

Rehabilitation Processes in Skilled Nursing Facilities in the Context of Shifting Policy

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Abstract

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The purpose of this dissertation is to explore relationships between Medicare policy, rehabilitation practice, and patient outcomes within the fragmented and complex Skilled Nursing Facility (SNF) industry. United by a conceptual framework that connects Medicare policy with the structures, processes, and outcomes of rehabilitation in SNFs, the articles included in this dissertation were motivated in part by the implementation of a new Medicare reimbursement model, the Patient Driven Payment Model (PDPM), in October 2019. In response to rising intensity and costs of what Medicare considered clinically unnecessary rehabilitation, PDPM drastically shifted incentives for physical and occupational therapy provision in SNFs. However, the design of the PDPM reimbursement system does not account for potential policy impacts on patient outcomes.

The first article, “Is More Always Better? Financially motivated therapy and patient outcomes in Skilled Nursing Facilities,” is a pre-PDPM secondary analysis of 2018 patient data from SNFs in the United States. The purpose of the study was to examine whether a financially motivated therapy billing practice known as thresholding was associated with patient functional improvement and community discharge outcomes. Thresholding, which occurred when SNFs

provided ten or fewer minutes of therapy above weekly reimbursement thresholds under the previous payment system, is a unique metric that allows for specific study of financially motivated therapy that can be examined separately from intensive therapy, which may be clinically indicated. Results of this study indicate that extra minutes of therapy received by patients who experienced thresholding were associated with small positive effects on functional improvement and community discharge rates, even when controlling for overall therapy intensity. While PDPM was designed to disincentivize both thresholding and intensive therapy overall, these results emphasize the importance of Medicare payment policy designed to promote, not disincentivize, potentially beneficial rehabilitation services for patients.

Using a similar cohort and study design, the second article, “Some But Not Too Much: Multiparticipant Therapy and Positive Patient Outcomes in Skilled Nursing Facilities,” establishes pre-PDPM relationships between multiparticipant therapy and patient outcomes. Provision of multiparticipant therapy – including two or more patients per therapy provider per session– is known to have increased over 300-fold immediately after PDPM implementation, as SNFs reduced intensive individualized therapy and utilized more multiparticipant sessions to reduce therapy staffing costs. Until post-PDPM data become available, this article used 2018 data to help predict possible implications for patients experiencing drastic shifts from individualized to multiparticipant therapy in SNFs. Models compared different levels of multiparticipant therapy provision as a proportion of total therapy. Compared to patients receiving no multiparticipant therapy, we found positive associations between low (below the median of 5%) and medium (median to <25%) multiparticipant therapy levels and outcomes. However, associations disappeared with high ($\geq 25\%$) levels of multiparticipant therapy. Results

indicate that providing up to 25% of physical and occupational therapy in multiparticipant sessions may be both efficient and beneficial for patients.

The final article, “Variability in Therapy Staffing Changes in Skilled Nursing Facilities Under the Patient Driven Payment Model,” used 2019-2020 publicly available SNF staffing data to test whether changes in physical and occupational therapy staffing under PDPM varied by SNF organizational characteristics. Using longitudinal models, we detected larger relative staffing declines in for-profit SNFs and facilities with more rural and Medicare patients, SNFs employing more therapy assistants, and SNFs providing more intensive therapy prior to policy change. Facilities serving more racially diverse patients lost more skilled therapists than SNFs with less diverse populations. Contract therapy declined more than in-house therapy in non-profit and high-quality facilities. Results indicate that SNFs that engaged in profit-maximizing behaviors under the previous payment model were more responsive to PDPM in terms of implementing larger therapy staffing reductions. The organizational characteristics identified in this article should be specifically targeted in quality monitoring and policy evaluation efforts to better understand the impacts of PDPM on patient outcomes, especially for vulnerable groups.

Together, these articles provide information for key stakeholders, including clinicians, SNF administrators, and policymakers to help inform practice, guide future research on the impacts of PDPM on patient outcomes, and inform patient-centered policy.

Plain Language Summary

Skilled Nursing Facilities (SNFs) provide care to 1-2 million Medicare patients every year after a hospitalization for an illness or procedure. A primary goal of rehabilitation during a SNF stay is to assist in recovery of independent physical function and help facilitate discharge back to a community or non-institutional setting. Medicare paid close attention to the drastic rise in costs for SNF care over the last twenty years. Rising costs of rehabilitation, especially physical and occupational therapy, in SNFs motivated Medicare to change the SNF reimbursement system, and Medicare implemented a new payment model, the Patient Driven Payment Model (PDPM), in 2019. The PDPM system no longer pays larger sums to SNFs for providing more therapy services, but some evidence has shown that patients benefit from receiving more therapy during SNF stays. PDPM caused concerns about how patient outcomes like functional improvement and successful return to the community might be impacted if SNFs provide less therapy to patients.

This dissertation explored how certain therapy practices in SNFs were related to patient outcomes before PDPM. Because data on patients after PDPM weren't yet available, these studies help to predict how patient outcomes might change if therapy drops significantly under new policy. The first study looked at thresholding, which occurred when SNFs provided just enough therapy minutes to increase reimbursement while limiting staffing costs. While thresholding is wasteful from Medicare's perspective, our study found that those extra few minutes of therapy were related to slightly improved patient outcomes. These results caution against large drops in therapy provision in SNFs under PDPM.

The second study looked at multipatient therapy (therapy sessions provided for more than one patient at a time with just one therapist) compared to individualized one-on-one

therapy. Compared to receiving all individualized therapy, patients who had a small portion of their total therapy time (up to 25%) had better outcomes. However, patients receiving 25% or more of their therapy time in multiparticipant sessions had no differences in outcomes compared to patients in all individual sessions. Multiparticipant sessions might encourage socialization, learning through watching other patients, or other benefits, but these results suggest that most therapy in SNFs should still be provided as individual treatment.

The final study examined how SNFs changed therapy staffing after PDPM. The SNF industry is made up of facilities with very different characteristics like size, profit status, types of patients, rural or urban location, what types of insurance is accepted, quality of care, and how facilities handle staffing and therapy provision. As not all SNFs were expected to respond to PDPM in the same ways, this study identified which types of SNFs reduced therapy staff the most. We found that SNFs were more likely to reduce therapy staff if they were for-profit, served more rural or Medicare patients, employed more therapy assistants, or provided more intensive therapy before PDPM. Facilities serving more racially diverse patients also lost more skilled therapists than SNFs with less diverse populations. These organizational factors are indicators for SNFs that should be targeted by Medicare for monitoring of patient therapy outcomes under PDPM. Together, these three studies provide feedback to Medicare on the impacts of PDPM as well as help guide SNF therapists and administrators to provide care that focuses on improving patient outcomes.

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Chapter 1

1.1 Introduction

1.1.1 The Skilled Nursing Facility Industry

The Centers for Medicare & Medicaid Services (CMS) spent \$28 billion in 2019 to provide Skilled Nursing Facility (SNF) services to 1.5 million fee for service Medicare beneficiaries.^{1,2} Medicare covers short-term rehabilitation and nursing services in SNFs after a hospital stay for beneficiaries with a variety of medical and post-surgical care needs.² Post-acute rehabilitation provided in SNFs includes physical therapy (PT), occupational therapy (OT), and speech therapy, with primary therapy goals of improving physical function and independence with activities of daily living to facilitate return home and avoid hospital readmissions.³ While most SNFs also provide custodial care for long-term residents which is primarily reimbursed by state Medicaid programs, Medicare payments for post-acute care are critically important to SNFs.²

The SNF industry grew rapidly in the 1980s with the passage of the Prospective Payment System for Hospitals, which had the impact of reducing hospital length of stay and increasing need for post-acute care services for patients who continued to have medical and rehabilitative needs.⁴ While utilization of SNF services continued to grow, plateauing in the mid-2010s,^{1,5} Medicare spending on SNF services doubled from 2000 to 2016, outpacing increases in beneficiaries admitted to SNFs.^{1,6,7} Spending increases were driven in large part by increases in therapy costs under the Prospective Payment System (PPS) for SNFs, which was implemented in 1998 and coupled higher payments with higher volume of rehabilitation.⁷ Under the SNF PPS,

the share of intensive therapy days, which garnered the highest reimbursements, increased from 27 to 83% between 2002-2017.⁸

Increases in therapy provision and Medicare spending vary across a heavily fragmented SNF industry. Over 15,000 SNFs operate in the United States, and SNFs account for 15% of all national geographic variation in Medicare spending.⁹ While local and regional chains exist, many SNFs are independent providers, with only 19% of SNFs operated by 25 of the largest chains.² In addition to variability in spending and chain affiliation, SNFs vary in size, ownership, and staffing strategies. A majority of SNFs (71%) are for-profit facilities, 97% are freestanding versus located within a hospital, and while the median SNF size is 100 beds, size varies significantly, with 10% of SNFs having under 50 beds.² Variability in rehabilitation provided in SNFs also may occur due to different staffing strategies, such as hiring contract companies to run rehabilitation departments within SNFs.¹⁰ In 2016, over 50% of SNFs employed exclusively contract therapy staff.^{11,12} SNFs also vary significantly in employment of less expensive therapy assistants versus therapists and the intensity of therapy services provided.¹¹⁻¹³ Such significant variation in a heavily utilized industry leads to variation in multiple domains of quality.

1.1.2 Quality of Care and Quality Reporting

CMS uses quality measure tools to measure healthcare structures, processes, outcomes, and patient perceptions in order to identify factors that help achieve high-quality care, defined as safe, effective, efficient, patient-centered, equitable, and/or timely care.¹⁴ CMS has developed myriad measures of quality pertaining to different aspects of care provided to beneficiaries in many settings, and CMS uses these quality measures in a variety of initiatives. For example, in post-acute care, public reporting initiatives such as Nursing Home Compare (NHC) use quality measures to improve transparency for Medicare beneficiaries and to increase accountability for

SNFs.¹⁵ CMS also uses quality measures in pay-for-reporting programs like the Skilled Nursing Facility Quality Reporting Program and quality improvement initiatives such as the Skilled Nursing Facility Value Based Purchasing program, which uses incentive payments to reward high quality of care, measured by performance on hospital readmission scores.¹⁶ There are three common outcomes pertinent to the quality of rehabilitative services that are measured in SNFs as part of CMS quality programs: discharge to the community, functional improvement, and hospital readmissions.¹⁷

1.1.3 Quality of Care Measures in Skilled Nursing Facilities

Discharge to the community is an important measure of SNF quality and the quality of rehabilitation provided in SNFs, defined as the percentage of patients who are discharged to the community, rather than an institution, from a SNF without an unplanned hospital readmission or death within 31 days of discharge.¹⁸ Community discharge is a goal for many patients receiving rehabilitation in SNFs who wish to avoid institutionalization and achieve independent function.¹⁸ The community discharge outcome is a comprehensive measure of multiple aspects of function and may also reflect quality of training or preparation gained during SNF rehabilitation, as the ability to reside in the community reflects a certain level of cognitive, physical, and psychological function and safety that allow for independent living.¹⁹ Beyond the importance to patients, CMS pays special attention to the community discharge outcome as there is significant variability in successful community discharge in the SNF sector and CMS considers it to be an actionable outcome because there is evidence that community discharge rates can be improved through specific clinical and care coordination interventions.^{20,21}

A primary goal of rehabilitation during a SNF stay is to assist a patient in recovery of independent physical function after a surgery or illness that required hospitalization.² Functional

improvement measures aim to capture changes in independence with mobility, such as bed mobility, transfers, and ambulation, as well as a patient's ability to perform activities of daily living or self-care tasks.²² Historically, the functional improvement measure used in the NHC program reports the percentage of short-stay patients in SNFs who were discharged from the SNF and gained independence in at least one of three functional tasks during their SNF stay: transfers, locomotion, and walking.²³ However, measuring function in SNFs has historically been fraught by questions of inaccuracy, and function was subsequently dropped from some CMS quality reporting programs.⁸ A new functional outcome measure, Section GG, which includes both mobility and self-care subscales, was introduced in 2018 for use across inpatient rehabilitation facilities, SNFs, and home health settings. The self-care subscale may also better reflect the impact and quality of OT and ST services in SNFs, which may not directly address mobility function and are thus not as fully captured in measures of transfers, locomotion, and walking independence.²⁴ The aim of Section GG is to make it easier to measure differences in functional outcomes across post-acute settings and reduce inconsistencies in reporting.⁸

Hospital readmissions are an important indicator of quality of care in SNFs for public reporting and transparency to consumers.¹⁹ The tracking of readmission data aims to promote provider accountability, improve care coordination especially for care transitions across settings, and reduce costs to Medicare, as readmissions are exceedingly costly and unfortunately common, with about one-fifth of SNF patients experiencing hospital readmission.^{19,25-28} Hospital readmissions also interrupt the SNF medical and rehabilitative plan of care, increases patients' risk of exposure to hospital-related adverse events, and can further contribute to loss of function.^{29,30} Including hospital readmissions as an indicator of SNF quality is important to CMS because there is also evidence that readmissions vary across the SNF sector according to

structural factors, with for-profit and chain affiliated SNFs, SNFs with higher patient volume, SNFs with lower staffing, and hospital-based SNFs having higher rates of hospital readmissions.^{28,31} Additionally, recent evidence demonstrates that hospital readmissions can be reduced through early post-discharge home health visits as well as quality improvement efforts focusing on care coordination and patient education activities.^{32,33}

1.1.4 Conceptual Framework

These measures of rehabilitation quality are represented as outcomes in the conceptual framework for this dissertation (Figure 1.1), which also captures the relationships between SNF structural factors and rehabilitation processes. This framework is based on Donabedian's model of three healthcare aspects that can be measured in assessing quality of care: structure, process, and outcome.³⁴ Examples of healthcare structures relevant to the SNF industry include facility ownership and profit status, geographic location, chain affiliation, and hospital-based versus freestanding location. SNF rehabilitation processes may include the volume or intensity of therapy provided, staffing practices, and multiparticipant versus individualized therapy provision.

The framework also includes health policy, which may interact with all three healthcare aspects. CMS continuously develops policies pertinent to SNFs, with the goals of improving quality without increasing or even lowering costs.³⁵ However, historically, CMS policies have seen mixed results in terms of improvement for both savings and clinical outcomes. I will apply the conceptual framework to the SNF PPS reimbursement policy with the goal of informing opportunities and gaps in research on the most recent SNF payment reform policy: the Patient Driven Payment Model (PDPM).

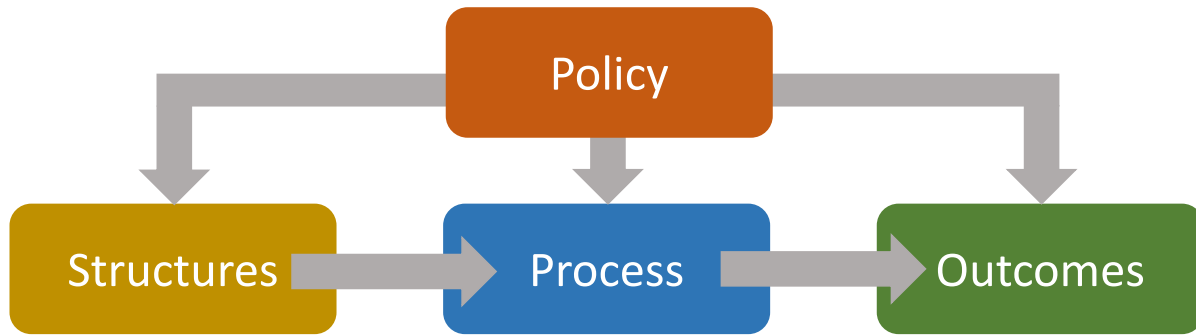


Figure 1.1 Conceptual Framework adapted from Donabedian’s Model for evaluating quality of health care

1.2 The Prospective Payment System for Skilled Nursing Facilities

1.2.1 The Balanced Budget Act

In 1997, the US Congress passed the Balanced Budget Act (BBA) in response to rising expenditures in post-acute care (Figure 1.2).⁴ Prior to passage of the BBA, CMS reimbursed post-acute care providers including SNFs on a retrospective, reasonable-cost basis, which did not limit costs for ancillary services such as rehabilitation.^{4,36} The 1983 Prospective Payment System for hospitals had increased the number of patients who were discharging “quicker and sicker” from hospitals, resulting in an increase in patients admitted to SNFs and an increase in the intensity of services required for sicker patients.^{4,7,37} This increase in SNF utilization combined with minimal incentives for cost-containment caused a massive increase in Medicare spending on SNF services in the early to mid-1990s.^{7,37} Between 1990 and 1998, CMS expenditures on SNFs increased from \$1.7 billion to \$10.2 billion.³⁸

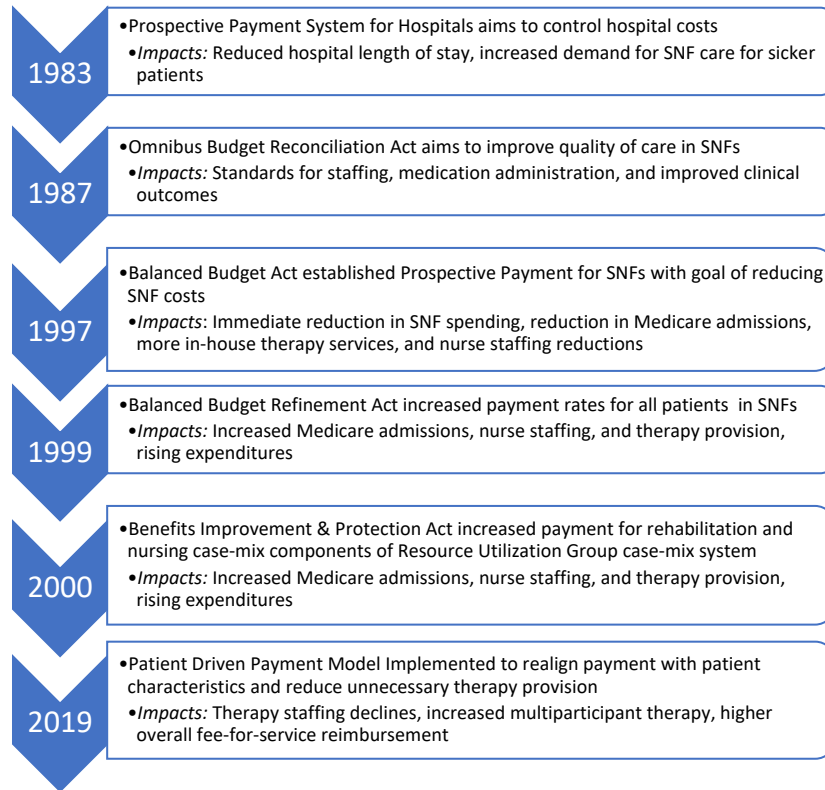


Figure 1.2 Timeline of select Medicare payment policy impacting rehabilitation in SNFs

The 1997 BBA aimed to curb the precipitous growth in SNF expenditures by establishing the SNF Prospective Payment System (PPS). The SNF PPS shifted payment from a retrospective to prospective system under which CMS payments did not vary with the actual cost of care provided, but instead varied based on patient case-mix categories.⁴ The initial SNF PPS established the Resource Utilization Group (RUG) III system, which included 44 different levels of payment based on resident severity, with higher payments for RUGs reflecting higher levels of care.³⁶ The RUG-III algorithm included rehabilitation treatment needs, basing the specific reimbursement for rehabilitation RUGs on total weekly minutes of PT, OT, and speech therapy. The RUG-III system created separate rehabilitation RUGs for specific therapy time ranges (45-149 minutes, 150-324 minutes, 325-499 minutes, 500-719 minutes, and 720+ minutes), with no

increase in payment until the minimum minute threshold for the next RUG level is met.^{36,39} The RUG-III system was updated to the RUG-IV system in 2011, which kept the same minute thresholds for rehabilitation RUGs but increased the number of RUGs and recalibrated payments to help account for the cost of caring for medically complex patients.

