RESEARCH ARTICLE

Postacute care outcomes and medicare payments for patients treated by physicians and advanced practitioners who specialize in nursing home practice

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Objective: To measure the association between clinician specialization in nursing home (NH) practice and outcomes of patients who received postacute care in skilled nursing facilities (SNFs).

Data Sources: Medicare claims and NH assessments for 2 118 941 hospital discharges to 14 526 SNFs in January 2012–October 2014 and MD-PPAS data for 52 379 clinicians.

Study Design: Generalist physicians and advanced practitioners with ≥ 90 percent of claims for NH-based care were considered NH specialists. The primary clinician during each SNF stay was determined based on plurality of claims during that stay. We estimated the effect of being treated by a NH specialist on 30-day rehospitalizations, successful discharge to community, and 60-day episode-of-care Medicare payments (Parts A and B). All models included patient demographics, clinical variables, and SNF fixed effects.

Principal Findings: Nursing home specialists' patients were less likely to be rehospitalized (14.71 percent vs 16.23 percent; adjusted difference, -1.51 percent, 95% CI -1.78 to -1.24), more likely to be successfully discharged to community (56.33 percent vs 55.49 percent; adjusted difference, 0.84 percent, 95% CI 0.54 to 1.14), but had higher 60-day Medicare payments (\$31 628 vs \$31 292; adjusted difference, \$335; 95% CI \$242 to \$429).

Conclusions: Clinicians who specialize in NH practice may achieve better postacute care outcomes at slightly higher costs.

KEYWORDS

care quality, hospitalization, nursing home, postacute care, specialization

1 | INTRODUCTION

One in five Medicare beneficiaries discharged from the hospital receives postacute care in nursing homes (NH), or skilled nursing facilities (SNFs), which provide nearly half (47 percent) of postacute care episodes.¹ Postacute care in SNFs cost Medicare nearly \$31 billion in 2016² and while these payments increased nearly 60 percent since 2006, concerns about the quality of care received in SNFs remain.^{1,3} Rehospitalization rates among patients discharged to SNFs are high⁴

and quite variable across SNFs.⁵ In 2015, the rehospitalization rates from SNFs in the highest quartile of rehospitalization were double those in the lowest quartile.⁶ Rates of discharge to the community—the goal of postacute care for most patients—are also highly variable, ranging from 39 percent to 66 percent between the top and bottom quartiles of performance.⁷

One factor that may influence patient outcomes in the SNF is the care they get by physicians and advanced practitioners (eg, nurse practitioners) while in the SNF. Physicians and advanced

practitioners are often considered integral to improving care coordination and transitions in care,⁸⁻¹⁰ yet their presence in nursing homes (NHs) has been traditionally limited.¹¹ Despite calls for "nursing home specialists,"¹² only 13 percent of physicians report sufficient training in NH practice making it difficult to recruit a specialized NH workforce.^{13,14} Over the past decade, however, the number of clinicians specializing in NH practice increased.¹⁵ Between 2012 and 2015, the number of clinicians who saw patients in NHs and focused their practice exclusively on those patients increased by 34 percent.¹⁶ However, whether clinician specialization in NH practice is associated with better postacute care outcomes for patients admitted to SNFs is unknown.

Prior studies evaluated several aspects of the relationship between physician practice in NHs and patient outcomes. A 1997 study of urban NHs in four states found that NHs with more physicians were associated with higher hospitalizations.¹⁷ While the question of physician specialization was not examined directly, NHs with more physicians are typically open-staff model where multiple community physicians follow their patients across settings. Those physicians are less likely to specialize in NH practice. A 2007 survey study of 200 NHs found that patients in NHs that reported a greater proportion of patients under the care of a single physician had 20 percent higher odds of 30-day rehospitalization, while patients in NHs with more formal physician attachment via employment and credentialing processes had 16 percent lower odds of rehospitalization.¹⁸ Whereas physicians who specialize in NH practice may be more willing to invest in forming formal attachment with a NH, it also follows that those physicians would care for a larger proportion of patients in a facility compared to nonspecialists. Lastly, a study of long-term care patients admitted to Texas NHs between 2006 and 2008 found that patients under the care of physicians and advanced practitioners who devoted less than 5 percent of their clinical effort to NH practice were at 52 percent higher risk of potentially avoidable hospitalization than those whose physicians devoted 85 percent or more of their clinical effort to NH practice.¹⁹

Our objective in this study was to measure whether SNF patients cared for by physicians and advanced practitioners who specialize in NH-based care have lower rehospitalization rates, higher rates of successful discharge to community, and lower Medicare payments for the episode of care. A secondary objective was to evaluate whether the number of NHs clinicians work in affects the association between NH-based practice specialization and patient outcomes.

