcomes = Long-term nursing home placement.

Medium-high group minutes/day ranged from 45 to < 60. Medium-low group minutes/day ranged from 30 to < 45. Low group minutes/day ranged from zero to <30.

≠p<.0001.

Table 4

Association of Therapy Intensity with LOS for Group Discharged Home: Incident Rate Ratios (IRR) *

Parameter	IRR (95% CI)
Intensity Group †	
High ±	0.95 (0.92, 0.97)
Medium-High	1.02 (0.91, 1.04)
Medium-Low	1.01 (0.98, 1.04)

Note.

* Full model estimates are contained in Appendix 2.

± Reference intensity group = low intensity.

† p<.0001.