1.2.2 SNF PPS Incentives and Concerns

The SNF PPS brought somewhat conflicting incentives for SNF administrators: on one hand, the fixed prospective nature of reimbursement incentivized SNFs to reduce daily costs of care, such as nursing costs, and disincentivized SNFs from admitting patients whose costs of care could exceed the fixed reimbursements.^{4,40} On the other hand, the increasing payment levels for higher severity case mix groups incentivized SNFs to move patients into higher paying rehabilitation RUGs. SNFs were also incentivized to only provide therapy close to the specific minute thresholds for higher reimbursement, as the marginal profitability of providing therapy within the minute ranges was zero.^{36,41}

The combination of these incentives caused initial concern that the SNF PPS would exacerbate inequities by causing SNFs to avoid admitting patients with complex medical care needs in favor of patients who could participate in therapy. There were also concerns that SNFs would provide less therapy overall under the SNF PPS, with the ultimate result that the SNF PPS would shift resources away from the patients with the highest needs who were most likely to benefit from SNF services.^{40,42}

1.2.3 SNF PPS Impacts: Costs and Process Changes

The SNF PPS was initially very successful in reducing CMS expenditures. The first two years of the SNF PPS saw a 14% reduction in CMS payments for SNF services, a total decrease in expenditures of over \$3.4 billion in 1999, which was more than double the intended

amount.^{7,42,43} This decline in payment had significant impacts on the SNF industry that varied according to SNF structural factors. For example, hospital-based and chain facilities endured higher rates of bankruptcy, with 20% of hospital-based SNFs leaving the market between 1998 and 2000.⁷

Early work analyzing the impact of the SNF PPS revealed an increase in the likelihood that Medicare patients would receive some therapy services, however there was an initial decrease in the overall amount of therapy provided.^{4,36,40,42} Specifically, SNFs appeared to be reducing extremely high levels of therapy and targeting therapy services towards moderate levels of therapy as well as therapy close to more profitable minute thresholds. These process changes differed according to SNF structural factors: for-profit freestanding SNFs were most likely to reduce therapy provision.^{4,42}

In terms of access to services, the SNF PPS was associated with a reduction in the number of Medicare patients admitted to SNFs, with results ranging from 8.7% to 19.5% fewer Medicare patients as a share of total SNF patients.⁷ However, SNF length of stay was relatively unchanged compared to the pre-PPS period, which was unsurprising as the SNF PPS reimbursed SNFs on a per diem and not an episode basis.^{4,7} Additional early process changes incentivized by the SNF PPS included a move towards bringing therapy services in-house rather than employing contract therapy companies, allowing SNFs more control over the cost of therapy services as they navigated uncertainty.¹⁰ The SNF PPS also impacted nurse staffing, with one study finding between 17-33 percent reductions in nurse staffing, and another study detecting a 9% reduction in nurse staff time per resident after PPS implementation.^{37,43} Staffing reductions differed according to SNF structural factors, with non-profit facilities being less likely to reduce nurse staffing than for-profits.

1.2.4 Mitigation of Initial SNF PPS Impacts

In response to objections from SNF industry stakeholders regarding excessive reductions in expenditures and industry instability caused by the SNF PPS, Congress passed the Balanced Budget Refinement Act (BBRA) in 1999 which increased payment rates for all RUG-III groups.⁴³ Reimbursement increases under the BBRA expired in 2006. In 2000, the Benefits Improvement and Protection Act (BIPA) further changed reimbursement to increase payment for all rehabilitation RUG-III groups as well as a temporary increase in payment for nursing components of the RUG-III system. In terms of access to care, these laws ushered in a return to prior SNF admission rates for Medicare beneficiaries.⁷

The BBRA and BIPA also mitigated some of the SNF nurse staffing reductions, with a 4-7% increase in nurse staffing after the passage of BBRA.⁴³ The reduction in therapy services under the SNF PPS was also mitigated, and an industry shift towards increasing intensity of therapy and concentrating Medicare patients into higher paying rehabilitation RUGs began in earnest.⁷ Ultimately, the BBRA and BIPA undid any reductions in SNF expenditures under the original SNF PPS, and expenditures continued to rise through the early 2000s, stabilizing after 2010.^{1,7}

1.2.5 SNF PPS Impacts: Patient and Quality Outcomes

Multiple studies explored the impact of the SNF PPS on quality outcomes. Early data in two studies showed that the SNF PPS was associated with higher counts of health deficiencies on regulatory surveys, with a 12% increase in average number of deficiencies after PPS implementation, however deficiency rates dropped after the passage of BBRA.^{37,43} Two studies examined community discharge outcomes after PPS implementation. Hutt et al. found that, in PPS demonstration SNFs, therapy intensity for the highest functioning patients increased,

however community discharge rates did not change.⁴¹ This study was limited in generalizability, however, as PPS demonstration SNFs may differ from non-demonstration SNFs and may not accurately reflect discharge outcomes once the SNF PPS was implemented nationally. Using data from after national PPS implementation, Wodchis et al. found reduced probabilities of discharging home from SNFs for Medicare patients, however this reduction in quality was accompanied by a decline in risk of death, causing the authors to conclude that “PPS is associated with neither uniformly declining standards of care nor a large improvement in effectiveness.”³⁸

1.2.6 Lessons from the SNF PPS

While the SNF PPS had immediate financial and process impacts for SNFs, including short term declines in therapy provision, staffing, and reductions in access to SNF care, changes were mitigated by subsequent legislation driven by stakeholder concerns, and the SNF PPS ultimately did little to curb CMS expenditures. There is also some evidence that the SNF PPS had a negative impact on quality outcomes. Lessons from SNF PPS implementation include the necessity to ensure that cost-containment policies have an acceptable trade-off with quality and to incorporate stakeholder perspectives into what acceptable quality and cost trade-offs might be.⁴³ Additionally, there was significant variability in SNF responsiveness to policy change according to SNF structural factors, with for-profit and freestanding facilities being more likely than non-profit SNFs to make process changes to maximize reimbursement. The immediate process changes seen in response to the SNF PPS highlight the significant and rapid impact that Medicare payment policy changes have on the SNF industry at large.

1.3 The Patient Driven Payment Model

1.3.1. Motivation for the Patient Driven Payment Model

Growth in Medicare expenditures for SNF services in the later years under the SNF PPS was attributed in large part to a rise in the proportion of patients in higher intensity rehabilitation RUG groups, despite minimal changes in patient characteristics that would have appeared to warrant this increase.^{8,44,45} Between 2002 and 2017, the share of patient days classified into intensive therapy RUG groups increased from 27 to 83 percent.⁸ CMS also began monitoring thresholding behavior, defined previously as providing therapy close to the specific minute thresholds for higher reimbursement.^{36,46} According to CMS, between 2005 and 2013, the percentage of patients who received 20 minutes or less of therapy over the threshold for the ultrahigh rehabilitation RUG group increased from 5 percent to 33 percent. In 2016, 62.3% of patient assessments in the ultrahigh rehabilitation RUG group received 10 or fewer minutes of therapy above the reimbursement threshold.¹¹ These financially motivated behaviors varied by organizational characteristics. For-profit and chain affiliated SNFs were more likely to place patients into higher paying RUGs, and for-profit and government facilities and SNFs using all therapy contract staff were more likely to engage in thresholding behavior.^{11,44}

In addition to financially motivated billing behavior, calls for reform of the SNF PPS also centered around issues of equitable access.⁴⁵ The SNF PPS was believed to increase disparities in access to SNF care, as it incentivized facilities to selectively admit patients who were appropriate for higher intensity rehabilitation over medically complex patients.^{8,47} Overall, the RUG system was increasingly seen as a system in need of reform, as it did not align reimbursement with patient care needs.

In October 2019, the Patient Driven Payment Model (PDPM) replaced the RUG system under the SNF PPS. Goals of PDPM included 1) improving payment accuracy and appropriateness by focusing on patient characteristics, rather than volume of services, to determine payment and 2) improving payments to underserved patients by redistributing payments from high intensity rehabilitation RUGs towards medical patients with high non-therapy ancillary costs.^{8,45} Under PDPM, per diem payment rates are calculated by adding five case-mix adjusted components: PT, OT, speech therapy, nursing, and non-therapy ancillary. Patients are classified into payment groups for each of the five components which utilize different discipline-relevant clinical criteria as the basis for classification. For example, PT and OT components use clinical categories based on the primary diagnosis and functional scores to classify patients into payment groups. By eliminating incentives to provide intensive therapy regardless of patient needs and shifting to classification based on patient characteristics, PDPM aims to improve accuracy and appropriateness of SNF reimbursement.⁴⁵

1.3.2 Early PDPM Impacts: Process Changes

Early evidence evaluating PDPM has shown a significant impact on rehabilitation staffing in SNFs, with a decline of up to 15% in occupational and physical therapy staffing time by March 2020.⁴⁸ Therapy assistants and contract staff experienced larger staffing reductions compared to therapists and in-house staff, respectively.^{48,49} Similarly, CMS reported a decline of over 30% in therapy minutes per patient immediately after PDPM implementation.⁵⁰ As overall therapy time decreased, SNFs also increased utilization of multiparticipant therapy sessions, which include two or more patients treated simultaneously by the same therapy provider. Multiparticipant therapy was used sparingly under the SNF PPS because multiparticipant therapy minutes were not weighed as heavily as individualized therapy in RUG group calculations.

Immediately after PDPM implementation, multiparticipant therapy provision expanded rapidly from being provided in less than 1% of therapy plans of care to about 30%, drawing concerns that some SNFs exceeded the 25% limit on multiparticipant therapy as a proportion of total therapy time established under PDPM.^{45,50} Importantly, exceeding the 25% multiparticipant therapy limit does not incur financial penalties for SNF providers.

1.3.3 Early PDPM Impacts: Costs and Quality

SNF staffing declines incurred scrutiny as reports emerged of increased payments to SNF under PDPM. While, unlike the SNF PPS, PDPM was intended to be budget neutral, the design of the PDPM case-mix system led to an unintended \$1.7 billion, or 5%, increase in payments to SNFs in 2020.⁵⁰ Plans for recalibration of the PDPM case mix system are underway to achieve the goal of budget neutrality. In terms of SNF outcomes, CMS reported no significant changes in injurious falls, pressure ulcers, or hospital readmissions under PDPM, but implications for rehabilitation-sensitive outcomes such as functional improvement and community discharge have not yet been studied.⁵⁰

Evaluation of SNF outcomes under PDPM is now confounded and somewhat overshadowed by the COVID-19 pandemic. However, if responses to historical CMS payment policies provide lessons for PDPM, the rapid decline in staffing and therapy provision is no surprise given PDPM's changing incentives for rehabilitation. Previous policy evaluation also reminds us that the response to PDPM will likely vary according to SNF structural factors, with for-profit freestanding providers and SNFs employing contract therapy staff potentially more likely to shift rehabilitation processes under PDPM. The impacts of rehabilitation process changes under PDPM on patient outcomes remains an important area of future research.

1.4 Conclusions

CMS has a decades-long history of implementing new policy in the effort to improve quality while reducing costs, to varying degrees of success. Previous policy implementation provides many lessons for the future, including the ability to predict possible relationships between policy and process changes depending on provider structural characteristics as well as highlighting the importance of considering trade-offs between cost savings and quality and completing targeted monitoring to ensure equitable access to necessary services.

While the ability to predict the impact of policy on process changes based on structural factors is valuable, gaps in understanding the relationships between therapy processes and quality measures in SNFs remain, and these relationships must be further explored in order to anticipate the impact of PDPM and the COVID-19 pandemic on quality outcomes.

1.5 Summary of Studies

The studies included in this dissertation will utilize the conceptual framework presented above to examine relationships between therapy processes and patient outcomes in SNFs in anticipation of changes under PDPM and to explore variability in process changes based on structural factors. The first two studies utilize patient-level data from the year prior to PDPM implementation to establish baseline relationships between two therapy processes, thresholding behavior and multiparticipant therapy, and patient outcomes. Data from 2018 was the most recent patient-level data available at the time these studies were initiated. The patient outcomes available in the data were patient functional improvement and community discharge. Both studies examined therapy processes that are likely to change under PDPM, as informed by the historical policy review above.

The final study utilizes publicly available data to examine how therapy staffing process changes under PDPM varied based on SNF structural characteristics. As patient-level data from after PDPM implementation were not yet available to examine individual changes in therapy provision, public data provide an early look at the impact of policy change on SNF staffing processes with the ability to specifically examine variation based on structural or organizational characteristics. All studies aim to guide targeted quality monitoring of patient outcomes in SNFs as the industry encounters significant challenges imposed by policy change and the COVID-19 pandemic.

Chapter 2: Is More Always Better? Financially Motivated Therapy and Patient Outcomes in Skilled Nursing Facilities

2.1 Abstract

Objectives: Recent increases in rehabilitation provision in Skilled Nursing Facilities (SNFs) motivated new Medicare payment policy which disincentivizes high intensity therapy. However, intensive therapy may be beneficial. Thresholding – when SNFs provide ten or fewer minutes of therapy above weekly reimbursement thresholds – is a specific metric for financially motivated therapy separate from intensive therapy. This study examined patient-level data to determine if thresholding was associated with patient outcomes in SNFs.

Design: Secondary analysis of 2018 Minimum Data Set for 1,023,620 Medicare patients admitted to SNFs for post-acute rehabilitation.

Methods: Associations between thresholding and functional improvement and community discharge outcomes were calculated using mixed effects models with facility random effects, adjusted for therapy intensity and patient and facility characteristics. Sensitivity analyses determined whether thresholding was similarly associated with outcomes when patients were stratified by therapy volume.

Results: Thresholding was associated with a small positive effect on functional improvement (OR 1.07; 95% CI 1.06-1.09) and community discharge (OR 1.03, 95% CI 1.02-1.05). Effect sizes for functional improvement were consistent across patients receiving different volumes of therapy. However, effect sizes for community discharge were larger for patients in low-volume therapy groups (OR 1.27, 95% CI 1.18-1.35).

Conclusions and Implications: Patients who experienced thresholding during post-acute SNF stays were slightly more likely to improve in function and successfully discharge to the community, especially for patients receiving lower volumes of therapy. While thresholding is an inefficient and financially motivated practice, results suggest that thresholding was not harmful to patients, and extra therapy time may have contributed positively to outcomes for patients receiving lower-volume therapy. As therapy volumes decline in SNFs, these results emphasize the importance of Medicare payment policy designed to promote, not disincentivize, potentially beneficial rehabilitation services for patients.

2.2 Introduction

Twenty percent of all hospitalized Medicare beneficiaries receive post-acute care in Skilled Nursing Facilities (SNFs),⁸ with SNF costs for the Centers for Medicare and Medicaid Services (CMS) totaling nearly \$28 billion in 2019.² In October 2019, the Centers for Medicare and Medicaid Services (CMS) drastically altered SNF payment policy in response to rising physical therapy (PT) and occupational therapy (OT) intensity in SNFs, which CMS considered to be financially motivated rather than clinically indicated.^{8,44,51,52} Under the previous Resource Utilization Group (RUG-IV) payment system, SNF reimbursement was based on hours of weekly therapy provided, and reimbursement rates increased at specific intervals of therapy time per week.³⁹ In addition to incentivizing higher therapy volumes, this system also incentivized thresholding behavior, a practice of providing ten or fewer minutes of therapy above the weekly threshold for higher reimbursement in order to garner higher payment with minimal increase in therapy staffing costs.^{11,36,39,46,53,54} Sharp increases in both overall therapy intensity and thresholding behavior in SNFs motivated CMS to develop the Patient Driven Payment Model

(PDPM), which, in part, aims to decrease clinically unnecessary PT and OT in SNFs by removing higher payments for higher volumes of therapy.⁴⁵

While PDPM intended to reduce inefficient financially motivated therapy, the design of PDPM disincentivizes intensive therapy across the board without incorporating rehabilitation outcomes in payment determinations.^{11,55} Previous research has linked intensive therapy with improved patient outcomes in SNFs,^{13,55-58} however, optimal therapy intensity to achieve desired patient outcomes in SNFs is unknown, especially because the previous payment system led to minimal variation in therapy intensity as SNFs sought to place patients into more profitable case mix groups.^{8,58} Without the ability to distinguish between clinically indicated and financially motivated therapy provision, rehabilitation payment policy will likely continue to be driven by costs rather than quality.⁵⁹ Monitoring thresholding behavior addresses this gap by providing an indicator that allows for specific study of financially motivated therapy. Because thresholding occurs when patients receive a certain amount of therapy close to each specific threshold for higher reimbursement, even for patients receiving low therapy volumes,¹¹ thresholding is a unique indicator of financially motivated therapy that can be examined separately from intensive therapy, which may be clinically indicated.

Previous work analyzing a national cohort of SNFs showed that SNF characteristics such as staffing processes and for-profit ownership were associated with higher rates of thresholding behavior for patients receiving ultrahigh intensity therapy (at least twelve combined PT, OT, and speech therapy hours per week).¹¹ Thresholding was also associated with worse outcomes at the facility level, including lower rates of community discharges and higher rates of 30-day hospital readmissions, however, effect sizes were very small.¹¹ Another facility-level analysis found that SNFs with high rates of thresholding into the ultrahigh therapy intensity payment category had

higher 30-day hospital readmission rates, longer lengths of stay, and higher costs per SNF stay.⁵⁴ However, there currently is no evidence on relationships between thresholding and outcomes at the patient level. Additionally, associations between thresholding and outcomes for patients receiving lower volumes of therapy are unknown. This study uses patient-level data to determine whether patients in SNFs who experienced thresholding experienced worse outcomes than patients who did not experience thresholding behavior, while controlling for overall therapy intensity.

2.3 Methods

2.3.1 Data Sources and Study Population

We created a national cohort of Medicare fee-for-service SNF stays using the 2018 Minimum Dataset (MDS) 3.0 and the 2018 Medicare Beneficiary Summary File (MBSF). The MDS is a required comprehensive assessment for all patients in SNFs, and includes demographic, functional, and clinical patient information as well as data on treatments received during SNF admission, including therapy services.^{60,61} The MBSF includes demographic and Medicare coverage information. We created complete SNF stays by including admission, discharge, and all interim MDS assessments, and then selected the first complete stay per patient in 2018 to avoid inducing correlation by using multiple stays per patient.⁶² To create our cohort of short-stay Medicare patients admitted to SNF for post-acute rehabilitation, we applied exclusion criteria consistent with previous research. We excluded patients missing insurance eligibility information from the MBSF file, long-stay patients with SNF length of stay over 100 days, patients admitted and discharged on the same day, patients admitted to SNF for hospice care, patients who died during SNF admission, patients who were comatose on admission, and patients who did not receive PT or OT during their stay.^{55,58,63–65}

2.3.2 Independent Variable

The primary independent variable of interest in this study was a dichotomous indicator for whether patients experienced thresholding in any assessment period during their SNF stay. Thresholding was calculated from the MDS, which reports the number of PT, OT, and speech therapy minutes in the last seven days of each assessment period as well as the RUG-IV category which determined payment for that assessment. Combined therapy minutes for each assessment period were summed, with any therapy minutes categorized as group therapy divided by four and minutes categorized as concurrent therapy divided by two, as per the RUG-IV allocation system.⁶⁶ Thresholding occurred if the total therapy minutes for any assessment period exceeded the minute threshold for the assigned RUG-IV category by ten or fewer minutes.

2.3.3 Outcome Variables

The outcomes of interest were successful discharge to the community and patient functional improvement. Functional improvement occurred when scores on MDS transfer, ambulation, or locomotion items improved between admission and discharge.^{67,68} Community discharge was considered successful if the MDS indicated discharge to a private home, assisted living facility, or group home, in contrast with hospital, hospice, or another rehabilitation-specific institutional setting.

2.3.4 Covariates

Covariates included overall intensity of therapy during the full SNF stay by including average minutes of occupational and physical therapy per day of therapy received during the SNF stay. We adjusted for demographics including age, sex, disability or end-stage renal disease as reason for Medicare entitlement, dual Medicare-Medicaid eligibility, a dichotomous indicator of marital status, and need for an interpreter. We included MDS indicators for vision and

communication impairments, and cognitive impairment scores from the Brief Interview for Mental Status (BIMS), categorized as no cognitive impairment (scores of 13 or higher), moderate cognitive impairment (scores of 8-12), or severe cognitive impairment (scores under 8).^{63,69} We adjusted for activity of daily living scale scores at baseline, which ranges from 0-28, with higher scores indicating more severe impairment on seven functional tasks.^{22,70} We included indicators for falls within the last six months, use of an assistive device, delirium, major depression, daily reported pain, wandering, rejection of care, and psychosis such as hallucinations or physical or verbal behavioral symptoms directed towards others.^{61,67} To reflect medical complexity we included indicators for a range of active medical diagnoses on SNF admission and clinical treatments received during the SNF stay, included in Table 2.1.

Finally, we controlled for specific organizational characteristics that have been shown to be associated with quality outcomes and/or thresholding behavior using calendar year 2018 LTCFocus data (www.ltcfocus.org)⁷¹ and the CMS Provider of Services File.^{11,72-74} We included urban versus rural county location, a dichotomous indicator for for-profit ownership, hospital-based versus freestanding location, chain affiliation, contractor therapy staffing (characterized as 100% in-house PT and OT staff, 100% contractors, or a mix), and assistant staffing, characterized as 0% PT and OT assistants, and then as quartiles of assistant staffing for SNFs staffing any assistants.