Our study contributes to the literature in several ways. First, we characterize NH specialization of clinicians using national provider utilization data that spans state lines. By using the MD-PPAS dataset that summarizes utilization at the provider-service level, we are able to more accurately identify NH specialists among clinicians who see patients in multiple NHs located in different states, for example. Second, we improve on the generalizability of our findings by using a large cohort of patients transferred from U.S. acute care hospitals to SNFs over a period of three years. Third, we attempt to account for heterogeneity across SNFs by estimating the average difference in outcomes between patients under the care of NH specialists vs

nonspecialists within NHs by using NH fixed effects. This is particularly important in the context of increasing adoption of NH specialists by NHs in the United States over the recent years. Lastly, we use rich clinical information from the NH Minimum Data Set (MDS) to adjust for patient-level factors that may influence the outcomes of interest.

2 | METHODS

2.1 | Data sources and study sample

Our primary data sources were Medicare claims data from January 2012 to October 2014, including the Medicare Provider Analysis and Review (MedPAR), Medicare Beneficiary Summary file, and Medicare Carrier File (also known as the Physician/Supplier Part B claim file). These data were supplemented with the NH Minimum Data Set (MDS), containing detailed clinical assessments on all NH residents in a Medicare or Medicaid-certified NHs, and the MD-PPAS dataset, which aggregates lines on fee-for-service Part B claims by procedure (HCPCS, or Healthcare Common Procedure Coding System) codes for each practicing clinician per year.

We used these data to create a cohort of Medicare fee-for-service beneficiaries discharged from an acute care hospital to a SNF under the Part A benefit (short-stay). We excluded beneficiaries under 66 years of age, patients who were in a NH in the 100 days prior to hospitalization, and, to ensure completeness of the claims, those not enrolled in Medicare Parts A and B during the duration of the hospital and SNF stays and for the 60 days after (or through the month of death, whichever occurred earlier). Patients who resided in a NH prior to the hospitalization were identified if they had any MDS assessments during 100 days prior to hospitalization. To measure variables for risk-adjustment, we excluded beneficiaries not enrolled in Medicare Part A for 12 months prior to the hospitalization. We also excluded stays that could not be linked to any Part B claims because we used Part B clinician visit claims to characterize the stays by the degree of NH specialization of the primary clinician for that stay (Appendix Figure).

2.2 | Key independent variable

Adopting an approach previously used to characterize physician practice in other settings,^{20,21} we used evaluation and management (E&M) codes and place of service information from Part B claims to measure the proportion of each clinicians' practice that is NH-based. First, we took the total number of lines submitted to Medicare for payment during each calendar year from the MD-PPAS dataset (the denominator).²² Then, using all Carrier claims for the cohort of patients admitted to SNF, we summed the number of lines submitted for any NH or SNF visits (to any NH or SNF) for each study year (the numerator). Physicians in generalist specialties (internal medicine, family medicine, general practice, physical medicine/rehabilitation, or geriatrics) and advanced practitioners (nurse practitioners and physician assistants) with at least 90 percent of claims for NH or SNF

care were considered NH specialists.^{16,23} We adopted this definition because it is analogous to the approach adopted by the Centers for Medicare and Medicaid Services (CMS) to define hospitalists,^{20,21} and has been used in prior analyses that characterized the increase in specialization among NH clinicians.^{16,23} We conducted sensitivity analyses using alternative thresholds for the proportion of NH-based practice to define clinician specialization.

2.3 | Outcomes variables and covariates

Our primary outcome was 30-day rehospitalization, defined as any unplanned readmission to an acute care hospital within 30 days of SNF admission observed in MedPAR data.²⁴ We included two secondary outcomes. Successful discharge to community was defined as a discharge within 100 days of admission to SNF reported in MDS as to “community” (eg, private home or assisted living facility), and remained alive and not readmitted to a hospital or SNF for at least 30 days.²⁴ Sixty-day episode of care payments by Medicare was defined as all facility and professional payments by Medicare Parts A and B (including hospital, SNF, physician, and other provider payments) during the 60 days after the initial acute care hospital admission. Payments were broken down into (a) Part A payment for the index hospitalization, (b) Part A payment for the subsequent SNF stay, (c) subsequent hospitalization (rehospitalization) Part A payment(s) (if any), (d) Part A payment for subsequent SNF stays (if any), and (e) Part B payments during the 60 days after the initial hospital admission date (any place of service). Payments for stays that extended beyond the 60-day episode were prorated by multiplying the total payment by the fraction of length of stay that occurred during the 60-day episode. Sensitivity analyses were conducted using the full payment amounts.

All outcomes were adjusted for demographics (age at admission, sex, and race), Elixhauser comorbidities,²⁵ and two sets of clinical variables used by CMS for NH Compare clinical measure risk-adjustment (Table S1).²⁴ These included two sets of MDS-derived risk-adjustment variables: 55 variables for the outcomes of 30-day rehospitalization and payment (eg, clinical conditions, treatments, and diagnoses); and 84 variables for the outcome of successful discharge to community (eg, clinical variables as well as functional status, cognitive function scale²⁶, and social factors such as marital status²⁴). Following the CMS methodology for the successful discharge to community measure, we included the 66 Resource Utilization Groups (RUG IV) measured on admission as dummy variables. The RUG categories are used by CMS to determine care and resource needs and prospective per-diem payment rates to SNFs.² These variables were supplemented with 6 variables derived from MedPAR claims (eg, principal diagnosis group, Medicare disability coverage, hospitalizations, and intensive care unit stays in prior year).²⁴ All models also included year and NH fixed effects.

2.4 | Attending clinician attribution

To examine the impact of clinician specialization on patient outcomes, we assigned each patient admitted to a SNF to an attending

clinician using NH-based Part B claims during each SNF stay. To do so, we identified physician and advanced practitioner E&M claims with place of service codes for SNF or NH care (POS 31 or 32) and that occurred between the admission and discharge dates of a SNF stay. Each SNF stay was then assigned to the attending clinician for that stay with a plurality of claims.

2.5 | Statistical analysis

Analyses were conducted at the SNF stay level. Outcomes were modeled as a function of whether the attending clinician specialized in NH practice, patient covariates, year, and NH fixed effects using the following model:

$$Y_{ij,n,t} = \beta_1 PS_{j,t} + \beta X_{i,t} + \varphi_n + time_t + \varepsilon_{ij,n,t} \quad (1)$$

where i indexes patients, j indexes a physician, and n indexes a NH; Y measures outcomes of interest (30-day rehospitalization, successful discharge to community, or 60-day payments), PS is an indicator for NH specialization (equal to 1 if the attending clinician is a NH specialist and 0 if the attending clinician is not a NH specialist), and X is a vector of patient controls, $time$ is a time-quarter dummy controlling for secular trends, and φ is NH fixed effect. By including NH fixed effects in the models, we estimated the average difference in outcomes between patients under the care of NH specialists vs nonspecialists *within each SNF*, using each SNF as a control for itself. Estimating the effect of clinician specialization within SNFs using fixed effects allows us account for unobserved heterogeneity across SNFs that might be correlated with both clinician characteristics as well as patient characteristics and measured outcomes and therefore reduce the bias that typically limits observational studies.

Linear probability models were used. We estimated adjusted patient outcomes by attending clinician NH specialization using the average adjusted predictions (margins command in Stata).²⁷ The Huber White sandwich estimator was used in all regressions to account for clustering of observations within NHs.²⁸

We also tested random effects and multilevel model specifications. To do so, we estimated hierarchical models with random effects at the NH and clinician levels. Although clinicians treated patients in different NHs, we treated clinicians as nested within NHs due to the high computational requirements of cross-classified models at the clinician level. The Hausman specification test was used to test consistency of random model estimators and indicated systematic bias. Thus, we report fixed effects estimates for all models; corresponding random effects estimates and Hausman tests are reported in Table S6.

2.6 | Additional analyses

In addition to the main models, we performed two additional analyses. First, we tested the effect of patient and stay characteristics (PT) (ie, medical vs surgical hospitalization, severity using Elixhauser index, dual eligibility for Medicare and Medicaid, and

cognitive function using the MDS 3.0 Cognitive Function Scale²⁶) on the association between being treated by a NH specialist and patient outcomes. To do this, we estimated models that included an interaction term between each patient or stay characteristic (PT) and the indicator for NH specialization (PS). The difference in the effect size within each category was measured as the sum of the coefficient on the characteristic (PT) and the interaction term (PT*PS). Second, we tested the effect of primary clinician practice concentration in a few vs many SNFs. To do this, we counted the total number of different SNFs where the attending clinician saw patients in each year. We also calculated the proportion of each attending's SNF patient volume in each SNF. To test the effect of these clinician characteristics on the association between clinician specialization in NH practice and patient outcomes, we re-estimated models that included an interaction term between each clinician characteristic (CC) and the indicator for NH specialization (PS).