2.3.5 Analyses

In our primary analysis, we estimated relationships between thresholding and odds of functional improvement and community discharge using generalized mixed effects logistic regression models with a random intercept for facility to control for correlation between patients admitted to the same SNF due to unobserved SNF-level factors. Models for functional

improvement and community discharge outcomes included different patient covariates to avoid model overfitting by including only specific MDS variables that previously have been shown to be associated with each outcome, as shown in Tables 2.2 and 2.3.⁷⁵

We then ran sensitivity analyses to explore whether thresholding was similarly associated with outcomes across SNF stays with different volumes of average weekly therapy. We hypothesized that patients receiving overall lower volumes of therapy may experience more benefit from the additional few minutes of therapy services per week received when thresholding occurs compared to patients already receiving high levels of therapy. For sensitivity analyses, we stratified patients into three groups based on their average combined PT and OT minutes per week throughout their SNF stay: Ultrahigh therapy group (patients receiving at least 720 minutes of weekly therapy), Very High therapy group (patients receiving between 500-720 minutes of weekly therapy), and Low therapy (all patients receiving under 500 minutes of therapy per week). We then ran mixed effects logistic regression models with facility random effects for functional improvement and discharge outcomes for the three groups. Models for sensitivity analyses included all the same covariates as the primary analyses, except for therapy minutes per day, as patients were already stratified based on therapy volume. Analyses were conducted using statistical software (RStudio version 1.2.5019, R Foundation for Statistical Computing, Vienna Austria). This study was approved by the institutional review board of the University of Washington (IRB ID STUDY00009986).

2.4 Results

Descriptive statistics for outcomes, patient demographic and clinical characteristics, and SNF stay characteristics for the 934,677 SNF stays that met inclusion criteria are included in Table 2.1. Thresholding was common in our sample, with 56.4% of patients experiencing

thresholding during their SNF stay. In terms of outcomes, 50.4% of patients improved in function for transfers, ambulation, or locomotion, and 66.7% of patients successfully discharged to the community.

Table 2.1. Descriptive Statistics for Complete Short-Stay Skilled Nursing Facility Patient Stays in 2018 (N=934,677)

Thresholding	Mean (SD) or N (%)
Thresholding during SNF stay	527,196 (56.4%)
Outcomes	
Improved in Function	471,432 (50.4%)
Successful Community Discharge	623,865 (66.7%)
Demographics	
Age (years)	80.5 (8.5)
Female	570,394 (61.0%)
Disability or ESRD as reason for Medicare Entitlement	200 (0.02%)
Dual Eligibility	170,719 (18.3%)
Married	332,702 (35.6%)
Needs Interpreter	24,700 (2.6%)
SNF Stay Characteristics	
Length of Stay (days)	25.2 (19.9)
PT Minutes per Day	56.3 (11.5)
OT Minutes per Day	54.9 (11.0)
Cognitive and Physical Function	

ADL Scale Score on Admit (0-28)	16.9 (4.3)
Falls in the last 6 months	426,662 (45.6%)
Daily pain	12,975 (1.4%)
Use of an assistive device	895,757 (95.5%)
Cognitive Impairment	
None (BIMS 13+)	579,695 (62.0%)
Moderate (BIMS 8-12)	173,714 (18.6%)
Severe (BIMS 0-7)	111,931 (12.0%)
Vision Impairment	141,805 (15.2%)
Communication Impairment	51,710 (5.5%)
Wandering	16,695 (1.8%)
Rejected Care	42,265 (4.5%)
Active Diagnoses	
Stroke	74,178 (7.9%)
Hip Fracture	82,179 (8.8%)
Other Fracture	110,847 (11.9%)
Cancer	71,626 (7.7%)
Diabetes Mellitus	303,017 (32.4%)
Wound Infection	7,219 (0.8%)
Foot Infection	8,909 (1.0%)
Anemia	251,146 (26.9%)
Asthma, COPD, or Chronic Lung Disease	228,637 (24.5%)

Pneumonia	87,751 (9.4%)
Heart Failure	216,843 (23.2%)
Hypertension	730,278 (78.1%)
Septicemia	38,890 (4.2%)
Urinary Tract Infection	111,701 (12.0%)
Alzheimer's Dementia	35,341 (3.8%)
Dementia Other than Alzheimer's	158,359 (16.9%)
Parkinson's Disease	36,319 (3.9%)
Malnutrition	40,746 (4.4%)
Psychosis or Behavioral Symptoms	43,605 (4.7%)
Major Depression	43,858 (4.7%)
Anxiety Disorder	163,359 (17.5%)
Psychiatric Disorder other than Schizophrenia	14,342 (1.5%)
Schizophrenia	11,893 (1.3%)
Clinical Treatments	
<hr/>	
Intravenous Medication	60,639 (6.5%)
Hemodialysis	25,496 (2.7%)
Facility Characteristics	
<hr/>	
Urban	783,338 (83.8%)
For-Profit	630,043 (67.4%)
Hospital-Based	43,154 (4.6%)
Chain Affiliation	556,965 (59.6%)

Contractor Staffing

All In-House Staff	366,423 (39.2%)
All Contract Staff	458,969 (49.1%)
Mix	109,285 (11.7%)

Assistant Staffing

None	71,007 (7.6%)
0 - <25%	162,606 (17.4%)
25 - <50%	233,636 (25.0%)
50 - <75%	234,928 (25.1%)
75%+	232,500 (24.9%)

Abbreviations: SD-Standard Deviation, OT- Occupational Therapy, PT- Physical Therapy, ADL- Activities of Daily Living, BIMS- Brief Interview for Mental Status

Results of our primary analyses are included in Tables 2.2 and 2.3. Thresholding was associated with a small positive effect on functional improvement, with patients who experienced thresholding having 1.07 times higher odds of improving in function (95% CI 1.06, 1.09). Similarly, thresholding was associated with 1.03 times higher odds of discharging to the community (95% CI 1.02, 1.05).

Table 2.2. Results of Generalized Mixed Effects Logistic Regression Model for Functional Improvement Outcome (N=823,260)

Variable	Odds Ratio (95% CI)	p-value
Thresholding	1.07 (1.06, 1.09)	<0.001
Demographics		
Female	1.05 (1.04, 1.06)	<0.001
Age	0.99 (0.99, 0.99)	<0.001
Disability or ESRD as reason for Medicare		
Entitlement	0.77 (0.54, 1.10)	0.15
Dual Eligibility	0.92 (0.90, 0.93)	<0.001
SNF Stay Characteristics		
Length of Stay (days)	1.03 (1.03, 1.03)	<0.001
PT Minutes per Day (10-minute increase)	1.18 (1.17, 1.18)	<0.001
OT Minutes per Day (10-minute increase)	1.09 (1.08, 1.10)	<0.001
Cognitive and Physical Function		
ADL Scale Score on Admit (0-28)	1.01 (1.01, 1.01)	<0.001
Cognitive Impairment		
None (BIMS 13+)	Ref.	-
Moderate (BIMS 8-12)	0.76 (0.75, 0.77)	<0.001
Severe (BIMS 0-7)	0.51 (0.51, 0.53)	<0.001
Heart Failure	0.88 (0.87, 0.90)	<0.001
Stroke	0.83 (0.81, 0.84)	<0.001

Hip Fracture	1.12 (1.10, 1.14)	<0.001
Other Fracture	1.07 (1.06, 1.09)	<0.001

Facility Characteristics

Urban	0.90 (0.87, 0.92)	<0.001
For-Profit	0.78 (0.76, 0.80)	<0.001
Hospital-Based	1.05 (0.98, 1.13)	0.15
Chain Affiliation	1.03 (1.00, 1.05)	0.048

Contractor Staffing

All In-House Staff	Ref.	-
All Contract Staff	0.99 (0.97, 1.02)	0.62
Mix	0.92 (0.88, 0.96)	<0.001

Assistant Staffing

None	Ref.	-
0 - <25%	0.97 (0.92, 1.02)	0.23
25 - <50%	0.95 (0.91, 0.99)	0.03
50 - <75%	0.92 (0.88, 0.96)	<0.001
75%+	0.87 (0.84, 0.92)	<0.001

Abbreviations: ESRD- End Stage Renal Disease, PT- Physical Therapy, OT- Occupational Therapy, ADL- Activities of Daily Living, BIMS- Brief Interview of Mental Status

Table 2.3 Results of Generalized Mixed Effects Logistic Regression Model for Community Discharge Outcome (N=829,927)

Variable	Odds Ratio (95% CI)	p-value
Thresholding	1.03 (1.02, 1.05)	<0.001
Demographics		
Female	1.25 (1.24, 1.27)	<0.001
Age	1.00 (1.00, 1.00)	<0.001
Disability or ESRD as reason for Medicare Entitlement	0.95 (0.66, 1.36)	0.78
Dual Eligibility	0.81 (0.80, 0.83)	<0.001
Married	1.14 (1.23, 1.16)	<0.001
SNF Stay Characteristics		
Length of Stay (days)	1.04 (1.04, 1.04)	<0.001
PT Minutes per Day (10-minute increase)	1.24 (1.23, 1.25)	<0.001
OT Minutes per Day (10-minute increase)	1.07 (1.06, 1.08)	<0.001
Cognitive and Physical Function		
ADL Scale Score on Admit (0-28)	0.85 (0.85, 0.85)	<0.001
Cognitive Impairment		
None (BIMS 13+)	Ref.	-
Moderate (BIMS 8-12)	0.78 (0.77, 0.80)	<0.001
Severe (BIMS 0-7)	0.76 (0.75, 0.78)	<0.001
Needs Interpreter	1.20 (1.15, 1.25)	<0.001
Vision Impairment	0.94 (0.92, 0.95)	<0.001

Communication Impairment	0.90 (0.87, 0.93)	<0.001
Falls in the last 6 months	0.99 (0.98, 1.00)	0.15
Daily pain	0.84 (0.80, 0.89)	<0.001
Use of an assistive device	1.21 (1.16, 1.25)	<0.001
Delirium	0.62 (0.59, 0.66)	<0.001
Wandering	0.99 (0.94, 1.04)	0.59
Rejected Care	0.97 (0.94, 1.00)	0.11
Psychosis or Behavioral Symptoms	0.77 (0.75, 0.80)	<0.001
Active Diagnoses		
Stroke	0.91 (0.89, 0.93)	<0.001
Hip Fracture	0.94 (0.91, 0.96)	<0.001
Other Fracture	0.93 (0.91, 0.94)	<0.001
Cancer	0.86 (0.84, 0.88)	<0.001
Diabetes Mellitus	0.87 (0.86, 0.88)	<0.001
Wound Infection	0.84 (0.78, 0.90)	<0.001
Foot Infection	0.80 (0.76, 0.85)	<0.001
Anemia	0.83 (0.82, 0.84)	<0.001
Asthma, COPD, or Chronic Lung Disease	0.89 (0.88, 0.91)	<0.001
Pneumonia	1.01 (0.99, 1.03)	0.61
Heart Failure	0.76 (0.75, 0.77)	<0.001
Hypertension	1.01 (0.99, 1.03)	0.14
Septicemia	0.99 (0.97, 1.02)	0.72

Alzheimer's Dementia	1.22 (1.18, 1.27)	<0.001
Dementia Other than Alzheimer's	0.87 (0.86, 0.88)	<0.001
Malnutrition	0.74 (0.72, 0.76)	<0.001
Psychosis or Behavioral Symptoms	0.77 (0.75, 0.80)	<0.001
Major Depression	0.69 (0.67, 0.71)	<0.001
Anxiety Disorder	0.99 (0.98, 1.01)	0.38
Psychiatric Disorder other than Schizophrenia	0.89 (0.85, 0.94)	<0.001
Schizophrenia	0.86 (0.81, 0.91)	<0.001
Clinical Treatments		
Intravenous Medication	0.69 (0.68, 0.71)	<0.0001
Hemodialysis	0.58 (0.56, 0.59)	<0.0001
Facility Characteristics		
Urban	1.03 (1.00, 1.07)	0.04
For-Profit	0.66 (0.63, 0.68)	<0.001
Hospital-Based	1.34 (1.24, 1.45)	<0.001
Chain Affiliation	1.07 (1.04, 1.10)	<0.001
Contractor Staffing		
All In-House Staff	Ref.	-
All Contract Staff	0.87 (0.85, 0.90)	<0.001
Mix	0.94 (0.90, 0.99)	0.02
Assistant Staffing		
None	Ref.	-

0 - <25%	1.09 (1.03, 1.15)	0.003
25 - <50%	1.06 (1.01, 1.12)	0.03
50 - <75%	1.02 (0.96, 1.07)	0.52
75%+	0.89 (0.84, 0.94)	<0.001

Abbreviations: ESRD- End Stage Renal Disease, PT- Physical Therapy, OT- Occupational Therapy, ADL- Activities of Daily Living, BIMS- Brief Interview of Mental Status, COPD- Chronic Obstructive Pulmonary Disease

Results from sensitivity analyses stratifying patients based on volume of therapy are included in Table 2.4. Contrary to our hypothesis that patients in lower volume therapy categories would experience larger effects of thresholding, results for functional improvement were similar to the primary analysis and similar across therapy volume groups. In contrast, consistent with our hypothesis, patients in low volume therapy groups had larger positive effect sizes for community discharge outcomes if they experienced thresholding. Among patients receiving ultrahigh therapy, patients who experienced thresholding had 1.07 times higher odds of community discharge compared to those who did not experience thresholding. Among patients receiving low volumes of therapy, patients who experienced thresholding had 1.27 times higher odds of community discharge compared to those who did not experience thresholding.

Table 2.4 Adjusted odds ratios for associations between thresholding and outcomes for therapy volume subgroups.

Functional Improvement		
Therapy Volume Subgroup	Odds Ratio (95% CI)	p-value
Ultrahigh (n =543,973)	1.10 (1.09, 1.12)	<0.001
Very High (n = 247,071)	1.07 (1.05, 1.10)	<0.001
Low (n = 32,216)	1.10 (1.04, 1.18)	0.003
Community Discharge		
Therapy Volume Subgroup	Odds Ratio (95% CI)	p-value
Ultrahigh (n =549,746)	1.07 (1.05, 1.08)	<0.001
Very High (n = 241,856)	1.03 (1.01, 1.06)	0.002
Low (n = 38,225)	1.27 (1.18, 1.35)	<0.001

2.5 Discussion

In this study, we found small positive associations between patient outcomes and receiving therapy just over weekly minute thresholds for higher reimbursement in SNFs, when adjusting for overall therapy intensity and patient and facility characteristics. Small positive associations between thresholding and functional improvement were consistent for patients receiving different volumes of therapy during their SNF stay. Effect sizes for the positive relationship between thresholding and successful community discharge were largest for patients in low-volume therapy groups.

This patient-level analysis suggests that the financially motivated therapy billing practice of thresholding, while inefficient for CMS as the payer, may be beneficial for individual patients,

especially those receiving lower overall therapy volumes. This may reflect that the extra minutes of therapy provided for patients experiencing thresholding constitute a ‘bonus’ in their overall therapy time beyond what would typically have been provided. Extra time spent in therapy sessions may provide additional time for planning and education, safety training, and skills improvement needed for successful community discharge.

In addition to extra time in therapy for patients experiencing thresholding, higher therapy intensity overall also had positive effect sizes for both outcomes, with 10 minutes more OT or PT per day associated with higher odds of functional improvement and community discharge. This result is consistent with a growing body of evidence on positive relationships between intensive therapy and outcomes for patients in SNFs.^{13,55,56,58} Thus these results suggest that, even when financially motivated, higher volumes of therapy provision may help SNFs aiming to provide quality care and improve patient outcomes, especially important as CMS moves towards value-based payment initiatives. These results are also concerning in the light of recent reports of declining therapy provision in SNFs under PDPM.⁷⁶

Positive effects of thresholding in this patient-level analysis were inconsistent with previous research that found small negative associations between thresholding and patient outcomes at the facility level.¹¹ The facility-level analysis used functional improvement, discharge and readmission outcome measures that were risk adjusted at the facility level for patient clinical factors associated with each outcome. However, the effect sizes in the facility-level analysis were so small as to indicate a clinically insignificant relationship between thresholding and patient outcomes at the facility level. Differences between facility-level and patient-level analyses point to the need for analyses of individual patient outcomes in addition to facility-level costs and quality under PDPM. Together, these two studies support a conclusion

that thresholding may be an inefficient financially motivated billing practice, but it does not appear to be negative for patients.

While thresholding behavior is no longer incentivized in SNFs under PDPM, SNFs are responsive to changes in payment policy incentives.^{37,38,43,59} Thus, even as CMS continues to move towards more patient-centered and value-based payment policy, the industry will likely continue to respond in ways to maximize profits, as seen in reports of decreased therapy staffing and therapy provision under PDPM.^{48,49,76} In that context, these results reinforce the importance of careful payment policy design that does not disincentivize services that may be beneficial to patients.

2.5.1 Limitations

This cross-sectional study demonstrates associations between thresholding behavior and patient outcomes and does not imply causality. Hospital readmission outcomes have previously been examined in the context of thresholding behavior at the facility level,¹¹ but individual readmission outcomes could not be calculated from MDS data. Future work incorporating claims data could be utilized to examine relationships between thresholding and readmissions. Additionally, MDS data do not include upstream factors from hospitalization preceding SNF stays, so we were unable to directly adjust for factors from the hospital stay that may be related to function or discharge outcomes.

Speech therapy was included in total minute calculations to detect thresholding, as weekly physical, occupational, and speech minutes are totaled to determine RUG group and indicate how close a patient was to a payment threshold. However, speech therapy minutes were not included in therapy intensity adjustments or sensitivity analysis stratifications because speech therapy costs have been shown to be inversely related to PT and OT costs.⁴⁵ Thus, we would not

expect patients receiving high intensity PT and OT to also receive high intensity speech therapy, or for speech therapy minutes to be utilized to achieve thresholding in the same manner as physical and occupational therapy minutes. However, future analyses could include all therapy disciplines to understand relationships between outcomes and all therapy services.

2.6 Conclusions and Implications

This study found that patients undergoing post-acute rehabilitation in SNFs who experienced thresholding behavior were slightly more likely to improve in function and successfully discharge to the community, especially for patients receiving lower volumes of therapy. While thresholding is a financially motivated inefficient billing practice that is disincentivized under new payment policy, it appears that thresholding was not harmful to patients, and may have even contributed positively to patient outcomes. As therapy volumes decline under PDPM, these results emphasize the importance of Medicare payment policy designed to promote, not disincentivize, beneficial rehabilitation services for patients.

Chapter 3: Some But Not Too Much: Multiparticipant Therapy and Positive Patient Outcomes in Skilled Nursing Facilities

3.1 Abstract

Background and Purpose: Physical and occupational therapy practices in Skilled Nursing Facilities (SNFs) shifted after implementation of the 2019 Medicare Patient Driven Payment Model (PDPM). Under PDPM, the practice of multiparticipant therapy – treating more than one patient per therapy provider per session – increased in SNFs, but it is unknown how substituting multiparticipant therapy for individualized therapy may impact patient outcomes. This cross-sectional study establishes baseline relationships between multiparticipant therapy and patient outcomes prior to PDPM.

Methods: We used Minimum Data Set assessments from all short-term Medicare fee-for-service SNF stays in 2018. Using adjusted generalized mixed effects logistic regression, we examined associations between the proportion of minutes of physical and occupational therapy that were received as multiparticipant sessions during the SNF stay and two patient outcomes: community discharge and functional improvement. Multiparticipant therapy as a proportion of total therapy was categorized as none, low (below the median of 5%), medium (median to <25%), and high (25% or more) to reflect the 25% limit on multiparticipant therapy required by PDPM.

Results and Discussion: Of 1,023,620 patients who met inclusion criteria, 901,544 had complete data for functional improvement and 912,996 had complete data for discharge outcomes.

Compared to patients receiving no multiparticipant therapy, adjusted models found positive associations between low and medium multiparticipant therapy levels and outcomes. Patients receiving low levels of multiparticipant therapy had 14% higher odds of improving in function

(95% CI 1.09-1.19) and 10% higher odds of community discharge (95% CI 1.05-1.15). Patients receiving medium levels of multiparticipant therapy had 18% higher odds of functional improvement (95% CI 1.13-1.24) and 44% higher odds of community discharge (95% CI 1.34-1.55). However, associations disappeared with high levels of multiparticipant therapy.

Conclusions: Prior to PDPM, providing up to 25% multiparticipant therapy was an efficient strategy that may have also benefitted patients. As positive associations disappeared with high levels ($\geq 25\%$) of multiparticipant therapy, it may be best to continue delivering the majority of therapy in SNFs as individualized treatment.

3.2 Introduction

Over 1.5 million Medicare beneficiaries received post-acute short-term skilled nursing and rehabilitation services in Skilled Nursing Facilities (SNFs) in the United States in 2019.² Patients are discharged from hospitals to SNFs with a wide variety of medical and post-surgical diagnoses and are diverse in their specific post-acute care needs. The most common conditions for short-stay patients in SNFs in 2019 ranged from joint replacement and hip and femur surgeries to septicemia, heart failure, and kidney infections.² Despite heterogenous medical needs, the objectives of physical therapy (PT) and occupational therapy (OT) in SNFs are similar across short-stay patients, with common goals of improving patient mobility and self-care function and to facilitate discharge to a community setting.¹³

Participation in rehabilitation during SNF stays is very common, and over 95% of beneficiaries received therapy services during post-acute SNF stays in 2018.¹⁷ However, rehabilitation in SNFs came under significant scrutiny by the Centers for Medicare & Medicaid Services (CMS) under the previous reimbursement system for SNFs, called the Prospective Payment System (PPS), which was in place between 1998 and 2019.⁵³ The PPS incentivized

higher intensity therapy provision by coupling higher payments to higher volumes of therapy, and CMS attributed rising costs of SNF care in large part to rising therapy provision.^{8,53} Under the PPS, Medicare SNF costs grew by \$1 billion between 2010-2015,⁸ totaling over \$28.5 billion by 2018.⁶ Concurrently, the share of patients receiving high levels of therapy rose from 27 percent to 84 percent between 2002-2018, with minimal changes in average patient functional dependence that would signal increased clinical need for therapy services.¹⁷ Additionally, equitable access to SNF services was a concern under PPS, as facilities were incentivized to admit patients who could tolerate high levels of rehabilitation and avoid patients with high medical complexity and nursing needs.⁸

Motivated by these PPS shortcomings, CMS implemented sweeping reforms to the SNF reimbursement system on October 1, 2019, replacing the PPS with the Patient Driven Payment Model (PDPM), which aims to decrease clinically unnecessary therapy in SNFs and re-align payment with patient need.⁴⁵ To achieve these aims, PDPM determines reimbursement based on patient diagnosis and functional status and removes therapy minutes as the primary determinant of payment for Medicare fee-for-service beneficiaries, thereby disincentivizing higher rates of therapy provision.⁴⁵

Consistent with previous SNF industry shifts in staffing after PPS implementation, it is anticipated that many SNFs will respond to changing incentives under PDPM by reducing therapy costs.^{36,37,45} One cost-saving strategy is to replace individual therapy with multiparticipant therapy; defined as either group therapy (two to six patients per therapy provider doing similar activities) or concurrent therapy (two patients per therapist doing different activities) in contrast with individualized therapy (one patient per therapist per session).⁷⁷ Multiparticipant therapy was not incentivized under the PPS and made up less than 1% of total

therapy minutes prior to PDPM.⁷⁸ The literature has not fully described how clinical decisions are made in terms of including certain patients in individual versus multiparticipant therapy sessions. However, prior to PDPM, there is evidence that SNF organizational factors were more strongly associated with multiparticipant therapy provision than patient clinical characteristics, thus these decisions are likely driven by a combination of clinician decisions and organizational policies.⁷⁹

As anticipated, the SNF industry increased multiparticipant therapy under PDPM, both in terms of overall minutes of multiparticipant therapy provided as well as the proportion of patients receiving multiparticipant therapy. CMS reported that the percentage of patient stays that included concurrent therapy rose from 1% to 32% and the percentage receiving group therapy rose from 1% to 29% immediately after PDPM implementation.⁷⁶ In a post-PDPM survey, 76% of SNF therapists and administrators reported increases in group therapy, and over two-thirds of respondents indicated that SNF employers either encouraged or mandated changes in multiparticipant therapy.⁸⁰ While patient isolation measures necessary during the COVID-19 pandemic reversed the early increase in multiparticipant therapy, further increases in multiparticipant therapy provision in SNFs are likely after successful vaccination efforts.^{2,76,81}

Citing preference for individualized therapy as the dominant modality of therapy provision in SNFs and responding to stakeholder concerns about excessive multiparticipant therapy provision, CMS limited multiparticipant therapy to 25% of total therapy time under PDPM, however no financial penalties are incurred by SNFs who exceed the 25% limit.^{45,82} While there is some evidence on the efficacy of multiparticipant therapy compared to individualized therapy, previous studies focused on specific patient populations (e.g., brain injury, back pain) in other healthcare settings, which are not generalizable to the heterogenous

SNF population.⁸³⁻⁸⁷ Only one study has examined relationships between multiparticipant therapy and rehabilitation outcomes in SNFs, finding no significant association between multiparticipant therapy provision and patient improvement in gait speed or balance.⁸⁸ However, this small study included patients from only one facility and used clinical outcome measures that CMS does not monitor as part of its quality initiatives. Another study found that low-quality SNFs were more likely to provide $\geq 25\%$ multiparticipant therapy prior to PDPM, however the Five-Star quality measure used in this study provides a broad facility-level summary of overall nursing and rehabilitation quality in SNFs and may not accurately reflect relationships between multiparticipant therapy and patient-specific outcomes.^{79,89} Thus, it remains unclear how national shifts in therapy practice away from individualized treatment towards multiparticipant therapy will impact patients, especially if increases in multiparticipant therapy are driven by organizational mandates rather than individual clinician decision-making. As post-PDPM patient-level data on therapy provision in SNFs are only available at two-year lags, the aim of this study is to establish baseline relationships between multiparticipant therapy and patient outcomes prior to PDPM to facilitate comparisons and provide insight into how patients could be affected as multiparticipant therapy increases in response to changing reimbursement incentives.

3.3 Methods

3.3.1 Data and Study Population

This cross-sectional analysis used patient data from the calendar year 2018 Minimum Data Set (MDS) 3.0 and Master Beneficiary Summary File (MBSF), which include data on all SNF residents in the United States, specifically patient demographic, clinical, and functional data, as well as service and therapy use during SNF admission.⁶¹ To avoid inducing correlation by using multiple stays per SNF resident, we included the first complete Medicare Part A fee-

for-service SNF stay per patient in 2018. We excluded patients missing from the MBSF, long-stay patients with a length of stay over 100 days, and patients who were admitted and discharged on the same day.^{55,63,90} Consistent with previous research on short-stay SNF patients, patients on hospice care or who were comatose at admission, patients who died during their SNF stay, and patients who received no therapy throughout the SNF stay were excluded.^{63,65} For the functional improvement outcome, we then removed patients who did not have two or more assessments during their stay, as we could not calculate changes in function. For the community discharge outcome, we excluded patients with discharge location missing from their discharge MDS assessment.

3.3.2 Outcomes

The two dichotomous outcomes in this study are patient functional improvement and successful discharge to a community setting. Community discharge location is indicated on MDS assessments, and can include a private home or apartment, assisted living, or group home setting, in contrast with an acute care hospital, hospice, or another rehabilitation facility. This MDS indicator for community discharge is used by CMS and frequently used in studies examining post-acute care outcomes.^{20,55,75,90} Consistent with CMS methods used in Nursing Home Compare and Quality Reporting Program initiatives, for this study, functional improvement occurred if a patient improved by at least one point on one or more of the six-point scales for transfers, ambulation, or locomotion performance between admission and discharge MDS assessments.⁶⁸

3.3.3 Independent Variables

The independent variable of interest is multiparticipant therapy minutes as a proportion of total therapy minutes during the SNF stay. We added minutes of concurrent and group PT and

OT across all MDS assessments and divided by total minutes of PT and OT across assessments completed throughout the SNF stay. As the overall proportion of multiparticipant therapy was anticipated to be small, we decided a priori to categorize multiparticipant therapy provision into levels that were clinically and policy relevant. We used the median proportion of multiparticipant therapy to distinguish between low and medium multiparticipant therapy and added an additional category for patients receiving at or above the CMS limit of 25% multiparticipant therapy. The median proportion among patients who received some multiparticipant therapy was 4.9%, so our final categories of multiparticipant therapy were: None (0%), Low (>0 to <5%), Medium (5 to <25%), and High (25% or more).

3.3.4 Descriptive Variables and Covariates

Individual-level covariates were obtained from MDS admission assessments and the MBSF. Patient demographic covariates included age, sex, dual Medicare-Medicaid eligibility, marital status, need for an interpreter, and disability or end stage renal disease as the reason for Medicare entitlement. SNF stay factors included length of stay (LOS) in days, therapy intensity reflected by OT and PT minutes received per day of therapy, and indicators for specific treatments received during the SNF stay, such as intravenous medication and hemodialysis. Patient functional covariates coded in the MDS included the activities of daily living (ADL) scale score at admission, which reflects patient performance on seven functional tasks.²² The ADL scale ranges from 0 to 28 with higher scores indicating more severe functional impairment. We included covariates for use of an assistive device (either a wheelchair, walker, cane, or prosthetic), communication or vision impairment, falls in the last 6 months, and whether patients reported pain on a daily basis during admission assessments. We included scores on the Brief Interview for Mental Status (BIMS), with scores of 13 or higher classified as no cognitive

impairment, scores of 8-12 classified as moderate impairment, and scores below 8 as severe cognitive impairment.^{63,69} Other covariates include dichotomous indicators from admission assessments for behaviors such as wandering, rejection of care, and psychosis such as hallucinations or physical or verbal behavioral symptoms directed towards others.^{61,75} Finally, we included a wide range of active diagnoses coded on the MDS, ranging from stroke and heart failure to hip fracture or Alzheimer's dementia (Table 3.1).⁶¹

3.3.5 Analysis

We used generalized mixed effects logistic regression models with random effects for facility to account for clustering at the SNF level. We estimated the odds of improving in function and the odds of community discharge for patients receiving different levels of multiparticipant therapy, adjusted for patient and SNF stay covariates. As different patient risk factors are clinically relevant to each outcome, we adjusted for different patient covariates in the functional improvement and discharge models, guided by CMS risk adjustment methods used in the Nursing Home Compare quality measures program which found specific MDS variables to be associated with each outcome.⁷⁵ To avoid model overfitting and to adjust only for true confounders in the relationship between multiparticipant therapy and our outcomes, we further limited our adjustment to covariates that were found to be associated with multiparticipant therapy in a previous analysis.⁷⁹ These adjustments also help reduce selection bias by accounting for potential clinical differences in patients who received different levels of multiparticipant therapy. Final covariates for each model are included in Tables 3.2 and 3.3.

Finally, we completed a sensitivity analysis exploring whether there were differential associations between outcomes and multiparticipant therapy provided by therapy disciplines separately. We ran one mixed effects logistic regression model for each outcome with separate

independent variables for the overall proportions of multiparticipant PT and multiparticipant OT provided across SNF stays, adjusted for the same patient characteristics as our primary models and with a facility random effect. This study was approved by the institutional review board of the University of Washington (IRB ID STUDY00009986). Analyses were conducted using statistical software (RStudio version 1.2.5019, R Foundation for Statistical Computing, Vienna Austria).

3.4 Results

We identified over 1.1 million complete first SNF stays between January 1 and December 31, 2018 (Figure 3.1). Descriptive statistics for our samples, consisting of 901,544 patients with complete functional improvement data and 912,996 with complete discharge data, are included in Table 3.1. The vast majority of short-stay patients (97%) in SNFs did not receive multiparticipant therapy in SNFs in 2018. For the subset of patients receiving some multiparticipant therapy in each group, the median proportion of multiparticipant PT and OT was quite low at about 5%, and only 0.1% of patients received 25% or more multiparticipant therapy.

The results of the logistic regression analysis for the odds of improving in function among patients receiving different levels of multiparticipant therapy are presented in Table 3.2. Compared to no multiparticipant therapy, low and medium levels of multiparticipant therapy had small but statistically significant associations with positive outcomes; patients receiving up to 5% multiparticipant therapy had 14% higher odds of improving in function (95% confidence interval [CI]: 1.09-1.19) and patients receiving 5-25% multiparticipant therapy had 18% higher odds of functional improvement (95% CI 1.13-1.24). However, high multiparticipant therapy

(25% or more) was not associated with differences in functional improvement compared to patients receiving all individualized therapy (95% CI 0.93-1.30).

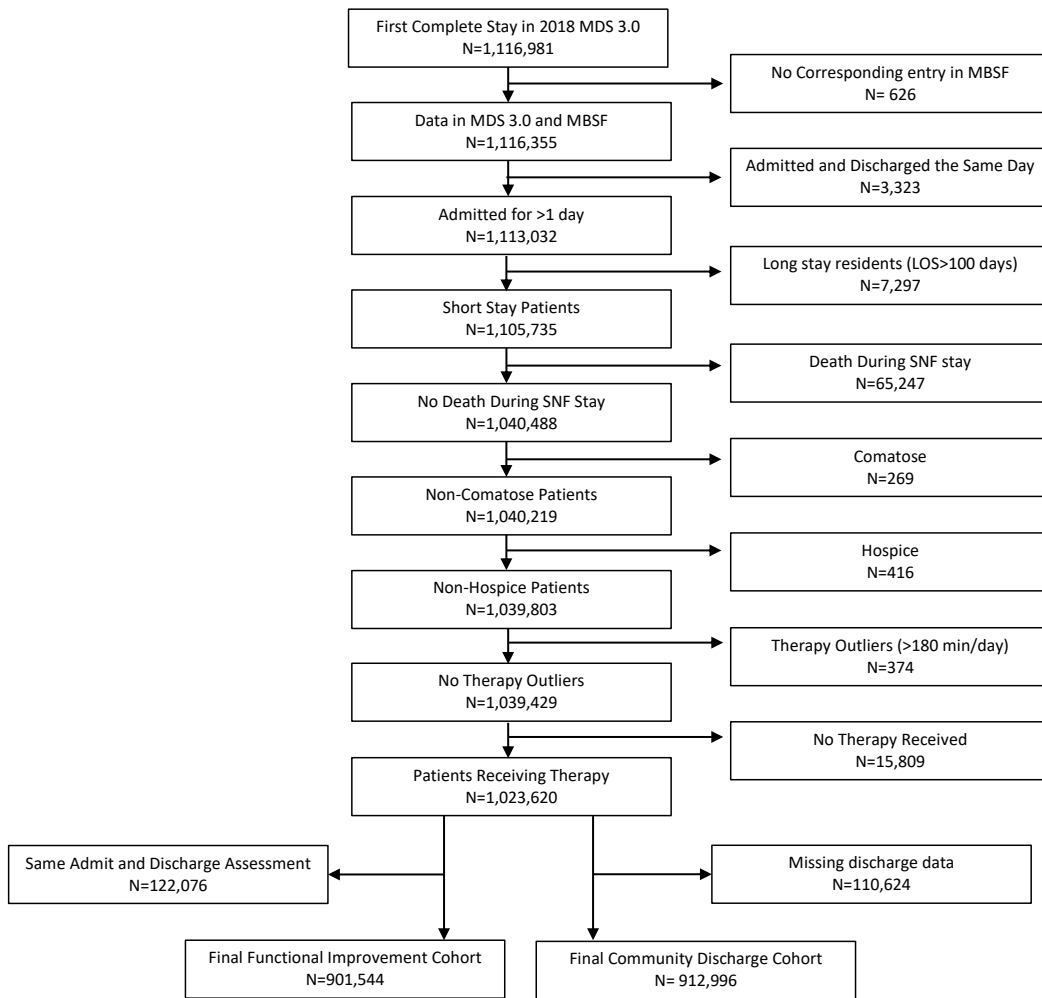


Figure 3.1 The selection of Medicare fee-for-service Skilled Nursing Facility stays from the Minimum Data Set 3.0 (MDS) during calendar year 2018. Abbreviations: MBSF- Master Beneficiary Summary File, LOS- Length of Stay.

Table 3.1. Descriptive Statistics for Complete Short-Stay Skilled Nursing Facility Patient Stays in 2018

	Functional Improvement Outcome (N=901,544)	Community Discharge Outcome (N=912,996)
Multiparticipant Therapy	Mean (SD) or N (%)	Mean (SD) or N (%)
Proportion Multiparticipant PT + OT*	0.23 (1.9)	0.22 (1.9)
Proportion Multiparticipant PT	0.26 (2.3)	0.25 (2.3)
Proportion Multiparticipant OT	0.20 (2.3)	0.20 (2.3)
Multiparticipant Therapy Categories		
None (0%)	873,421 (96.9%)	886,455 (97.1%)
Low (>0 to <5%)	14,510 (1.6%)	13,202 (1.4%)
Medium (5 to <25%)	12,494 (1.4%)	12,208 (1.3%)
High (25% or more)	1,119 (0.1%)	1,131 (0.1%)
Outcomes		
Improved in Function	519,779 (65.0%)	-
Successful Community Discharge	-	687,573 (75.3%)
Demographics		
Age (years)	80.6 (8.5)	80.3 (8.4)
Female	557,238 (61.8%)	556,253 (60.9%)

Disability or ESRD as reason for Medicare Entitlement	181 (0.02%)	203 (0.02%)
Dual Eligibility	164,158 (14.8%)	135,360 (14.8%)
Married	315,509 (35.0%)	339,124 (37.1%)
Needs Interpreter	23,048 (2.6%)	21,902 (2.4%)

SNF Stay Characteristics

Length of Stay (days)	27.8 (19.6)	22.8 (17.5)
PT Minutes per Stay	733.4 (394.3)	674.0 (379.0)
OT Minutes per Stay	690.9 (379.8)	631.8 (363.7)
PT Minutes per Day of Therapy	56.7 (11.1)	56.8 (11.4)
OT Minutes per Day of Therapy	55.4 (10.7)	55.4 (11.0)

Cognitive and Physical Function

ADL Scale Score on Admit (0-28)	16.7 (4.1)	16.7 (4.2)
Falls in the last 6 months	423,101 (46.9%)	408,100 (44.7%)
Daily pain	13,253 (1.5%)	13,071 (1.4%)
Use of an assistive device	899,925 (96.4%)	878,212 (96.2%)

Cognitive Impairment

None (BIMS 13+)	579,559 (66.8%)	591,548 (70.2%)
Moderate (BIMS 8-12)	175,962 (20.3%)	160,602 (19.0%)
Severe (BIMS 0-7)	112,384 (12.9%)	91,020 (10.8%)
Vision Impairment	133,209 (14.8%)	129,878 (14.2%)
Communication Impairment	47,601 (5.3%)	41,446 (4.5%)

Wandering	15,320 (1.7%)	12,592 (1.4%)
Rejected Care	38,756 (4.3%)	36,234 (3.7%)

Active Diagnoses

Heart Failure	207,029 (23.0%)	212,768 (23.3%)
Stroke	72,859 (8.1%)	68,297 (7.5%)
Hip Fracture	83,002 (9.2%)	80,296 (8.8%)
Other Fracture	111,131 (12.3%)	107,637 (11.8%)
Psychosis or Behavioral Symptoms	39,639 (4.4%)	35,400 (3.9%)
Wound Infection	6,884 (0.8%)	7,101 (0.8%)
Paraplegia	1,973 (0.2%)	1,860 (0.2%)
Multiple Sclerosis	4,024 (0.4%)	3,909 (0.4%)
Foot Infection	8,744 (1.0%)	8,858 (1.0%)
Anemia	241,815 (26.8%)	245,107 (26.8%)
Pneumonia	83,313 (9.2%)	86,490 (9.5%)
Urinary Tract Infection	109,092 (12.1%)	104,107 (11.4%)
Alzheimer's Dementia	34,359 (3.8%)	27,991 (3.1%)
Malnutrition	38,755 (4.3%)	37,914 (4.2%)
Anxiety Disorder	157,260 (17.4%)	156,750 (17.2%)
Psychiatric Disorder other than		
Schizophrenia	13,670 (1.5%)	11,217 (1.2%)
Schizophrenia	11,487 (1.3%)	8,927 (1.0%)

Clinical Treatments

Intravenous Medication	58,138 (6.4%)	62,460 (6.8%)
Hemodialysis	23,877 (2.6%)	25,777 (2.8%)

*Proportion of minutes in multiparticipant therapy sessions is calculated as the total group and concurrent therapy minutes divided by the total therapy minutes during each Skilled Nursing Facility stay.

Abbreviations: SD-Standard Deviation, OT- Occupational Therapy, PT- Physical Therapy, ADL- Activities of Daily Living, BIMS- Brief Interview for Mental Status

The results of the model examining odds of discharging to the community for patients receiving different levels of multiparticipant therapy are presented in Table 3.3. Similarly, there was no statistically significant difference in community discharge rates for patients receiving high levels of multiparticipant therapy compared to no multiparticipant therapy. Compared to patients receiving only individualized therapy, low levels of multiparticipant therapy were associated with 10% higher odds of community discharge (95% CI 1.05-1.15) and medium levels were associated with 44% higher odds of community discharge (95% CI 1.34-1.55).