We conducted a number of sensitivity analyses. First, we recalculated the estimates using a slightly larger sample that included patients under the care of nongeneralist physicians (ie, physicians of other specialties). In this larger sample, 2.9 percent of the stays were under the care of nongeneralist physicians, whereas 97.1 percent were under the care of generalist physicians and advanced practitioners. Second, we re-estimated Part A payments for the SNF stay, adjusting for the 66 RUG IV indicator variables, which adjust for treatment intensity during the SNF stay.

Statistical analyses were performed using Stata, version 15. The study was approved by the University of Pennsylvania Institutional Review Board and the Centers for Medicare and Medicaid Services privacy board.

3 | RESULTS

3.1 | Patient characteristics

Our study included 2 118 941 hospital discharges to 14 526 SNFs, for whom a NH specialist provided care in 10.8 percent of stays. Sixty-six percent of the patients were female, 89 percent white, and 12 percent were dual-eligible (Table S1). Characteristics of SNF stays under the care of NH specialists and non-NH specialists were generally similar with the exception of cognitive function scale (Table 1). Patients under the care of non-NH specialists were more cognitively impaired compared to patients under the care of NH specialists. More stays under the care of nonspecialists were in hospital-based or smaller (<100 bed) facilities compared to stays under the care of NH specialists. Nearly all NH specialist stays were in facilities in urban locations.

3.2 | Clinician characteristics

There were substantial differences in clinician characteristics between the stays under the care of clinicians specializing vs not specializing in NH care (Table 2). The most common primary specialty

of clinicians specializing in NH care was nurse practitioner (40.7 percent), followed by internal medicine (21.2 percent) and physical medicine/rehabilitation (15.9 percent), whereas the most common specialty of clinicians not specializing in NH care was internal medicine (44.6 percent), followed by family medicine (24.2 percent) and nurse practitioner (17.5 percent). Compared to stays under the care of nonspecialists, stays under the care of NH specialists had more visits (5.7 vs 3.9, $P < 0.001$) and a higher number of different clinicians (2.3 vs 1.7, $P < 0.001$). Consistent with this, NH specialists provided a lower proportion of overall services during the SNF stay compared to nonspecialists (0.72 vs 0.82, $P < 0.001$). Both types of clinicians treated patients in about 4 SNFs on average (median 3 for both, IQR 2–6 for nonspecialists and 2–5 for specialists, not shown in table). NH specialists had a higher proportion of patients in the same SNF compared to nonspecialists (0.69 vs 0.61, $P < 0.001$) (Table 2).

3.3 | Patient outcomes

Patients under the care of NH specialists were less likely to be re-hospitalized during 30 days after SNF admission (14.71 percent vs 16.23 percent; adjusted difference, –1.51 percent, 95% CI –1.78 to –1.24) and more likely to be successfully discharged to the community (56.33 percent vs 55.49 percent; adjusted difference, 0.84 percent, 95% CI 0.54 to 1.14) (Table 3). These adjusted differences were slightly smaller than the unadjusted differences (Table 3).

The differences in discharge to community rates between stays under the care of NH specialists and non-NH specialists were concentrated among stays following medical (vs surgical) hospitalizations and stays by patients with Elixhauser index greater or equal to 8 (compared to Elixhauser index of less than 8), stays by patients with dual eligibility, and stays by more cognitively impaired patients (Table 4). The differences in rehospitalizations were not statistically different across these categories.

Patients under the care of NH specialists had higher total 60-day Medicare payments (\$31 628 vs \$31 292; adjusted difference, \$335; 95% CI \$242 to \$429; Table 5). When the difference in payments was subdivided into components, the higher payments for stays under NH specialists' care stemmed mainly from higher payments for the initial SNF stay (\$11 614 for NH specialists' vs \$11 048 for nonspecialists' stays; adjusted difference, \$566; 95% CI \$495 to \$637). Part B payments were slightly higher for stays under the care of NH specialists, compared to clinicians who did not specialize in NH practice (\$3653 vs \$3615, adjusted difference: \$37, 95% CI \$20 to \$55). Stays under the care of NH specialists were associated with lower Part A payments (payments to hospitals or NHs) after discharge from SNF, consistent with the findings of lower rehospitalization and higher successful discharge to community rates for this group (Table 5). Adjusting for SNF treatment intensity reduced the difference in payments for SNF stays but did not eliminate it (\$11 456 for NH specialists' vs \$11 067 for non-NH specialists' stays, adjusted difference, \$389; 95% CI \$331 to \$447) (Table 5).

TABLE 1 Characteristics of SNF stays under the care of clinicians specializing in nursing home care vs clinicians not specializing in nursing home care

	Stays under the care of clinicians special- izing in nursing home care (n = 228 814)	Stays under the care of clinicians not specializing in nursing home care (n = 1 890 127)	P-value
Patient characteristics			
Age, mean (SD)	81.7 (8.0)	82.1 (7.9)	<0.001
Race, %			
White	87.8	88.7	<0.001
Black	8.9	7.6	
Other	3.4	3.7	
Female, %	65.7	65.6	0.23
Elixhauser Index, mean (SD)	8.6 (10.2)	8.8 (10.1)	<0.001
Hospital LOS, mean (SD)	7.7 (5.6)	7.7 (5.6)	0.28
SNF LOS, mean (SD)	27.6 (18.4)	27.8 (19.5)	0.003
Any ICU stay in prior year, %	29.5	29.8	0.004
Hospital stays in prior year, mean (SD)	0.7 (1.2)	0.6 (1.1)	<0.001
Late loss ADLs, mean (SD)	8.2 (3.8)	8.1 (4.0)	<0.001
Cognitive function Scale, %			
Cognitively intact	62.5	56.5	<0.001
Mildly impaired	21.6	23.9	
Moderately impaired	13.6	16.6	
Severely impaired	2.3	3.0	
30-day rehospitalization	15.3	16.1	<0.001
Successful discharge to community	60.3	55.0	<0.001
SNF characteristics, %			
Hospital-based	5.0	7.9	<0.001
Part of a chain	57.4	57.0	<0.001
Urban location	97.5	86.7	<0.001
Region			
Northeast	27.7	25.3	<0.001
South	37.5	36.6	
Midwest	22.3	24.0	
West	12.6	14.3	
Ownership			
For-profit	72.6	68.3	<0.001
Nonprofit	25.9	28.9	
Government	1.5	2.8	
Size			
<100 beds	22.4	32.0	<0.001
100-199 beds	59.8	56.0	
≥200 beds	17.8	12.0	

After stratifying the sample into stays where the attending clinician was a physician vs an advanced practitioner, the differences between NH specialists and nonspecialists were concentrated among stays where the attending clinician was a physician (Table S3).

3.4 | Sensitivity analyses

Sensitivity analyses that included physicians of all specialties (not just generalist specialties) were generally consistent with the main

TABLE 2 Clinician practice characteristics for stays under the care of clinicians specializing vs not specializing in nursing home care^a

	Stays under the care of clinicians specializing in nursing home care (n = 228 814)	Stays under the care of clinicians not specializing in nursing home care (n = 1 890 127)
Primary specialty, %		
Internal medicine	21.2	44.6
Family medicine	8.7	24.2
General practice	0.6	1.2
Physical medicine/Rehabilitation	15.9	4.4
Geriatrics	3.0	4.7
Nurse practitioner	40.7	17.5
Physician assistant	10.0	3.5
Number of clinicians during SNF stay, mean (SD)	2.3 (1.2)	1.7 (0.9)
Number of visits by primary clinician during SNF stay, mean (SD)	5.7 (5.0)	3.9 (4.0)
Proportion of services provided by the primary clinician during the stay, mean (SD)	0.72 (0.31)	0.82 (0.27)
Number of SNFs where primary clinician saw patients in year, mean (SD)	4.0 (3.2)	4.5 (3.9)
Proportion of visits to patients in same SNF relative to all SNF visits by primary clinician in year, mean (SD)	0.69 (0.32)	0.61 (0.33)

^aP < 0.001 for all comparisons.

results (Tables 3 and 5). Using alternative thresholds to define a NH specialist, we found that the difference in rehospitalization rates between stays under the care of NH specialists and nonspecialists remained stable between the thresholds of 50 percent to 90 percent of practice that was NH-based. The largest adjusted difference of −1.62 percent lower (95% CI −2.16 to −1.08) rehospitalization rate for NH specialists was observed at the 80 percent threshold. The adjusted difference in rehospitalizations started to decrease below the 50 percent threshold for NH specialization. In contrast, the difference in successful discharge to community rates was greatest at the 80 percent threshold (adjusted difference 0.92 percent, 95 percent CI 0.68 percent to 1.15 percent) and attenuated completely below the 50 percent threshold (Table S4). The interactions between being a NH specialist and the number of facilities a clinician practiced in or the proportion of a clinician's patient panel in a NH were not statistically significant (Table S5).