Table 3.2. Results of Mixed Effects Logistic Regression Model with Adjusted Odds Ratios for Patient Functional Improvement

Proportion of Multiparticipant Therapy	Odds Ratio	95% CI	p-value
None (0%)	Ref.	Ref.	-
Low (>0 to <5%)	1.14	1.09-1.19	<0.001
Medium (5 to <25%)	1.18	1.13-1.24	<0.001

High (25% or more)	1.10	0.93-1.30	0.267
Demographics			
Age (years)	0.99	0.99-0.99	<0.001
Female Sex	1.05	1.04-1.06	<0.001
Disability or ESRD as reason for Medicare Entitlement	0.75	0.53-1.05	0.093
Dual Eligibility	0.91	0.90-0.93	<0.001
SNF Stay Factors			
Length of Stay (days)	1.03	1.03-1.03	<0.001
OT Minutes per Day of Therapy (15 min increase)	1.13	1.12-1.14	<0.001
PT Minutes Per Day of Therapy (15 min increase)	1.27	1.26-1.29	<0.001
Cognitive and Physical Function			
ADL Scale Score on Admit (0-28)	1.01	1.01-1.01	<0.001
Cognitive Impairment			
None (BIMS 13+)	Ref	Ref	-
Moderate (BIMS 8-12)	0.76	0.75-0.77	<0.001
Severe (BIMS 0-7)	0.51	0.50-0.52	<0.001
Active Diagnoses			
Heart Failure	0.89	0.88-0.90	<0.001
Stroke	0.83	0.81-0.85	<0.001

Hip Fracture	1.12	1.10-1.14	<0.001
Other Fracture	1.07	1.06-1.09	<0.001

Abbreviations: CI-Confidence Interval, Ref-Reference, ESRD- End Stage Renal Disease, LOS- Length of Stay, OT- Occupational Therapy, PT- Physical Therapy, ADL- Activities of Daily Living, BIMS- Brief Interview for Mental Status

Our sensitivity analyses examining PT and OT disciplines separately found no association between the overall proportion of multiparticipant OT and functional improvement, but higher proportions of multiparticipant PT were associated with higher odds of functional improvement (Supplementary Table 3.1). Effect sizes were small, however, with a 5% increase in multiparticipant PT associated with 4% higher odds of functional improvement (95% CI: 1.02-1.05). When examining community discharge, multiparticipant OT and PT were both positively associated with improved community discharge rates. Five percent higher multiparticipant OT was associated with 2% higher odds of community discharge (95% CI 1.01-1.04), and five percent higher multiparticipant PT was associated with 5% higher odds of community discharge (95% CI 1.03-1.07).

Table 3.3. Results of Mixed Effects Logistic Regression Model with Adjusted Odds Ratios for Successful Community Discharge

Proportion of Multiparticipant Therapy	Odds Ratio	95% CI	p-value
None (0%)	Ref.	Ref.	-
Low (>0 to <5%)	1.10	1.05-1.15	<0.001

Medium (5 to <25%)	1.44	1.34-1.55	<0.001
High (25% or more)	1.03	0.75-1.43	0.833
Demographics			
Age (years)	1.00	1.00-1.00	<0.001
Female Sex	1.24	1.22-1.25	<0.001
Dual Eligibility	0.76	0.75-0.77	<0.001
SNF Stay Factors			
Length of Stay (days)	1.04	1.04-1.04	<0.001
OT Minutes per Day of Therapy (15 min increase)	0.77	0.76-0.78	<0.001
PT Minutes Per Day of Therapy (15 min increase)	0.91	0.90-0.92	<0.001
Cognitive and Physical Function			
ADL Scale Score on Admit (0-28)	0.84	0.84-0.84	<0.001
Cognitive Impairment			
None (BIMS 13+)	Ref.	Ref.	-
Moderate (BIMS 8-12)	0.74	0.73-0.75	<0.001
Severe (BIMS 0-7)	0.71	0.70-0.72	<0.001
Needs Interpreter	1.30	1.25-1.35	<0.0001
Vision Impairment	0.91	0.89-0.92	<0.0001
Communication Impairment	0.81	0.79-0.84	<0.001
Falls in the last 6 months	1.00	0.99-1.01	0.782

Daily pain	0.81	0.77-0.85	<0.001
Use of an assistive device	1.33	1.29-1.38	<0.001
Wandering	1.00	0.95-1.04	0.842
Rejected Care	0.87	0.84-0.89	<0.001
Psychosis or Behavioral Symptoms	0.71	0.69-0.74	<0.001

Active Diagnoses

Stroke	0.85	0.84-0.87	<0.001
Hip Fracture	1.05	1.02-1.07	0.355
Wound Infection	0.82	0.77-0.87	<0.001
Paraplegia	0.72	0.64-0.80	<0.001
Multiple Sclerosis	1.15	1.05-1.26	0.002
Foot Infection	0.76	0.72-0.81	<0.001
Anemia	0.81	0.80-0.82	<0.001
Pneumonia	0.92	0.90-0.94	<0.001
Urinary Tract Infection	1.02	0.99-1.04	0.060
Alzheimer's Dementia	1.20	1.16-1.24	<0.001
Malnutrition	0.69	0.67-0.71	<0.001
Anxiety Disorder	0.96	0.95-0.98	<0.001
Psychiatric Disorder other than			
Schizophrenia	0.90	0.86-0.95	<0.001
Schizophrenia	0.85	0.81-0.90	<0.001

Clinical Treatments

Intravenous Medication	0.66	0.65-0.68	<0.001
Dialysis	0.50	0.49-0.52	<0.001

Abbreviations: CI-Confidence Interval, Ref-Reference, OT- Occupational Therapy, PT- Physical Therapy, ADL- Activities of Daily Living, BIMS- Brief Interview for Mental Status

3.5 Discussion

This is the first analysis of a national cohort of SNF patients that examines associations between multiparticipant therapy and patient outcomes. Our adjusted results suggest that providing up to 25% of therapy minutes as multiparticipant therapy may help achieve small improvements in patient function and community discharge outcomes while potentially reducing overall therapy staffing costs.⁹¹ However, positive associations between multiparticipant therapy minutes and both outcomes disappeared once the proportion of multiparticipant therapy reached 25% of total therapy time. Small sample sizes in the high multiparticipant therapy groups compared to the full cohort may have impacted the precision of this estimate, thus future work when post-PDPM data with higher multiparticipant therapy provision are available will be essential to confirm this finding. For now, the lack of benefit associated with high rates of multiparticipant therapy in our study supports 25% multiparticipant therapy time as a reasonable limit under PDPM, which was established in an effort to prioritize patient-centered care specific to individual patient needs.⁴⁵ While high rates of multiparticipant therapy may be less costly for SNFs, until high rates of multiparticipant therapy are shown to be beneficial for patients, individualized therapy should remain the dominant modality of PT and OT treatment for the

heterogeneous SNF population that benefits from patient-centered care targeted at complex individual needs.⁹²

Specific to function, receiving both low and medium levels of multiparticipant therapy was associated with slightly higher functional improvement rates compared to no multiparticipant therapy in our adjusted model. These results are consistent with studies in international healthcare settings of multiparticipant therapy for specific patient populations, including a study by Vestri et al. that showed larger improvements in functional independence outcomes for patients with brain injury who received some multiparticipant therapy compared to those who received individual treatment only.⁸⁵ However, their study did not adjust for length of rehabilitation stay or overall intensity of therapy provision, and group therapy contents included structured activities that would fall outside of a typical physical or occupational therapy plan of care in the SNF setting, such as reading and socialization activities.⁸⁵ Another study by Renner et al. examined the efficacy of group versus individual progressive task training for patients after stroke during a six-week inpatient rehabilitation stay.⁸⁴ The study randomly assigned patients to group versus individual treatment with dose-matched therapy intensity.⁸⁴ The authors concluded that group therapy was as effective as individualized therapy for mobility outcomes, however, the long LOS and single diagnosis in this study may not be as generalizable to the SNF setting in the United States.⁸⁴ Additionally, the relatively low level of baseline cognitive and functional impairments for patients in the Renner study highlights the ongoing need for individualized therapy, especially for patients with higher levels of functional or cognitive impairment who may not be able to as effectively participate in multiparticipant therapy sessions.^{79,84,88}

The potential positive impact of social support provided in a multiparticipant therapy setting may be a mechanism for the improvements in function seen for patients participating in

low to medium amounts of multiparticipant therapy in this study. Benefits unique to the social environment in multiparticipant therapy sessions include decreased sense of social isolation and depression that could enhance motivation and improve participation and opportunities for peer feedback and vicarious learning.^{83,93-95} However, lack of previous research on multiparticipant therapy in the heterogenous and complex SNF population, including lack of research on contents of multiparticipant therapy sessions, does not allow us to draw firm conclusions about the specific social benefits of multiparticipant therapy for the SNF population.

Similar to our functional improvement results, patients who received low to medium levels of multiparticipant therapy (up to 25% of total therapy time) had slightly higher odds of a positive community discharge outcome. This may be a novel result, as we are not aware of any other studies comparing individualized therapy to multiparticipant therapy for community discharge outcomes from any setting. The mechanism for potential improvements in community discharge rates for patients receiving low to medium levels of multiparticipant therapy in our cohort remains unknown, however, similar to functional improvement, social support, feedback, and vicarious learning during multiparticipant therapy sessions may allow patients to better achieve levels of independence for a safe discharge home. One qualitative study by Nilsson et al. evaluated a group occupational therapy program aimed at decreasing post-discharge challenges for older adults after a stroke, which emphasized reflection on the post-discharge environment, patients' anticipated needs and abilities, and building capacity in household activities.⁹⁶ Participants in the group program reported increases in self-reflection, curiosity, and motivation that led to learning, anticipation, and goal-setting for home discharge. As there are no current studies examining specific contents of multiparticipant therapy session in SNFs, it is unknown whether multiparticipant therapy in the SNF setting similarly prepares patients for discharge.⁹⁶

Again, similar to functional improvement, it appears that spending $\geq 25\%$ of therapy time in multiparticipant sessions may not be beneficial for community discharge. As specific discharge environments are unique across this heterogeneous population, this result emphasizes the importance of individualized treatment to work towards safe community discharge for patients in SNFs.

Finally, the results of our sensitivity analysis that divided PT and OT disciplines suggest that only multiparticipant PT contributed to differences in functional improvement outcomes. This is unsurprising given the CMS definition of functional improvement used in this study, which includes only transfers, ambulation, and locomotion. OT treatment in SNFs emphasizes independence in self-care tasks and may not directly impact the mobility tasks measured in this study. Research using new outcome measures from assessment items introduced in SNFs in late 2018, which incorporate both self-care and mobility tasks, may allow for a more sensitive understanding of the impact of OT treatment on self-care function in SNFs.^{24,97} For the sensitivity analysis examining community discharge, multiparticipant PT was a larger contributor to differences in community discharge rates than multiparticipant OT. Similar to the potential explanation that more therapy is provided for patients with worse discharge potential as discussed above, it may be that the self-care skills needed for successful community discharge addressed by OT require more individualization according to the patient discharge environment, while improving physical function necessary for safety and mobility in the home setting is more easily addressed through group exercises delivered by PTs.

3.5.1 Limitations

This cross-sectional study demonstrates associations between outcomes and multiparticipant therapy provision and does not imply direct causality. Additionally, while there

is no established minimum clinically important difference for either outcome in this study, the effect sizes in this study for the association between multiparticipant therapy and functional improvement and discharge outcomes were small. However, similar or smaller effect sizes have been seen in other studies examining SNF rehabilitation outcomes,^{55,88,98,99} and given this study's large national sample of over 900,000 complete SNF stays in 2018, even a small increase in odds of a positive outcome may indicate a positive effect for a large number of patients.

Results are also generalizable only to Medicare short-stay patients admitted to SNF for rehabilitation. Low overall rates of multiparticipant therapy did not allow for a comparison of concurrent versus group therapy and outcomes, however, increases in the practice of multiparticipant therapy under PDPM may allow for the differentiation between the two modes of multiparticipant therapy provision in the future. Model limitations include the inability to adjust for upstream factors from the acute hospital stay that may be related to functional improvement or community discharge. Additionally, we carefully fit our models and adjusted for clustering at the facility level, but it is still possible that there is unmeasured confounding, such as differences in patient expectations for rehabilitation or other facility practices, that are unavailable on the MDS.⁸⁸ Further research should capitalize on increasing rates of multiparticipant therapy after PDPM to confirm these results and examine the mechanisms behind the impact of multiparticipant therapy on patient outcomes, to include examination of the content, social opportunities, and physiologic intensity of multiparticipant therapy sessions as well as the differential impact of multiparticipant therapy on different patient subgroups.

3.6 Conclusions

In the context of large increases in multiparticipant therapy provision in SNFs under PDPM, our results indicate that providing up to 25% of PT and OT in multiparticipant sessions is

an efficient strategy of therapy delivery that may also provide benefit to patients in terms of functional improvement and discharge outcomes. However, multiparticipant therapy at or above the 25% threshold set by CMS was not positive for patient outcomes in our study. This research suggests that the majority of PT and OT treatment in SNFs should continue to be delivered through individualized therapy sessions despite removal of financial incentives for intensive individualized therapy under PDPM.

Chapter 3 Supplementary Material

Supplementary Table 3.1 Adjusted Results of Sensitivity Analyses for Functional Improvement and Community Discharge Outcomes

Functional Improvement	Odds Ratio	95% CI	p-value
Proportion of Multiparticipant PT (5% Increase)	1.04	1.02-1.05	<0.001
Proportion of Multiparticipant OT (5% Increase)	1.01	0.99-1.02	0.33
Community Discharge			
Proportion of Multiparticipant PT (5% Increase)	1.05	1.03-1.07	<0.001

Proportion of Multiparticipant OT (5% Increase)	1.02	1.01-1.04	0.01
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Functional improvement mixed effects logistic regression model was adjusted for all Skilled Nursing Facility stay and patient factors included in Table 3.2. Community discharge mixed effects logistic regression model was adjusted for all Skilled Nursing Facility stay and patient factors included in Table 3.3. Abbreviations: CI- confidence interval, PT- Physical therapy, OT- Occupational Therapy.

Chapter 4: Variability in Therapy Staffing Changes in Skilled Nursing Facilities Under the Patient Driven Payment Model

4.1 Abstract

Objective: Therapy staffing declined in Skilled Nursing Facilities (SNFs) after implementation of the Patient Driven Payment Model, which may have negative implications for patient outcomes. To identify targets for quality monitoring, this study examined whether certain SNF characteristics were associated with larger staffing declines.

Design: Secondary analysis of Medicare administrative data from 12,982 SNFs in the United States. Outcomes included paid physical and occupational therapy staffing hours per patient-day from January 2019 – June 2020.

Methods: We used linear mixed effects models with a random intercept for facility and interaction terms between time in weeks and SNF characteristics to test whether changes in longitudinal staffing patterns varied by SNF organizational characteristics, adjusted for local COVID-19 case rates.

Results: By June 2020, compared to average staffing prior to PDPM, total therapy minutes per patient-day declined by 22.2%, therapy assistant minutes declined by 25.5%, therapist minutes declined by 18.1%, contract therapy minutes declined 29.2%, and in-house staff minutes declined by 10.9%. The magnitude of staffing declines varied based on SNF organizational factors. Larger relative staffing declines occurred in for-profit facilities, as well as facilities (a) in Northwestern and Northeastern regions, (b) with more rural and Medicare patients, (c) employing more therapy assistants at baseline, and (d) providing more intensive therapy prior to policy change. Facilities serving more racially diverse patients lost more skilled therapists than

SNFs with less diverse populations. Contract therapy declined more than in-house therapy in non-profit and high-quality facilities.

Conclusions and Implications: Therapy staffing in SNFs did not decline uniformly. Facilities that engaged in profit-maximizing behaviors under the previous payment model had larger decreases in therapy staffing. Payment reform and the COVID-19 pandemic may have provided dual disincentives for contract therapy. Declines in skilled therapist staffing may have quality implications for facilities serving diverse populations. Specific attention to organizational characteristics may help better target monitoring of response to PDPM.

4.2 Introduction

Twenty percent of all hospitalized Medicare beneficiaries receive care in skilled nursing facilities (SNFs).² Spending for SNFs by the Centers for Medicare & Medicaid Services (CMS) exceeds all other post-acute settings, and SNF costs nearly doubled between 2003 and 2019.^{2,100} Rising costs per stay were primarily driven by volume of physical therapy (PT) and occupational therapy (OT) without concurrent changes in indicators of patient need for therapy, which raised concerns about payment incentives promoting clinically unnecessary therapy.^{44,53} Despite moderate-quality evidence that intensive therapy is positively associated with patient outcomes,^{13,55,56,58} concerns about excessive therapy motivated dramatic changes to SNF payment policy, with CMS implementing the Patient Driven Payment Model (PDPM) on October 1, 2019.⁴⁴ PDPM aims to shift volume-based payment to payment based on patient clinical characteristics and removed therapy minutes as the primary determinant of reimbursement.⁴⁵

While PDPM was intended to be budget neutral, the design of the PDPM case-mix adjustment system led to an unanticipated 5% increase in SNF payments in 2020.^{50,76} While

payments to SNFs increased, therapy staffing and therapy provision declined, with CMS citing a 30-percent reduction in therapy minutes in the first quarter of PDPM.⁵⁰ Paid therapy staffing hours decreased by nearly 15% in the first two quarters of PDPM, with larger declines for therapy assistants and contract staff compared to therapists and in-house staff, respectively.^{48,49} In the context of evidence demonstrating positive relationships between therapy intensity and outcomes, PDPM has been met with concerns regarding negative implications for patients as therapy declines.^{13,55}

Identifying SNFs that were more likely to reduce staffing under PDPM may help provide insight into variability in the industry response to PDPM and the COVID-19 pandemic as well as targeted monitoring for potential changes in patient outcomes. One previous study found that SNFs with higher staffing of contract therapists and therapy assistants and higher proportions of Medicare beneficiaries had larger declines in therapy staffing under PDPM, but there were no differences in staffing changes based on ownership.⁴⁹ This was surprising, as previous work demonstrated that for-profit SNFs were more likely to reduce therapy staffing after previous policies reduced financial incentives for therapy.^{37,42,43} Additional SNF characteristics that were previously associated with staffing differences and should be examined as potential predictors of responsiveness to changing payment incentives include freestanding versus hospital location, size and occupancy rate, Five-Star quality ratings, and geographic location.^{101–103} Finally, early analyses of staffing under PDPM examined data from prior to March 2020 and thus could not account for the emerging COVID-19 pandemic.^{48,49} This study aims to characterize SNF staffing changes for therapists, assistants, and contract versus in-house employees through June 2020 to determine whether staffing changes differed based on SNF organizational characteristics, while adjusting for local impacts of COVID-19.

4.3 Methods

4.3.1 Staffing Outcomes

We used Payroll-Based Journal (PBJ) data from all Medicare-certified SNFs in the United States from January 1, 2019 through June 30, 2020, (39 weeks before and 39 weeks after PDPM implementation).¹⁰⁴ The PBJ is an accurate and auditable source of staffing data, reporting paid staffing time for contract and in-house staff.¹⁰² We calculated facility-level average staffing minutes for contract and in-house physical therapists, occupational therapists, physical therapist assistants, and occupational therapy assistants; minutes were divided by daily patient census. Final staffing variables were 1) total therapy 2), therapist, 3) assistant, 4) contract therapy (including therapists and assistants), and 5) in-house employee therapy (including therapists and assistants) staffing minutes per patient-day.

4.3.2 Organizational Characteristics

We used the most recent publicly available data sources for organizational characteristics: 2018 Post-Acute Care and Hospice Provider Utilization and Payment Public Use File (PACPUF),¹⁰⁵ 2019 Provider of Services Files,¹⁰⁶ 2020 Nursing Home Compare (NHC),¹⁰⁷ and 2018 LTCFocus.⁷¹ Characteristics included ownership (non-profit, for-profit, or government), rural or urban county,¹⁰⁶ geography (CMS regional designation),¹⁰⁶ location in a state with a certificate of need law or moratorium on SNF expansion,¹⁰⁸ Medicare certified bed count, in-hospital versus freestanding location, CMS Five-Star overall quality of care rating,⁸⁹ and chain affiliation.

For baseline staffing, we included average PBJ staffing hours from January 1 – September 30, 2019. For ease of interpretation and clinical relevance, we categorized variables based on previous research and/or distribution (i.e. quartiles for normally distributed

variables).¹⁰⁹ We calculated contractor hours as percentages of total therapy staff hours, characterized as all in-house staff, all contractors, or a mix.¹¹ We included the proportion of assistant versus therapist hours, characterized as 0% assistants and then into quartiles.⁷² To reflect baseline therapy intensity, we included quartiles of the percentage of patient days in 2018 delivered as ultrahigh rehabilitation, the highest payment category where patients receive over 12 hours of weekly therapy.

For payer mix, we divided the facility-level percentage of patients whose primary insurance was Medicaid into quartiles. As Medicaid is the primary payer for long-term care residents, SNFs in higher quartiles of Medicaid patients are less likely to be impacted by PDPM, which applies only to Medicare fee-for-service SNF stays.² We included an indicator for a high proportion of Medicare fee-for-service residents if the percentage of Medicare patients exceeded the median.

To reflect service to rural beneficiaries in addition to facility rural location, we included the percentage of beneficiaries living in rural zip codes, characterized as 0% rural beneficiaries and then into quartiles. To reflect patient acuity, we included facility-level average Hierarchical Condition Category (HCC) scores, which consider diagnoses, disability, Medicaid eligibility, and long-term care residence, with higher scores indicating higher predicted care costs.¹¹⁰ To reflect racial diversity, we included an indicator for facilities in the top quartile of non-white beneficiaries, based on facility-level percentages of patients in six self-reported race/ethnicity categories provided in the PACPUF.¹⁰⁵ Facilities were excluded if they were missing from any public data source.