4 | DISCUSSION

Among Medicare fee-for-service beneficiaries discharged to a SNF, those under the care of clinicians that specialized in NH practice had better postacute care outcomes compared to patients of clinicians that did not specialize in NH practice. The difference in rehospitalization rates represents a potential 9 percent relative reduction in readmissions. However, stays under the care of NH specialists were associated with 1 percent higher Medicare payments for the 60-day

episode of care starting with hospital admission, which stemmed primarily from the difference in payments for the initial SNF stay. Approximately a third of the difference in the SNF payments were related to treatment intensity. This may help explain the mechanism by which NH-specializing clinicians reduce readmissions—by providing higher intensity care in the SNF, for instance by providing more skilled care and higher intensity rehabilitation services.

Recent payment reforms, such as bundled payments and accountable care organizations, rely on the notion that care coordination and communication during episodes of care and between transitions in care will result in improved patient outcomes and lower costs.^{29–33} Understanding the role of the prescribing clinicians (physicians or advanced practitioners) in improving these care transitions is essential, particularly when patients transition to postacute care in the NH, which is costly and a setting in which poor outcomes such as hospital readmission are common. We found that patients under the care of physicians and advanced practitioners who concentrate their practice on NH-based care have lower rehospitalization rates but receive more intensive care during their SNF stay, resulting in slightly higher costs to Medicare. Although the majority of clinicians were generalist physicians and advanced practitioners, the findings were consistent for medical subspecialist clinicians as well. Furthermore, the findings were similar for clinicians who provided care in few vs many facilities. Together, these findings suggest that clinician specialization in this case measures aspects of practice that are transferrable across facilities such as clinical expertise in postacute care, for example.

TABLE 3 Patient rehospitalizations and successful discharge to community among patients treated by a clinician specializing in nursing home practice and those not specializing in nursing home practice

	Stays under the care of clinicians specializing in nursing home care	patients treated by clinicians not specializing in nursing home care	Difference (95% CI)
Unadjusted models: Generalist physicians and advanced practitioners			
30-day rehospitalization, %	14.47 (14.21 to 14.73)	16.24 (16.22 to 16.28)	-1.79 ^a (-2.07 to -1.48)
Discharge to community, %	57.09 (56.76 to 57.43)	55.40 (55.36 to 55.44)	1.69 ^a (1.31 to 2.08)
Adjusted models: Generalist physicians and advanced practitioners			
30-day rehospitalization, %	14.71 (14.47 to 14.94)	16.23 (16.19 to 16.25)	-1.51 ^a (-1.78 to -1.24)
Discharge to community, %	56.33 (56.16 to 56.50)	55.49 (55.46 to 55.52)	0.84 ^a (0.54 to 1.14)
Adjusted models: All clinicians, including nongeneralist physicians			
30-day rehospitalization, %	14.73 (14.49 to 14.97)	16.21 (16.19 to 16.24)	-1.49 ^a (-1.76 to -1.22)
Discharge to community, %	56.37 (56.10 to 56.64)	55.49 (55.46 to 55.52)	0.88 ^a (0.58 to 1.19)

^a $P < 0.001$.**TABLE 4** Difference in rehospitalizations and successful discharge to community between patients treated by clinicians specializing in nursing home practice and clinicians not specializing in nursing home practice, by stay and patient characteristics^b

			Difference, percentage points	95% Confidence interval
Hospitalization type	30-day rehospitalization	Medical	-1.63	-1.96 to -1.31
		Surgical	-1.43	-1.74 to -1.13
	Discharge to community ^a	Medical	1.21	0.86 to 1.56
		Surgical	0.25	-0.14 to 0.65
Dual eligibility	30-day rehospitalization	No	-1.52	-1.79 to -1.25
		Yes	-1.47	-2.04 to -0.90
	Discharge to community ^a	No	0.66	0.35 to 0.97
		Yes	2.43	1.69 to 3.18
Cognitive status	30-day rehospitalization	Intact	-1.62	-1.90 to -1.34
		Mildly impaired	-1.53	-1.99 to -1.07
		Moderately or Severely Impaired	-1.22	-1.73 to -0.71
	Discharge to community ^a	Intact	0.22	-0.11 to 0.56
		Mildly impaired	1.33	0.84 to 1.83
		Moderately or Severely Impaired	2.58	1.93 to 3.23
Elixhauser Index	30-day rehospitalization	Less than 8	-1.41	-1.73 to -1.08
		Greater or equal to 8	-1.63	-1.92 to -1.33
	Discharge to community ^a	Less than 8	0.55	0.18 to 0.91
		Greater or equal to 8	1.15	0.79 to 1.51

^aInteraction statistically significant at $P < 0.001$.^bInteractions between specialization and SNF being part of chain (vs not being part of chain), ownership type (for-profit vs not-for-profit), and size (<100, 100-199, 200+) were not statistically significant at $P < 0.01$.

Despite the importance of this area, little empirical evidence exists on how physician practice arrangements with NHs affect postacute care outcomes. Prior studies found that more formal physician practice arrangements with NHs via employment and credentialing processes were associated with lower odds of rehospitalizations.¹⁸ NH specialists may improve outcomes through closer working relationships with NH direct care staff and better expertise

in NH processes of care and quality improvement infrastructure. We tested this potential mechanism by measuring each primary clinician's practice concentration within each NH relative to overall NH practice volume. We also tested whether the association between specialization and outcomes differs between primary clinicians that treat patients in few vs many different NHs. A clinician who treats a large proportion of patients at a NH or works in fewer NHs might

TABLE 5 Medicare payments per 60-day episode of care for patients of nursing home specialists vs non-NH specialists^b

	Stays under the care of clinicians specializing in nursing home care	Stays under the care of clinicians not specializing in nursing home care	Difference (95% CI)
Generalist physicians and advanced practitioners			
Total 60-day payments, \$	31 628 (31 544 to 31 711)	31 292 (31 282 to 31 303)	335 ^a (242 to 429)
Initial hospitalization, \$	12 047 (11 999 to 12 095)	11 935 (11 930 to 11 940)	112 ^a (54 to 171)
Initial SNF stay, \$	11 614 (11 550 to 11 677)	11 048 (11 040 to 11 055)	566 ^a (495 to 637)
Rehospitalization(s), \$	3102 (3050 to 3155)	3343 (3337 to 3349)	-241 ^a (-299 to -182)
Any additional SNF stays, \$	1212 (1187 to 1237)	1352 (1349 to 1355)	-140 ^a (-167 to -113)
Professional and other services covered by Part B, \$	3653 (3637 to 3669)	3615 (3613 to 3617)	37 ^a (20 to 55)
Generalist physicians and advanced practitioners: Payments adjusted for RUG categories			
Total 60-day payments, \$	31 558 (31 479 to 31 637)	31 301 (31 292 to 31 310)	257 ^a (166 to 349)
Initial hospitalization, \$	12 043 (11 995 to 12 091)	11 935 (11 929 to 11 940)	107 ^a (49 to 165)
Initial SNF stay, \$	11 456 (11 404 to 11 507)	11 067 (11 060 to 11 073)	389 ^a (331 to 447)
Rehospitalization(s), \$	3155 (3106 to 3204)	3337 (3332 to 3342)	-181 ^a (-237 to -125)
Any additional SNF stays, \$	1245 (1222 to 1267)	1348 (1345 to 1351)	-103 ^a (-128 to -78)
Professional and other services covered by Part B, \$	3660 (3644 to 3675)	3614 (3612 to 3616)	45 ^a (28 to 63)
All clinicians, including nongeneralist physicians			
Total 60-day payments, \$	31 609 (31 525 to 31 692)	31 295 (31 285 to 31 305)	314 ^a (220 to 407)
Initial hospitalization, \$	12 035 (11 983 to 12 086)	11 936 (11 930 to 11 943)	98 ^a (40 to 156)
Initial SNF stay, \$	11 604 (11 540 to 11 668)	11 049 (11 042 to 11 057)	555 (483 to 626)
Rehospitalization(s), \$	3105 (3054 to 3156)	3342 (3336 to 3348)	-238 (-296 to -179)
Any additional SNF stays, \$	1214 (1189 to 1239)	1351 (1348 to 1354)	-138 (-165 to -111)
Professional and other services covered by Part B, \$	3652 (3636 to 3668)	3615 (3613 to 3617)	36 (19 to 54)

^aP < 0.001.^bPayments for stays that extended beyond the 60-day episode were prorated by multiplying the total payment by the fraction of length of stay that occurred during the 60-day episode. Payments for hospital and SNF stays completed within 60 days of hospital admission were included in full.

have a greater sense of “investment” in the overall clinical care in that facility compared to a clinician who treats a small proportion of his or her patients at the NH or works in many NHs. We did not observe differential effects by these measures of clinician practice concentration. However, the effect of NH specialists on outcomes was concentrated among stays where the primary clinician was a physician. Future work should evaluate whether these findings represent actual differences in care delivery or are a consequence of challenges in measuring clinician practice using billing data (eg, claims may not capture instances where physicians and advanced practitioners work in teams).