4.3.3 Analysis

To test whether staffing changes over time varied by SNF organizational characteristics, we used linear mixed effects models with a random intercept for facility and interaction terms between time (in weeks) and all SNF characteristics. We adjusted for six major Federal holidays, staffing in the first week of the study period, and weekly county-level COVID-19 cases per capita using data from USAFacts to reflect local impact of COVID-19.¹¹¹ Analyses were conducted using RStudio version 1.2.5019 Package lme4, R Foundation for Statistical Computing, with statistical significance at $\alpha < 0.05$. This study does not involve human subjects research and is not subject to the University of Washington Institutional Review Board as all data are public and deidentified.

4.4 Results

Of 14,163 SNFs reporting PBJ data in Q1 2018, we included 12,892 facilities that reported data in all sources. As public data sources exclude small cells to protect privacy,^{89,112} excluded SNFs ($n=1,271$) were typically smaller facilities. Compared with baseline staffing averages, by June 2020, total therapy minutes per patient day declined by 22.2% (95% CI -22.4, -21.9), assistant staffing declined by 25.5% (95% CI -25.8, -25.2), and therapist staffing declined by 18.1% (95% CI -18.4, -17.7) (Figure 4.1). The largest decline of 29.2% was for contract therapy staffing (95% CI -29.2, -28.9) compared to a 10.9% decline for in-house therapy staffing (95% CI -11.4, -10.4). Descriptive statistics for baseline staffing and facility characteristics are in Table 4.1. Percent differences in staffing over time associated with SNF characteristics from the mixed effects models are in Table 4.2. Supplementary Table 4.1, included after the references for Chapter 4, includes interaction terms and confidence intervals.

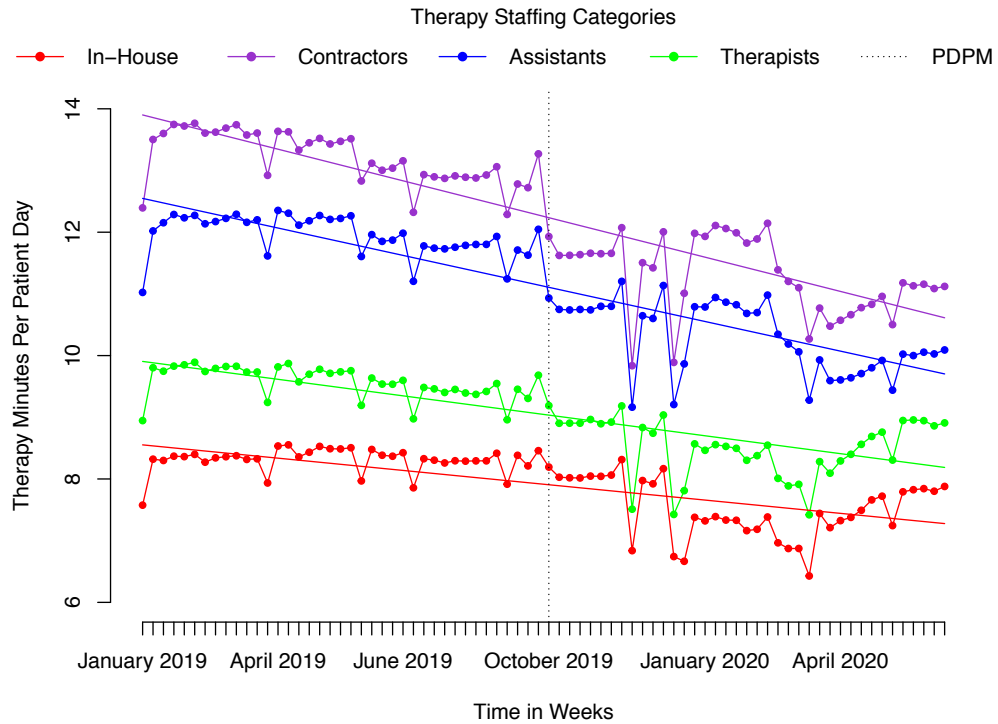


Figure 4.1 Average weekly therapy minutes/patient-day in Skilled Nursing Facilities (January 2019 – June 2020). Physical and occupational therapist and therapy assistant minutes for both in-house and contract staff are included. Linear regression lines are unadjusted for ease of comparison between groups. The dotted line indicates the implementation of the Patient Driven Payment Model (PDPM).

Table 4.1 Descriptive facility characteristics and staffing information for Skilled Nursing Facilities (SNFs); (N = 12,892)

Baseline Therapy Staffing (January 2019-September 2019)	Mean (SD)
Total PT and OT min/patient day	21.53 (17.8)
PT and OT Assistant min/patient day	11.95 (10.35)
PT and OT Therapist min/patient day	9.57 (10.50)
In-House therapy min/patient day	8.31 (17.51)
Contract therapy min/patient day	13.22 (14.68)
Staffing and Therapy Provision	No. (%) or Mean (SD)
All In-House staffing	3006 (23.32%)
Mix of In-House and Contract staffing	1646 (12.77%)
All Contract staffing	8240 (63.92%)
Baseline Percent Assistant Staffing (PT and OT)	55.32 (20.90)
Baseline Percent Ultrahigh Intensity Therapy Provision	53.52 (24.08)
Ownership and Facility Variables	No. (%) or Mean (SD)
Non-profit ownership	3038 (23.57%)
Government ownership	677 (5.25%)
For-profit ownership	9177 (71.18%)
Rural County	3611 (28.0%)
Chain Affiliation	7881 (61.13%)
Certificate of Need Law	8769 (68.02%)
SNF Moratorium	2717 (21.08%)

Certified Bed Count	109.8 (58.88)
In-Hospital Location	369 (2.86%)

Facility-Level Patient Factors

Mean (SD)

Average Patient HCC Score	2.56 (0.63)
Percent Medicaid Patients	58.87 (22.70)
Percent Medicare Patients	14.07 (12.85)
Percent Non-White Beneficiaries	17.64 (19.5)
Percent Rural Beneficiaries	31.78 (38.76)

Five-Star Overall Quality of Care Rating

No. (%)

1-Star	733 (5.69%)
2-Star	1772 (13.74%)
3-Star	2659 (20.63%)
4-Star	3276 (25.41%)
5-Star	4452 (34.53%)

CMS Region

No. (%)

Region 1 (Boston)	803 (6.23%)
Region 2 (New York)	804 (6.24%)
Region 3 (Philadelphia)	1219 (9.46%)
Region 4 (Atlanta)	2371 (18.39%)
Region 5 (Chicago)	2907 (22.55%)
Region 6 (Dallas)	1669 (12.95%)
Region 7 (Kansas City)	1197 (9.28%)

Region 8 (Denver)	448 (3.48%)
Region 9 (San Francisco)	1127 (8.74%)
Region 10 (Seattle)	347 (2.69%)

Abbreviations: PT- Physical Therapy, OT- Occupational Therapy, HCC- Hierarchical Condition Category, CMS- Centers for Medicare & Medicaid Services

Table 4.2 Adjusted percent differences in Skilled Nursing Facility physical and occupational therapy staffing variables over time by June 30, 2020, compared to January-September 2019 averages; (N = 12,892).

Staffing and Therapy Provision	All Therapy		Therapist		Assistant		In-House Therapy		Contract Therapy	
	Minutes/Patient Day		Minutes/Patient Day		Minutes/Patient Day		Minutes/Patient Day		Minutes/Patient Day	
	% Difference	p-value	% Difference	p-value	% Difference	p-value	% Difference	p-value	% Difference	p-value
Contractor Therapy Staffing										
All In-House	Ref.	-	Ref.	-	Ref.	-	Ref.	-	Ref.	-
Mix	0.85%	<0.001	-1.68%	0.004	2.87%	<0.001	52.51%	<0.001	-31.63%	<0.001
All Contract	3.38%	0.046	-1.17%	0.007	7.03%	<0.001	84.54%	<0.001	-47.63%	<0.001
Baseline Therapy Assistant Staffing										
None	Ref.	-	Ref.	-	Ref.	-	Ref.	-	Ref.	-
Quartile 1	-40.64%	<0.001	-33.03%	<0.001	-46.76%	<0.001	-86.22%	<0.001	-12.00%	<0.001
Quartile 2	-43.95%	<0.001	-16.72%	<0.001	-65.78%	<0.001	-86.77%	<0.001	-17.04%	<0.001
Quartile 3	-45.96%	<0.001	-7.03%	<0.001	-77.17%	<0.001	-80.24%	<0.001	-24.42%	<0.001
Quartile 4	-44.44%	<0.001	1.88%	0.05	-81.55%	<0.001	-79.44%	<0.001	-22.43%	<0.001
Baseline Ultrahigh Intensity Therapy Provision										
Quartile 1	Ref.	-	Ref.	-	Ref.	-	Ref.	-	Ref.	-

Quartile 2	-5.03%	<0.001	-7.20%	<0.001	-3.29%	<0.001	-3.55%	<0.001	-5.96%	<0.001
Quartile 3	-9.39%	<0.001	-9.88%	<0.001	-9.00%	<0.001	-0.72%	0.32	-14.84%	<0.001
Quartile 4	-15.95%	<0.001	-14.43%	<0.001	-17.17%	<0.001	-3.47%	<0.001	-23.79%	<0.001

Ownership and Facility Variables

Non-profit Ownership	Ref.	-	Ref.	-	Ref.	-	Ref.	-	Ref.	-
Government Ownership	1.90%	0.001	-1.56%	0.05	4.68%	<0.001	-7.58%	<0.001	7.86%	<0.001
For-Profit Ownership	-1.33%	<0.001	-4.55%	<0.001	1.25%	<0.001	-13.88%	<0.001	6.56%	<0.001
Rural County	0.80%	0.08	0.60%	0.34	0.96%	0.06	3.34%	<0.001	-0.80%	0.2
Chain Affiliation	-1.29%	<0.001	0.87%	0.01	-3.03%	<0.001	2.47%	<0.001	-3.66%	<0.001
Certificate of Need Law	-1.33%	<0.001	-3.36%	<0.001	-0.37%	0.33	-18.11%	<0.001	8.62%	<0.001
SNF Moratorium	5.53%	<0.001	3.49%	<0.001	7.17%	<0.001	1.99%	0.004	7.76%	<0.001
Bedcount (10-bed increase)	0.27%	<0.001	0.24%	<0.001	0.29%	<0.001	0.12%	<0.001	0.36%	<0.001
In-Hospital Location	-3.09%	<0.001	0.73%	0.48	-6.16%	<0.001	-9.76%	<0.001	1.11%	0.27

Facility-Level Patient Factors

Average Patient HCC Score	-0.35%	0.14	0.09%	0.79	-0.70%	0.008	5.94%	<0.001	-4.31%	<0.001
High Medicare	-11.73%	<0.001	-10.72%	<0.001	-12.54%	<0.001	-8.32%	<0.001	-13.87%	<0.001
High Racial Diversity	0.60%	0.08	-1.86%	<0.001	2.57%	<0.001	-0.47%	0.48	-2.52%	0.14
% Medicaid Patients										

Quartile 1	Ref.	-	Ref.	-	Ref.	-	Ref.	-	Ref.	-
Quartile 2	11.89%	<0.001	12.30%	<0.001	11.57%	<0.001	7.58%	<0.001	14.60%	<0.001
Quartile 3	17.29%	<0.001	17.82%	<0.001	16.86%	<0.001	16.21%	<0.001	17.96%	<0.001
Quartile 4	19.95%	<0.001	19.49%	<0.001	20.34%	<0.001	17.18%	<0.001	21.69%	<0.001

% Rural Beneficiaries

None	Ref.	-	Ref.	-	Ref.	-	Ref.	-	Ref.	-
Quartile 1	-7.59%	<0.001	-10.70%	<0.001	-5.11%	<0.001	-11.94%	<0.001	-4.86%	<0.001
Quartile 2	-4.43%	<0.001	-6.36%	<0.001	-2.89%	<0.001	-10.91%	<0.001	-0.36%	0.54
Quartile 3	-0.74%	0.12	-3.87%	<0.001	1.76%	0.001	-6.57%	<0.001	2.92%	<0.001
Quartile 4	-0.80%	0.2	-2.16%	0.01	3.17%	<0.001	-7.82%	<0.001	6.22%	<0.001

Five-Star Overall Quality of Care Rating

1-Star	Ref.	-	Ref.	-	Ref.	-	Ref.	-	Ref.	-
2-Star	0.30%	0.62	-0.85%	0.3	1.21%	0.07	6.93%	<0.001	-3.88%	<0.001
3-Star	-0.01%	0.98	-0.25%	0.75	0.17%	0.78	9.30%	<0.001	-5.86%	<0.001
4-Star	-0.35%	0.54	-1.26%	0.11	0.38%	0.54	8.02%	<0.001	-5.60%	<0.001
5-Star	-1.39%	0.01	-2.03%	0.009	-0.89%	0.16	4.16%	<0.001	-4.89%	<0.001

CMS Region

Region 1 (Boston)	Ref.	-	Ref.	-	Ref.	-	Ref.	-	Ref.	-
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Region 2 (New York)	8.42%	<0.001	0.46%	0.66	14.79%	<0.001	11.57%	<0.001	6.45%	<0.001
Region 3 (Philadelphia)	5.75%	<0.001	1.37%	0.14	9.27%	<0.001	-15.46%	<0.001	19.09%	<0.001
Region 4 (Atlanta)	6.24%	<0.001	0.32%	0.72	10.99%	<0.001	-16.12%	<0.001	20.30%	<0.001
Region 5 (Chicago)	3.46%	<0.001	-1.87%	0.02	7.74%	<0.001	-18.04%	<0.001	16.99%	<0.001
Region 6 (Dallas)	11.34%	<0.001	4.23%	<0.001	17.03%	<0.001	2.15%	0.11	19.82%	<0.001
Region 7 (Kansas City)	11.41%	<0.001	2.96%	0.002	18.18%	<0.001	-12.11%	<0.001	26.20%	<0.001
Region 8 (Denver)	8.74%	<0.001	6.36%	<0.001	10.64%	<0.001	-12.89%	<0.001	22.35%	<0.001
Region 9 (San Francisco)	1.65%	0.03	-5.95%	<0.001	7.72%	<0.001	-15.38%	<0.001	12.36%	<0.001
Region 10 (Seattle)	-11.34%	<0.001	-17.03%	<0.001	-6.79%	<0.001	-19.45%	<0.001	-6.22%	<0.001

Percent differences were calculated from linear mixed effects model coefficients for interactions between organizational characteristics and changes in therapy staffing per week, multiplied by 78 weeks in the study period, then divided by the January-September 2019 average baseline therapy staffing minutes per patient-day. Abbreviations: SNF- Skilled Nursing Facility, CMS- Centers for Medicare & Medicaid Services.

SNFs serving more Medicaid patients had consistent patterns of smaller staffing reductions compared to SNFs serving fewer Medicaid patients. As reflected in Figure 4.2, as the proportion of Medicaid patients decreased, trajectories of staffing declines were steeper across all categories. In contrast, SNFs with high proportions of Medicare fee-for-service patients had larger reductions in therapy staffing across all categories compared to SNFs serving fewer Medicare patients.

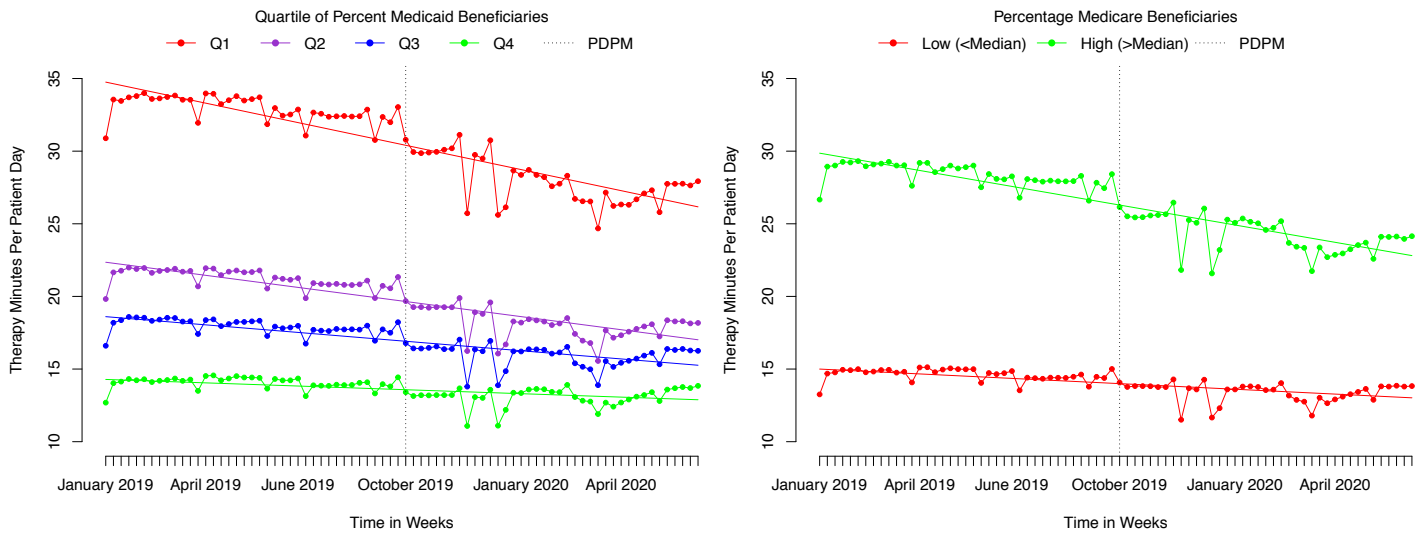


Figure 4.2 Average weekly total therapy minutes/patient-day in Skilled Nursing Facilities (January 2019 – June 2020). Facilities are stratified by categories of payer mix. Physical and occupational therapist and therapy assistant minutes for both in-house and contract staff are included. Linear regression lines are unadjusted for ease of comparison between groups. Abbreviations: Q-Quartile, PDPM- Patient Driven Payment Model.

For-profit SNFs had a slightly steeper decline in total staffing over time, and smaller declines in assistant staffing, compared to non-profits. In-house therapy minutes declined 13.9% more in for-profit SNFs compared to non-profits. In contrast, for-profit SNFs retained 6.6% more contract therapy staff over time compared to non-profits (Figure 4.3).

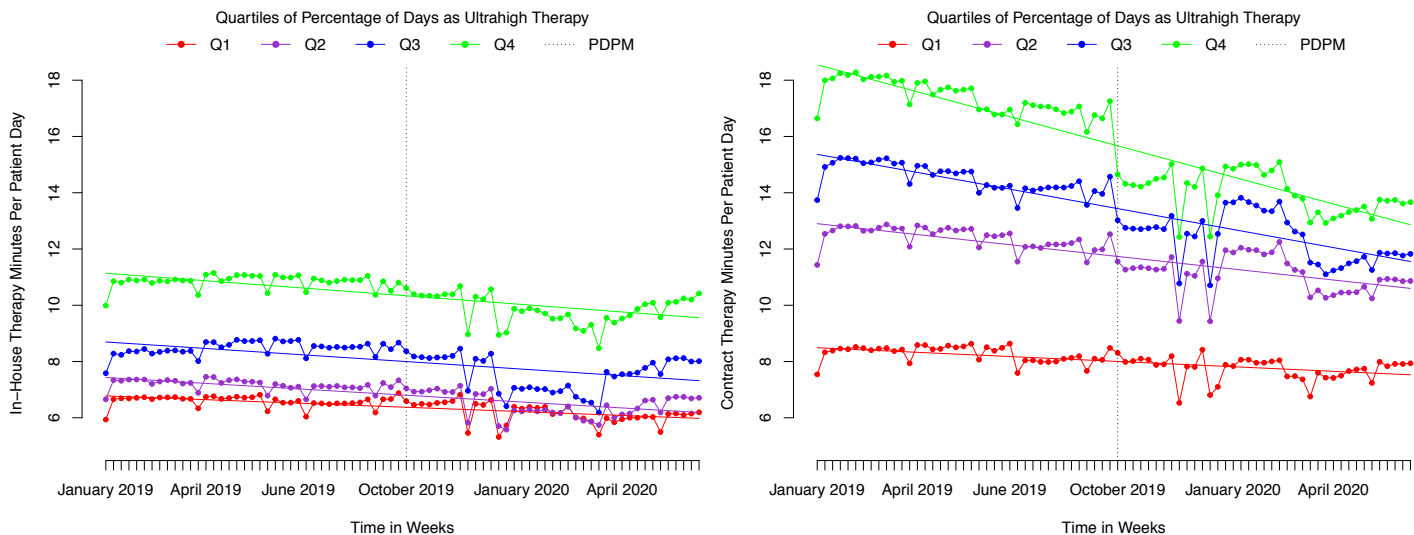


Figure 4.3 Average weekly in-house and contract therapy minutes/patient-day in Skilled Nursing Facilities (January 2019 – June 2020). Facilities are stratified by ownership. Linear regression lines are unadjusted for ease of comparison between groups. The dotted line indicates the implementation of the Patient Driven Payment Model (PDPM).

SNFs providing the highest baseline quartile of ultrahigh therapy had almost 16% larger declines in total therapy staffing compared to SNFs in the lowest quartile (Supplementary Figure 4.1, included after Chapter 4 references). The largest reductions were for contract therapy staff, which were 23.8% larger in SNFs providing the highest quartile of ultrahigh therapy compared to SNFs in the lowest quartile (Figure 4.4).

Compared to SNFs utilizing contract therapy staff, SNFs employing all in-house staff had the highest baseline staffing, yet a larger decline in total staffing over time. SNFs employing all in-house staff also had smaller declines in therapist staffing and larger declines in assistant staffing compared to SNFs utilizing contract staff. The decline in SNFs that employed both contractors and in-house staff was primarily due to declines in contract staffing (Supplementary

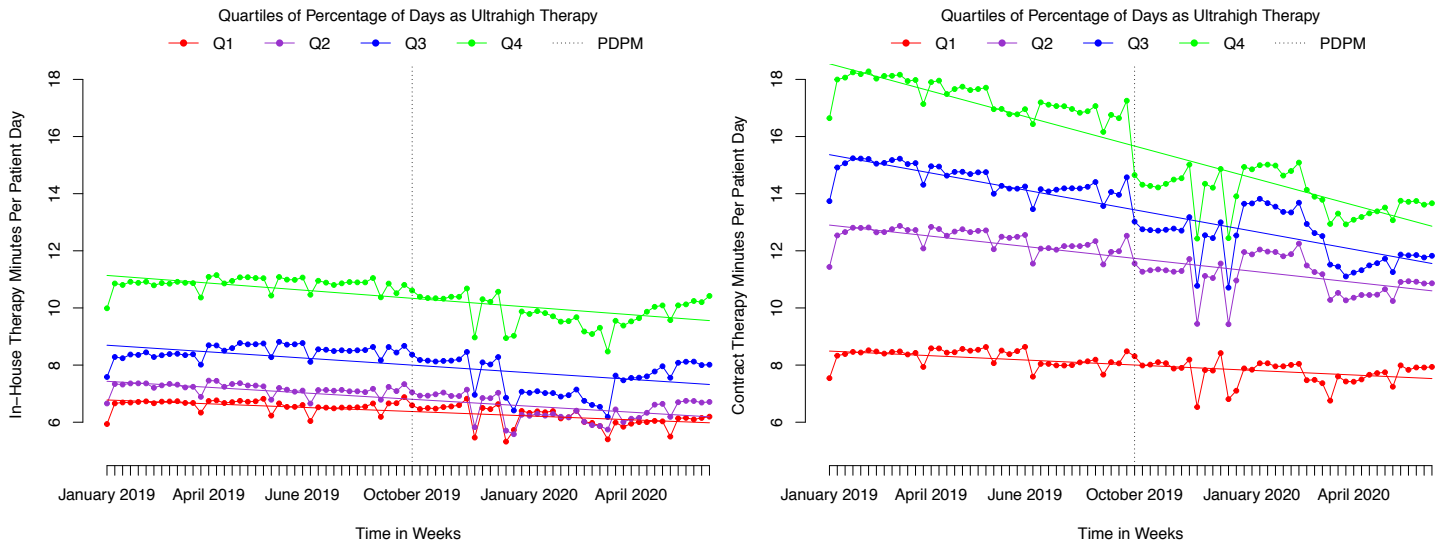


Figure 4.4 Average weekly in-house and contract therapy minutes/patient-day in Skilled Nursing Facilities (January 2019 – June 2020). Facilities are stratified by quartile of ultrahigh therapy provision in 2018. Linear regression lines are unadjusted for ease of comparison between groups. Abbreviations: Q-Quartile, PDPM-Patient Driven Payment Model.

Figure 4.2). Large effect sizes for differences in staffing over time were seen comparing SNFs employing different levels of therapy assistants. Compared to SNFs staffing no assistants at baseline, SNFs employing some assistants had larger staffing declines, especially for in-house staff.

SNFs serving higher proportions of patients from rural zip codes generally had larger declines in staffing, especially for therapists and in-house staff. SNFs located in Northeastern and Northwestern regions had larger total therapy staffing reductions compared to all other regions. Chain affiliation was associated with larger declines in therapy staffing compared to non-chain SNFs, especially for assistant and contract staff. Compared to freestanding facilities,

hospital-based SNFs had larger declines for in-house therapy staff, losing 9.8% more in-house employees.

Five-Star overall quality ratings had fewer associations with total therapy staffing changes than most other SNF characteristics we examined. However, 2 to 5-Star SNFs retained more in-house staff and lost more contract staff than 1-Star SNFs. Finally, SNFs in the highest quartile of racial/ethnic minority patients had larger declines in therapist staffing but smaller declines for assistants compared to SNFs with less diverse patient populations.

4.5 Discussion

This study provides the first analysis of therapy staffing in SNFs under PDPM which compares differences in staffing patterns across SNF characteristics and adjusts for local COVID-19 case rates. Consistent with previous work demonstrating early declines in SNF therapy staffing in the first six months of PDPM, at nine months post-implementation we found that declines in total PT and OT staffing were over 20%.^{48,49} While all categories of therapy staffing saw declines, in-house staff and therapists were retained more than contract staff and assistants.

We found significant variation in longitudinal staffing patterns based on SNF characteristics. The most consistent effects were for payer mix variables. As anticipated, SNFs that were more likely to be impacted by PDPM due to fewer long-stay Medicaid patients and higher proportions of short-stay Medicare patients experienced larger staffing declines. These results are consistent with analyses of previous SNF reimbursement policy changes which found larger shifts in therapy provision for Medicare patients.^{7,36} Additionally, our results are consistent with research demonstrating that SNFs with the highest therapy staffing have the highest percentage of Medicare patients and lowest percentages of Medicaid patients.^{43,103} The larger

staffing declines in SNFs with more Medicare patients in our study may be due to a combination of higher baseline staffing and more responsiveness to Medicare-specific payment policy.

For-profit SNFs responded to PDPM with slightly larger total therapy staffing declines versus non-profits, consistent with prior evaluations in which for-profit SNFs were more responsive to reimbursement changes.^{37,42,43} While differences in staffing changes over time were small, non-profit SNFs had the highest therapy staffing at baseline and maintained higher staffing by June 2020. Larger declines for therapists and smaller declines for assistants in for-profit SNFs are consistent with patterns of profit-maximizing behavior in for-profit facilities, whose leadership may be motivated to retain lower-cost assistants in lieu of higher-paid therapists.¹² Larger declines in contract therapy staffing in non-profit SNFs may be related to higher baseline staffing in non-profits as well as potentially stronger policies on retaining in-house staff for improved continuity of care.^{74,113} Therapy assistants experienced steeper declines in staffing compared to therapists, and SNFs with high baseline therapy assistant staffing had larger negative total staffing trajectories. Employment of higher proportions of lower-paid assistants may help SNFs maximize profits by reducing therapy staffing costs,¹² thus SNFs employing more assistants at baseline may have been more responsive to PDPM by continuing to demonstrate profit-maximizing behavior in reducing total therapy staffing.

As expected with the removal of incentives for intensive therapy provision under PDPM, we found consistently larger staffing declines in facilities with higher baseline levels of ultrahigh therapy.¹⁰³ Contract staffing had a 23.8% larger decline in SNFs with the highest baseline intensive therapy provision compared to those in the bottom quartile. Contract therapy companies were engaged under the previous SNF reimbursement system to help maximize therapy for higher reimbursement, and contract staffing was associated with financially-

motivated therapy practices.¹¹ These results, consistent with work examining contract relationships after previous shifts in Medicare policy,¹⁰ suggest that PDPM had the effect of shifting therapy staffing away from contract relationships that are no longer as advantageous under PDPM incentives, especially for SNFs previously providing high therapy volumes.

As this study period captures SNF staffing during the COVID-19 pandemic, larger declines in contract staffing compared to in-house staffing may be related to concerns about the spread of COVID-19 by contract staff who often work in multiple buildings.¹¹⁴ While associations between contract therapy staff and risk for outbreaks or transmission have not yet been studied, heavy use of contract nursing staff and larger overall SNF staff size was associated with higher risk of COVID-19 outbreaks early in the pandemic.^{109,115,116} PDPM and the pandemic may have provided dual disincentives for contract therapy staffing in SNFs.

We found large regional differences in the trajectory of therapy staffing changes after PDPM, even when models adjusted for organizational factors, local impacts of COVID-19, and state-level indicators of market regulation. This finding is consistent with research demonstrating that post-acute care is the largest contributor to geographic variability in Medicare spending.¹¹⁷ Interestingly, SNFs in Region 1 had the largest declines in most staffing categories despite having baseline therapy staffing slightly below the national average. Future work incorporating local wages and demand for SNF services will be valuable in exploring mechanisms behind differential regional responses to PDPM.

We found minimal differences in total therapy staffing changes across different Five-Star overall quality of care ratings, except for a 1.4% steeper decrease comparing 5-Star to 1-Star facilities. Consistent with previous research,¹¹⁸ 5-Star SNFs had higher therapy staffing at baseline and in June 2020, despite slightly steeper declines in staffing over time. More stable

total therapy staffing in low-quality SNFs may be related to a floor effect in which staffing could not be further reduced from low baseline staffing. Higher-quality SNFs did have larger declines in contract staffing and smaller declines in in-house staffing compared to 1-star SNFs, and together with our results showing larger contract staff declines in non-profit SNFs, suggests a tendency for SNFs of higher quality to prioritize in-house staff that may contribute to better quality of care or contribute less to the spread of COVID-19.^{113,115} However, the minimal differences in total staffing across quality ratings suggests that quality ratings may not be as important for monitoring SNF responses to PDPM compared to other organizational factors. This finding adds to concerns that Five-Star ratings do not reliably reflect underlying constructs of quality of care provided, as SNFs utilize many mechanisms of improving Five-Star scores without undergoing process improvements.^{119,120}

4.5.1 Limitations

This study examines associations between SNF organizational characteristics and changes in PT and OT staffing over time but does not imply causality. Due to CMS waivers during the early COVID-19 pandemic, one quarter of data (January – March 2020) included PBJ staffing hours for fewer SNFs than previous quarters (n=7658). Urban, for-profit, in-hospital, contract-hiring SNFs in counties with higher COVID-19 cases and SNFs in CMS Region 2 were slightly less likely to report (Supplemental Table 3). However, reporting returned to baseline after March 2020, and mixed effects models accommodate missingness related to observed SNF characteristics. Speech therapy staffing was not included due to its inverse relationship with PT and OT costs in SNFs and because speech therapy is separately case-mix adjusted under PDPM;⁴⁵ however, other studies noted a decline in speech therapy staffing under PDPM,⁴⁹ thus

future analyses could be inclusive of all disciplines to understand quality effects related to all therapy services.

Facility-level data did not allow for direct adjustment for shifts in case-mix, which may have occurred with changes in elective surgeries or patient acuity during the COVID-19 pandemic.^{121,122} We used county-level COVID-19 case rates to reflect local pandemic impact, however, these rates cannot directly measure impact at the facility level. While CMS maintains data on SNF COVID-19 cases and deaths, these data cannot be used in longitudinal analyses as reporting was not required until May 2020 and early cases may have been reported in batches.

4.6 Conclusions and Implications

We found that declines in OT and PT staffing in SNFs after PDPM implementation varied according to organizational characteristics. After adjusting for COVID-19 cases, we found the largest relative total therapy staffing declines in SNFs in Northwestern and Northeastern regions, SNFs with high Medicare populations, and SNFs employing high proportions of therapy assistants or intensive therapy prior to PDPM. Contract therapy declined more than in-house staffing in non-profit and high-quality SNFs. While our study may be interpreted that PDPM had the intended effect of “right-sizing” therapy provision,^{45,49} the optimal balance between therapy and quality remains unknown, especially in the context of research connecting intensive therapy to positive patient outcomes.¹³ Additionally, larger declines in therapist versus assistant staffing in SNFs serving more racially diverse beneficiaries may have implications for quality of care, as SNFs with more balanced staffing of therapists and assistants have better outcomes.⁷² Consistent with research demonstrating racial disparities in outcomes and access to high-quality SNFs,^{123,124} this result is a concerning indicator that PDPM may have an inequitable impact on quality for disadvantaged patients. This study provides specific SNF characteristics associated with larger

staffing changes under PDPM. These characteristics should be targeted in quality monitoring and policy evaluation efforts to better understand the impacts of PDPM on patient outcomes, especially for vulnerable groups.

Chapter 4 Supplementary Material

Supplementary Table 4.1 Linear mixed effects model coefficients for Skilled Nursing Facility staffing between January 1, 2019, and June 30, 2020, n = 12,892.

	All Therapy Minutes/ Patient Day Coefficient (95% CI)	Therapist Minutes/ Patient Day Coefficient (95% CI)	Therapy Assistant Minutes/ Patient Day Coefficient (95% CI)	In-House Therapy Staff Minutes/ Patient Day Coefficient (95% CI)	Contract Therapy Staff Minutes/ Patient Day Coefficient (95% CI)
Time (weeks)	0.04 (0.04, 0.05)	0.003 (-0.002, 0.007)	0.04 (0.04, 0.04)	0.02 (0.02, 0.03)	0.02 (0.02, 0.03)
Staffing and Therapy Provision					
Contractor Staffing					
All In-House staffing	Ref.	Ref.	Ref.	Ref.	Ref.
Mix of Contract and In-House	-0.25 (-0.64, 0.14)	-0.02 (-0.02, 0.02)	-0.28 (-0.51, -0.04)	-2.26 (02.58, -1.93)	3.02 (2.67, 3.37)
All Contract staffing	-2.07 (-2.37, -1.78)	-0.97 (-1.15, -0.80)	-1.29 (-1.47, -1.12)	-7.25 (-7.55, -6.95)	7.76 (7.45, 8.07)
Mix of Contract and In-House * 78 Weeks	0.18 (0.00,0.36)	-0.16 (-0.27, -0.05)	0.34 (0.23, 0.45)	4.36 (4.23, 4.50)	-4.18 (-4.33, -4.03)
All Contract staffing * 78	0.73 (0.60, 0.86)	-0.11 (-0.19, -0.03)	0.84 (0.76, 0.92)	7.02 (6.93, 7.12)	-6.30 (-6.41, -6.19)

Weeks

Percent Assistant Staffing- PT & OT

None- 0%	Ref.	Ref.	Ref.	Ref.	Ref.
Quartile 1	5.48 (4.84, 6.11)	2.26 (1.88, 2.63)	3.74 (3.34, 4.11)	4.59 (4.08, 5.11)	0.36 (-0.19, 0.91)
Quartile 2	6.35 (5.72, 6.98)	1.18 (0.81, 1.54)	6.03 (5.63, 6.41)	4.87 (4.36, 5.38)	1.01 (0.47, 1.55)
Quartile 3	6.49 (5.85, 7.13)	0.29 (-0.08, 0.66)	7.27 (6.87, 7.67)	4.63 (4.12, 5.14)	1.52 (0.97, 2.07)
Quartile 4	6.15 (5.51, 6.79)	-0.67 (-1.04, -0.29)	7.98 (7.58, 8.39)	4.53 (4.01, 5.05)	1.24 (0.68, 1.79)
Quartile 1 * 78 Weeks	-8.75 (-9.04, -8.46)	-3.16 (-3.34, -2.98)	-5.59 (-5.77, -5.41)	-7.16 (-7.38, -6.95)	-1.59 (-1.83, -1.35)
Quartile 2 * 78 Weeks	-9.46 (-9.75, -9.18)	-1.60 (-1.78, -1.43)	-7.86 (-8.04, -7.69)	-7.21 (-7.42, -6.99)	-2.25 (-2.49, -2.02)
Quartile 3 * 78 Weeks	-9.90 (-10.19, -9.61)	-0.67 (-0.85, -0.50)	-9.22 (-9.40, -9.04)	-6.67 (-6.88, -6.45)	-3.23 (-3.47, -2.99)
Quartile 4 * 78 Weeks	-9.57 (-9.86, -9.27)	0.18 (0.00, 0.36)	-9.17 (-9.93, -9.57)	-6.60 (-6.82, -6.38)	-2.97 (-3.21, -2.72)

Ultrahigh Intensity Therapy Provision

Quartile 1	Ref.	Ref.	Ref.	Ref.	Ref.
Quartile 2	1.08 (0.75, 1.40)	0.48 (0.29, 0.67)	0.74 (0.54, 0.94)	0.26 (-0.00, 0.52)	0.93 (0.64, 1.22)
Quartile 3	1.80 (1.45, 2.14)	0.80 (0.60, 1.00)	1.23 (1.02, 1.44)	0.52 (0.24, 0.79)	1.50 (1.20, 1.80)
Quartile 4	2.60 (2.24, 2.96)	1.06 (0.85, 1.27)	1.95 (1.74, 2.17)	0.76 (0.47, 1.04)	2.17 (1.85, 2.48)
Quartile 2 * 78 Weeks	-1.08 (-1.23, -0.93)	-0.69 (-0.78, -0.60)	-0.39 (-0.49, -0.30)	-0.29 (-0.41, -0.18)	-0.79 (-0.91, -0.66)

Quartile 3 * 78 Weeks	-2.02 (-2.18, -1.87)	-0.95 (-1.04, -0.85)	-1.08 (-1.17, -0.98)	-0.06 (-0.18, 0.06)	-1.96 (-2.09, -1.83)
Quartile 4 * 78 Weeks	-3.43 (-3.59, -3.27)	-1.38 (-1.48, -1.28)	-2.05 (-2.15, -1.95)	-0.29 (-0.41, -0.17)	-3.14 (-3.28, -3.01)

Ownership and Facility Variables

Non-profit Ownership	Ref.	Ref.	Ref.	Ref.	Ref.
Government Ownership	-0.31 (-0.98, 0.23)	-0.08 (-0.40, 0.24)	-0.27 (-0.59, 0.06)	0.19 (-0.25, 0.62)	-0.57 (-1.04, -0.10)
For-Profit Ownership	-0.06 (-0.35, 0.23)	0.08 (-0.10, 0.25)	-0.12 (-0.29, 0.62)	0.40 (0.16, 0.63)	-0.54 (-0.80, -0.28)
Government Ownership * 78 Weeks	0.41 (0.16, 0.66)	-0.15 (-0.30, 0.00)	0.56 (0.41, 0.71)	-0.63 (-0.81, -0.45)	1.04 (0.84, 1.24)
For-Profit Ownership * 78 Weeks	-0.29 (-0.42, -0.15)	-0.44 (-0.52, -0.35)	0.15 (0.07, 0.23)	-1.15 (-1.25, -1.05)	0.87 (0.76, 0.98)
Rural County	-0.43 (-0.85, -0.01)	-0.19 (-0.44, 0.06)	-0.31 (-0.57, -0.05)	-0.12 (-0.46, 0.22)	-0.34 (-0.71, 0.04)
Rural County * 78 Weeks	0.17 (-0.02, 0.37)	0.06 (-0.06, 0.18)	0.11 (0.00, 0.23)	0.28 (0.13, 0.42)	-0.11 (-0.27, 0.05)
Chain Affiliation	-0.08 (-0.31, 0.16)	-0.05 (-0.19, 0.09)	0.00 (-0.14, 0.15)	-0.13 (-0.32, 0.06)	0.09 (-0.12, 0.30)
Chain Affiliation * 78 Weeks	-0.28 (-0.35, -0.13)	0.08 (0.02, 0.15)	-0.36 (-0.43, -0.29)	0.21 (0.12, 0.29)	-0.48 (-0.57, -0.39)
Certificate of Need Law	0.08 (-0.40, 0.23)	0.06 (-0.13, 0.24)	-0.11 (-0.30, 0.08)	0.21 (-0.04, 0.46)	-0.37 (-0.65, -0.09)
Certificate of Need Law * 78 Weeks	-0.29 (-0.39, -0.17)	-0.32 (-0.41, -0.23)	-0.04 (-0.13, 0.04)	-1.51 (-1.61, -1.40)	1.14 (1.02, 1.26)
SNF Moratorium	0.14 (-0.19, 0.47)	-0.05 (-0.24, 0.15)	0.17 (-0.03, 0.37)	0.14 (-0.13, 0.41)	-0.07 (-0.36, 0.21)