Previous calls for “NH specialists” raised concerns that concentrating NH practice among a few specialized clinicians would reduce continuity of care with primary care providers, leading to more challenging transitions to community.^{34,35} Our findings suggest the opposite effect—patients under the care of NH specialists have higher rates of successful discharge to community than patients of other clinicians. Nevertheless, we did not specifically compare the outcomes of NH specialists’ patients with

those of the patients of primary care clinicians who follow their own patients across settings including when they are admitted to the NH. In older surveys, between 23 and 55 percent of physicians reported working at NHs under open-staff models where community physicians provide care to their patients while they are admitted to the NH.^{36,37} However, more recent data suggest that fewer primary care physicians follow their patients across settings. For example, a patient’s primary care physician was the hospital attending in only 14.2 percent of admissions by Medicare beneficiaries in 2013.³⁸

The concept of a NH specialist (or “SNFist”) is not well defined aside from a focus on NH practice. Unlike hospitalists who typically work in one or two hospitals, many clinicians who specialize in NH practice see patients in several different NHs in part because of lower patient volume per facility. Furthermore, clinicians may also provide postacute care in other settings such as assisted living facilities, for example. By modeling the effect of clinician specialization in NH practice using alternative thresholds, we found that the 90 percent cutoff used for hospitalists may be too high for NH specialists.

Interestingly, we observed that the effect on hospital readmission was relatively stable for clinicians who focused at least half of their practice on NH care, whereas the effect on successful discharge to community decreased below the 80 percent threshold. Overall, our findings suggest that NH specialization threshold around 80 percent is associated with the greatest effect on the probability of hospital readmission and successful discharge to the community. Future work should explore potential mechanisms to explain these differential effects.

Another potential concern of setting-specific specialization of clinicians is that such specialists may be more reluctant to discharge patients to care outside of the facility. Approximately 10 percent of patients discharged from hospitals to postacute care in NHs become institutionalized by transitioning into long-term care.³⁹ Although our study did not evaluate long-term outcomes, patients under the care of NH specialists had higher rates of successful discharge to community compared to other clinicians' patients, somewhat alleviating these concerns. Nevertheless, the relative difference in discharge to community between stays under the care of NH specialists compared to non-NH specialists was small. Overall, a large proportion (40 percent) of patients admitted to SNFs were not successfully discharged to the community. Future studies should evaluate the barriers for discharge to community and test interventions to improve this outcome.

Unlike hospitalists, who have been associated with lower hospitalization costs,⁴⁰ stays under the care of NH specialists had slightly higher 60-day Medicare payments stemming primarily from SNF stay payments. The small statistically significant difference in the initial hospitalization payments between NH specialists' and other clinicians' stays may stem from unobserved differences in case mix. Adjusting for care intensity during the SNF stay accounted for approximately half of the differences in costs, suggesting that NH specialists may provide higher treatment intensity compared to other clinicians as a potential mechanism through which they achieve better outcomes. Consistent with this interpretation, Part B payments were higher for patients cared for by NH specialists, reflecting higher visit frequency for NH specialists compared to clinicians who did not specialize in NH practice. Consistent with readmission and discharge to community results, we observed that hospitalization and subsequent SNF payments after the initial stay were lower for NH specialists.

4.1 | Limitations

This study has a number of limitations. First, observational retrospective study design limits inferences regarding causality. For example, there may be patient selection between the two groups of clinicians, although we adjusted for observed factors and the adjustment did not appear to change the findings. Presumably, NH specialists' ability to select healthier patients would be limited by poor availability of other clinicians who maintain practice in other settings and SNF's willingness to work with clinicians who select out sicker patients. Second, there may be unobserved patient, market, and time-varying

NH characteristics that confound the relationship between outcomes and clinician specialization. In addition to a broad range of clinical variables derived from MDS that cover cognitive, functional, treatment, and other factors known to affect postacute care outcomes, we included NH fixed effects to account for heterogeneity across facilities. Third, some rehospitalizations may be appropriate and our outcomes do not capture other aspects of quality such as patient satisfaction. Future studies should explore differences in other outcomes and care processes between the two types of clinicians. Fourth, we did not have outpatient, home health, and hospice claims data, underestimating the total costs. For instance, we were unable to evaluate observation stays that did not result in a hospitalization which are included in outpatient claims. Nevertheless, these noninstitutional costs likely compose a small percentage of the total episode-of-care costs. Lastly, we did not measure office visits made outside of the NH and did not evaluate the outcomes of patients who were not seen by a NH clinician during the SNF stay (eg, prior to readmission or death).

5 | CONCLUSIONS

In summary, health systems aiming to increase value of care delivered by controlling costs while improving outcomes may consider the adoption of clinicians who focus their practice on NH patients. Our findings suggest that this may be particularly worthwhile in reducing 30-day rehospitalizations but may increase Medicare payments.

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CONFLICT OF INTEREST

Werner receives a consultancy from CarePort Health.

DISCLAIMER

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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