SNF Moratorium * 78 Weeks	1.19 (1.04, 1.34)	0.33 (0.24, 0.43)	0.86 (0.76, 0.95)	0.16 (0.05, 0.28)	1.03 (0.90, 1.15)
Bed Count (10-bed increase)	-0.13 (-0.15, -0.11)	-0.06 (-0.08, -0.05)	-0.08 (-0.09, -0.07)	-0.05 (-0.07, -0.03)	-0.08 (-0.10, -0.07)
Bed Count (10-bed increase) * 78 Weeks	0.06 (0.05, 0.07)	0.02 (0.02, 0.03)	0.03 (0.03, 0.04)	0.01 (0.00, 0.02)	0.05 (0.04, 0.06)
In-Hospital Location	2.96 (2.26, 3.66)	1.86 (1.45, 2.27)	1.45 (1.03, 1.88)	2.20 (1.63, 2.76)	0.66 (0.05, 1.26)
In-Hospital Location * 78 Weeks	-0.67 (-0.98, -0.35)	0.07 (-0.12, 0.26)	-0.74 (-0.93, -0.54)	-0.81 (-1.05, -0.57)	0.15 (-0.12, 0.41)
Facility-Level Patient Variables					
Average Patient HCC Score	0.02 (-0.2, 0.2)	-0.08 (-0.21, 0.04)	0.10, (-0.03, 0.23)	-0.14 (-0.32, 0.03)	0.18 (-0.01, 0.37)
Average Patient HCC Score * 78 Weeks	-0.08 (-0.18, 0.02)	0.01 (-0.05, 0.07)	-0.08 (-0.14, -0.02)	0.49 (0.42, 0.57)	-0.57 (-0.65, -0.49)
High Medicare	2.08 (1.82, 2.33)	0.96 (0.81, 1.11)	1.37 (1.22, 1.52)	0.82 (0.61 (1.02)	1.48 (1.26, 1.70)
High Medicare * 78 Weeks	-2.53 (-2.64, -2.41)	-1.03 (-1.10, -0.96)	-1.50 (-1.57, -1.43)	-0.69 (-0.78, -0.61)	-1.83 (-1.93, -1.74)
High Racial Diversity	-0.14 (-0.45, 0.17)	0.04 (-0.15, 0.22)	-0.21 (-0.40, -0.02)	0.12 (-0.13, 0.37)	-0.28 (-0.56, -0.01)
High Racial Diversity * 78 Weeks	0.13 (-0.01, 0.27)	-0.18 (-0.27, -0.09)	0.31 (0.22, 0.40)	-0.04 (-0.07, 0.15)	-0.33 (-0.45, -0.22)
% Medicaid Patients					
Quartile 1	Ref.	Ref.	Ref.	Ref.	Ref.
Quartile 2	-2.86 (-3.19, -2.53)	-1.43 (-1.62, -1.24)	-1.77 (-1.96, -1.57)	-1.36 (-1.62, -1.10)	-1.60 (-1.88, -1.32)

Quartile 3	-3.44 (-3.80, -3.09)	-1.71 (-1.92, -1.51)	-2.14 (-2.35, -1.92)	-1.79 (-2.07, -1.52)	-1.78 (-2.08, -1.47)
Quartile 3	-3.62 (-4.01, -3.23)	-1.79 (-2.02, -1.56)	-2.27 (-2.50, -2.03)	-1.72 (-2.03, -1.41)	-2.07 (-2.41, -1.73)
Quartile 2 * 78 Weeks	2.56 (2.41, 2.71)	1.18 (1.09, 1.27)	1.38 (1.29, 1.47)	0.63 (0.52, 0.74)	1.93 (1.81, 2.05)
Quartile 3 * 78 Weeks	3.72 (3.57, 3.88)	1.71 (1.61, 1.80)	2.02 (1.92, 2.11)	1.35 (1.23, 1.46)	2.31 (2.25, 2.50)
Quartile 4 * 78 Weeks	4.30 (4.12, 4.47)	1.87 (1.76, 1.97)	2.43 (2.32, 2.54)	1.43 (1.30, 1.56)	2.87 (2.72, 3.01)

% Rural Beneficiaries

None-0%	Ref.	Ref.	Ref.	Ref.	Ref.
Quartile 1	0.98 (0.57, 1.39)	0.64 (0.39, 0.88)	0.45 (0.20, 0.70)	0.75 (0.42, 1.08)	0.23 (-0.13, 0.59)
Quartile 2	0.41 (0.01, 0.81)	0.25 (0.09, 0.48)	0.25 (0.01, 0.50)	0.55 (0.23, 0.88)	-0.16 (-0.51, 0.19)
Quartile 3	0.15 (-0.29, 0.59)	0.12 (-0.14, 0.38)	0.08 (-0.19, 0.34)	0.50 (0.14, 0.85)	-0.41 (-0.79, -0.02)
Quartile 4	-0.23 (-0.81, 0.35)	1.06 (0.85, 1.27)	-0.06 (-0.41, 0.30)	0.23 (-0.24, 0.70)	-0.51 (-1.02, -0.00)
Quartile 1 * 78 Weeks	-1.63 (-1.82, -1.45)	-1.02 (-1.14, -0.91)	-0.61 (-0.73, -0.49)	-0.99 (-1.13, -0.85)	-0.64 (-0.80, -0.49)
Quartile 2 * 78 Weeks	-0.95 (-1.14, -0.77)	-0.61 (-0.72, -0.50)	-0.35 (-0.46, -0.23)	-0.91 (-1.04, -0.77)	-0.05 (-0.20, 0.10)
Quartile 3 * 78 Weeks	-0.16 (-0.36, -0.04)	-0.37 (-.49, -0.25)	0.21 (0.09, 0.34)	-0.55 (-0.70, -0.39)	0.39 (0.22, 0.55)
Quartile 4 * 78 Weeks	-0.17 (-0.09, 0.44)	-0.21 (-0.37, -0.04)	0.39 (0.21, 0.54)	-0.65 (-0.85, -0.45)	0.82 (0.60, 1.04)

Five-Star Overall Quality of Care Rating

1-Star	Ref.	Ref.	Ref.	Ref.	Ref.
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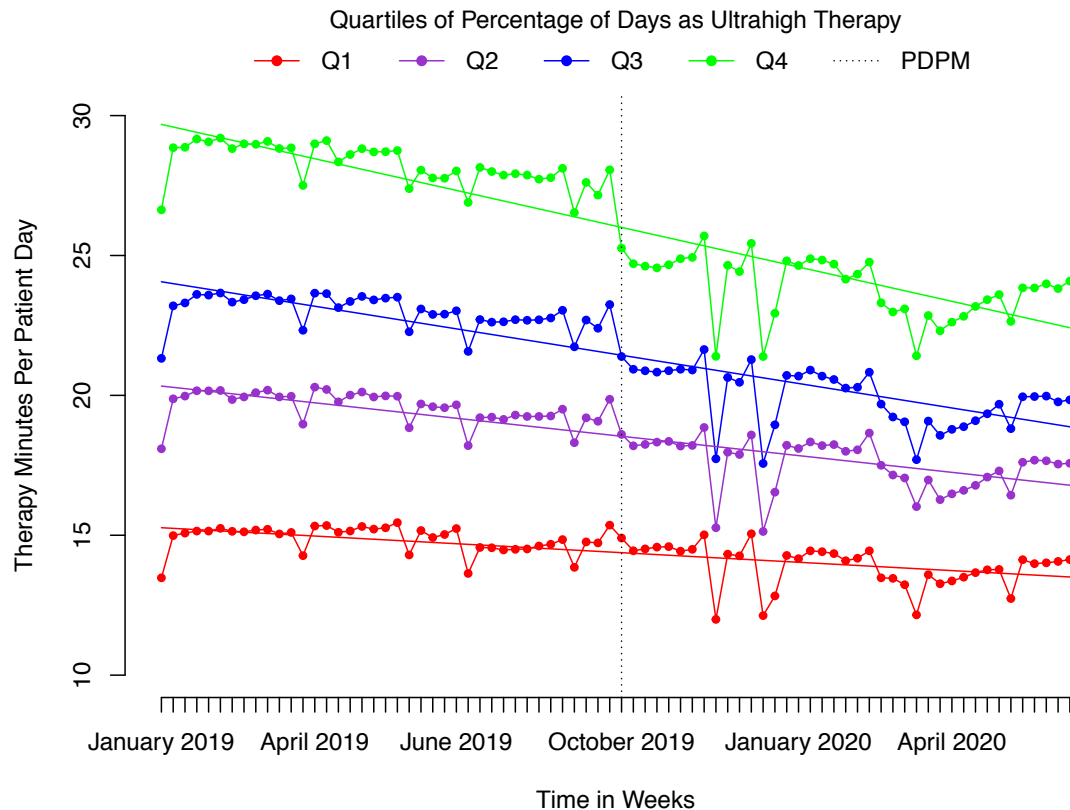
2-Star	0.15 (-0.39, 0.69)	0.09 (-0.23, 0.41)	0.05 (-0.28, 0.38)	-0.14 (-0.58, 0.30)	0.31 (-0.17, 0.79)
3-Star	0.18 (-0.35, -0.70)	-0.03 (-0.34, 0.28)	0.21 (-0.11, 0.53)	-0.05 (-0.47, 0.37)	0.23 (-0.22, 0.69)
4-Star	0.23 (-0.29, 0.75)	0.09 (-0.22, 0.40)	0.16 (-0.15, 0.48)	-0.15 (-0.57, 0.27)	0.46 (-0.00, 0.91)
5-Star	0.65 (0.13, 1.17)	0.27 (-0.04, 0.58)	0.43 (0.12, 0.75)	0.18 (-0.24, 0.60)	0.52 (0.06, 0.98)
2-Star * 78 Weeks	0.06 (-0.19, 0.31)	-0.08 (-0.23, 0.07)	0.15 (-0.01, 0.30)	0.58 (0.39, 0.76)	-0.51 (-0.72, -0.31)
3-Star * 78 Weeks	0.00 (-0.24, 0.24)	-0.02 (-0.17, 0.12)	0.02 (-0.13, 0.17)	0.77 (0.59, 0.95)	-0.77 (-0.97, -0.58)
4-Star * 78 Weeks	-0.07 (-0.31, 0.17)	-0.12 (-0.27, 0.03)	0.05 (-0.10, 0.19)	0.67 (0.49, 0.85)	-0.74 (-0.94, -0.54)
5-Star * 78 Weeks	-0.30 (-0.54, -0.06)	-0.19 (-0.34, -0.05)	-0.11 (-0.26, 0.04)	0.35 (0.17, 0.53)	-0.65 (-0.84, -0.45)

CMS Region

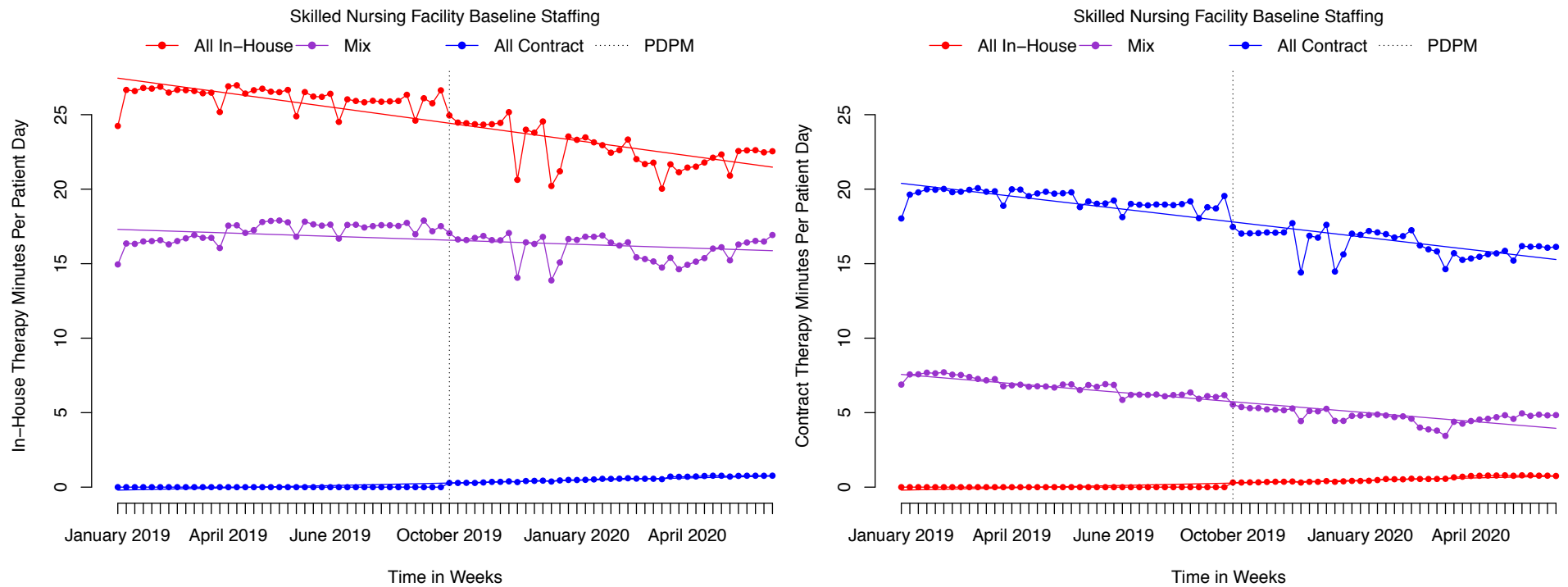
Region 1 (Boston)	Ref.	Ref.	Ref.	Ref.	Ref.
Region 2 (New York)	0.64 (-0.05, 1.33)	0.29 (-0.12, 0.70)	0.02 (0.02, 0.03)	-0.40 (-0.96, 1.57)	0.98 (0.37, 1.58)
Region 3 (Philadelphia)	0.73 (0.01, 1.36)	0.30 (-0.77, 0.67)	0.01 (0.01, 0.02)	0.37 (-0.14, 0.88)	0.35 (-0.20, 0.91)
Region 4 (Atlanta)	0.74 (0.15, 1.32)	0.34 (-0.01, 0.68)	0.02 (0.01, 0.02)	0.37 (-0.10, 0.84)	0.27 (-0.24, 0.78)
Region 5 (Chicago)	0.92 (0.39, 1.45)	0.50 (0.19, 0.82)	0.01 (0.01, 0.01)	0.66 (0.23, 1.09)	0.17 (-0.29, 0.64)
Region 6 (Dallas)	0.03 (-0.61, 0.67)	0.15 (-0.23, 0.53)	0.03 (0.02, 0.03)	0.38 (-0.14, 0.90)	-0.56 (-1.12, -0.01)
Region 7 (Kansas City)	-0.58 (-1.23, 0.07)	-0.07 (-0.46, 0.31)	0.03 (0.03, 0.03)	0.26 (-0.26, 0.79)	-1.20 (-1.77, -0.63)
Region 8 (Denver)	-0.88 (-1.71, -0.05)	-0.51 (-1.00, -0.01)	0.02 (0.01, 0.02)	0.38 (-0.29, 1.05)	-1.66 (-2.39, -0.93)

Region 9 (San Francisco)	1.24 (0.53, 1.95)	0.88 (0.46, 1.30)	0.01 (0.01, 0.01)	0.84 (0.27, 1.42)	0.15 (-0.48, 0.77)
Region 10 (Seattle)	1.71 (0.86, 2.56)	0.90 (0.40, 1.41)	-0.01 (-0.01, -0.01)	0.80 (0.11, 1.48)	1.03 (0.29, 1.78)
Region 2 (New York) * 78 Weeks	1.81 (1.49, 2.13)	0.04 (-0.15, 0.24)	1.77 (1.57, 1.97)	0.96 (0.72, 1.20)	0.85 (0.59, 1.12)
Region 3 (Philadelphia) * 78 Weeks	1.24 (0.95, 1.53)	0.13 (-0.04, 0.31)	1.11 (0.93, 1.29)	-1.28 (-1.50, -1.07)	2.52 (2.29, 2.76)
Region 4 (Atlanta) * 78 Weeks	1.34 (1.08, 1.61)	0.03 (-0.13, 0.19)	1.31 (1.15, 1.48)	-1.34 (-1.54, -1.14)	2.68 (2.46, 2.91)
Region 5 (Chicago) * 78 Weeks	0.75 (0.50, 0.99)	-0.18 (-0.33, 0.03)	0.93 (0.77, 1.08)	1.50 (-1.68, -1.32)	2.25 (2.04, 2.45)
Region 6 (Dallas) * 78 Weeks	2.44 (2.15, 2.73)	0.41 (0.23, 0.58)	2.04 (1.85, 2.22)	0.18 (-0.40, 0.04)	2.62 (2.38, 2.86)
Region 7 (Kansas City) * 78 Weeks	2.46 (2.16, 2.75)	0.28 (0.10, 0.46)	2.17 (1.99, 2.36)	-1.01 (-1.23, -0.79)	3.46 (3.22, 3.71)
Region 8 (Denver) * 78 Weeks	1.88 (1.50, 2.26)	0.61 (0.38, 0.84)	1.27 (1.04, 1.51)	-1.07 (-1.36, -0.79)	2.95 (2.64, 3.27)
Region 9 (San Francisco) * 78 Weeks	0.35 (0.03, 0.68)	-0.57 (-0.77, -0.37)	0.92 (0.72, 1.13)	-1.28 (-1.52, -1.03)	1.63 (1.36, 1.91)
Region 10 (Seattle) * 78 Weeks	-2.44 (-2.83, -2.05)	-1.63 (-1.87, -1.39)	-0.81 (-1.05, -0.57)	-1.62 (-1.91, -1.32)	-0.82 (-1.15, -0.50)

Coefficients are also adjusted for weekly county covid rates normalized by population and Federal holidays. Interaction terms between organizational characteristics and time in weeks are presented under main effects for each variable category. Interaction terms are multiplied by 78 to reflect overall differences in staffing trajectories by organizational characteristic across the 78 weeks in the study period.



Supplementary Figure 4.1 Average weekly therapy minutes/patient-day in Skilled Nursing Facilities (January 2019-June 2020). Facilities are stratified by quartile of ultrahigh therapy provision in 2018. Physical and occupational therapist and therapy assistant minutes for both in-house and contract staff are included. Linear regression lines are unadjusted for ease of comparison between groups. Abbreviations: Q-Quartile, PDPM-Patient Drive Payment Model.



Supplementary Figure 4.2 Average weekly in-house and contract therapy minutes/patient-day in Skilled Nursing Facilities (January 2019 – June 2020). Facilities are stratified by categories of baseline therapy staffing from January – September 2019. Physical and occupational therapist and therapy assistant minutes for both in-house and contract staff are included. Linear regression lines are unadjusted for ease of comparison between groups. PDPM- Patient Driven Payment Model.

Chapter 5: Conclusions

The three analyses in this dissertation were guided by the conceptual framework in Figure 1.1, in which health policy may impact rehabilitation processes and quality outcomes in SNFs and policy may have differential impacts on SNFs based on structural characteristics.

The first two papers establish baseline relationships between therapy processes and patient outcomes in SNFs prior to PDPM implementation, which will provide valuable comparisons for assessing how therapy processes may shift under new payment policy. Both analyses also provide examples of SNF therapy processes that were found to be positively associated with higher quality. Chapter 2 suggests small positive associations between additional therapy minutes above RUG group thresholds and improved functional improvement and community discharge outcomes. Chapter 3 suggests a positive relationship between small proportions of multiparticipant therapy and improved outcomes, providing potential justification, in addition to improved efficiency, for replacing a minority of individual therapy sessions with multiparticipant sessions. Models in both analyses also demonstrated positive associations between higher overall therapy intensity and outcomes, consistent with previous research. Together, the results of these two chapters should serve to caution facilities motivated to significantly reduce overall therapy provision under PDPM. Additionally, these results provide valuable feedback to Medicare, as these studies support the 25% limit on multiparticipant therapy and suggest that disincentivizing therapy provision across the board may negatively impact patient outcomes.

Chapter 4 explored variability in therapy staffing declines in the first six months after PDPM implementation. Consistent with the conceptual framework, staffing changes varied by

organizational factors, with SNFs that implemented profit-maximizing processes prior to PDPM demonstrating larger staffing declines. This study suggests SNF organization factors that should receive particular attention when studying the impact of PDPM and when performing quality monitoring, as reduced therapy staffing may be related to quality.

Future directions for this work include the need to examine relationships between multiparticipant therapy and patient outcomes after PDPM implementation, especially as multiparticipant therapy provision increased rapidly and then fluctuated as isolation requirements have shifted during the COVID-19 pandemic. Future work is still needed before best practices can be established to guide clinical practice that prioritizes outcomes, including evidence on patient subgroups that benefit from multiparticipant therapy and research highlighting active ingredients of multiparticipant therapy sessions that facilitate ideal outcomes. Additional attention to relationships between therapy intensity, staffing, and patient outcomes is also needed with more recent data after PDPM implementation. Finally, specific attention to disparities in access to therapy and patient outcomes is needed given the larger reduction in skilled therapist staffing in SNFs with more racially diverse patients.

In addition to setting a foundation for future work on the impact of PDPM on SNF processes and outcomes, the studies in this dissertation provide policy-relevant information for clinicians, SNF administrators, and Medicare. These results may help guide more targeted monitoring of Medicare policy and emphasize the ongoing need for policy development and policy evaluation that maintain a central focus on patient outcomes.

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Appendix

Statement of Co-Authorship: Chapter 3

As co-authors of the manuscript entitled: “Some But Not Too Much: Multiparticipant Therapy and Positive Patient Outcomes in Skilled Nursing Facilities” that had been submitted to the Journal of Geriatric Physical Therapy,

We confirm that Rachel Prusynski was the primary contributor to the study in each of the following areas:

- Design of the study
- Data collection
- Data analysis and interpretation of the findings
- Writing of the manuscript and critical appraisal of the content

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