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Medical Staffing Organization and Quality of Care Outcomes in Post-acute Care Settings

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Abstract

Background and Objectives: Medical providers are significant drivers of care in post-acute long-term care (PALTC) settings, yet little research has examined the medical provider workforce and its role in ensuring quality of care.
Research Design and Methods: This study examined the impact of nursing home medical staffing organization (NHMSO) dimensions on the quality of care in U.S. nursing homes. The principal data source was a survey specifically designed to study medical staff organization for post-acute care. Respondents were medical directors and attending physicians providing PALTC. We linked a number of medical provider and nursing home characteristics to the Centers for Medicaid and Medicare Services Nursing Home Compare quality measures hypothesized to be sensitive to input by medical providers.
Results: From the sample of nursing home medical providers surveyed (*n* = 1,511), 560 responses were received, yielding a 37% response rate; 425 medical provider responses contained sufficient data for analysis. The results of the impact of NHMSO dimensions were mixed, with many domains not having any significance or having negative relationships between provider characteristics and quality measures. Respondents who reported having a formal process for granting privileges and nursing homes with direct employment of physicians reported significantly fewer emergency visits.
Discussion and Implications: Further research is needed regarding what quality measures are sensitive to both medical provider characteristics and NHMSO characteristics.

Keywords: Medical provider, Nursing homes, Physician, Quality measures

Workforce issues are one of the most significant challenges facing post-acute and long-term care (PALTC) settings, such as nursing homes. Much of the literature on workforce challenges in the PALTC setting centers around the gaps in knowledge, skills, and training of nurses (Keeler et al., 2019) and direct care workers (Swanson-Aprill et al., 2019), as well as nursing staff coverage (Armijo-Olivo et al., 2019). Although numerous nonphysician workforce factors affect nursing

home quality, physicians are indeed crucial members of nursing home care teams. However, this is complicated by the fact that many primary care physicians graduate and enter practice lacking sufficient training in PALTC or geriatric medicine. In a survey of graduating medical residents, fewer than 13% of internal medicine residents and only 27% of family medicine residents felt "very prepared" to deliver nursing home care (Blumenthal et al., 2001, p. 1029, 1030).

The barriers to an expansive medical provider workforce in PALTC are numerous. They include regulations, extensive paperwork, and high legal risk (Caprio et al., 2009). In addition, there is underappreciation within facilities of the linkages between medical director care and quality outcomes (Katz, Karuza, Intrator, & Mor, 2009). Questions remain as to how nursing homes can best optimize their medical providers, and how each type of provider (e.g., physician, nurse practitioner) contributes to optimal resident outcomes (Barker et al., 2018).

While facility characteristics such as bed size, ownership, chain membership, and payment status (e.g., Medicaid) are part of the quality of care equation, the role of medical providers and medical staffing organization in a facility is less understood. Despite the fact that a resident is required by federal regulations to have a medical provider visit them regularly (e.g., every 60 days), medical providers' presence in this setting is often limited and described as "missing in action" (Shield et al., 2005, p. 1652, 1653). Existing research finds that the utilization of medical providers who have a high degree of engagement in this setting (e.g., specialization in a nursing home panel) will experience lower likelihood of rehospitalization and higher likelihood of discharge to the community (Ryskina et al., 2019).

In addition to the characteristics and engagement of individual medical providers, their relationships with each other and the nursing home—that is, their organization—could also affect the quality of care. Medical staffing organization is a theoretically derived concept that includes the necessary ingredients for high-quality medical provider practice in nursing homes. A conceptual framework linking nursing home physician practice to quality identified three critical dimensions: commitment, a physician's nursing home practice competencies, and the organizational structure (Katz, Karuza, Intrator, Zinn, et al., 2009), and there is preliminary evidence lending credence to the conceptual model (Kuo et al., 2013). In order to determine the relationship between physician provider practice and the quality of care in PALTC settings, the Nursing Home Medical Staff Organization (NHMSO) scale was developed and psychometrically tested (Katz, Karuza, Intrator, Zinn, et al., 2009).

The conceptual link between PALTC medical staff organization and clinical outcomes stems directly from the work of Roemer and Friedman and Shortell on physician practice in the hospital setting (Roemer & Friedman, 1971; Shortell et al., 1976; Shortell & LoGerfo, 1981). A theoretical link between physician practice and quality in the NH was first posited in Katz, Karuza, Intrator, and Mor (2009), and nursing home medical staff organizational structure and on-site physician availability have been shown to be an independent marker of quality (Katz et al., 2011; Young et al., 2011). Using the NHMSO scale, researchers found that two of nine quality measures (pneumococcal vaccination rates and restraint use) were significantly correlated with medical staff organization. This was a small study (*n* = 202 participants), and further research with larger samples is necessary to examine the relationships among the NHMSO domains and their contributions to nursing home quality measures.

Given the advances in PALTC provider care over the past decade with increases in the number of medical providers who both specialize in PALTC practice (Teno et al., 2017) and exclusively follow residents in nursing homes (Ryskina et al., 2017), we aimed to explore the relationship between medical staffing organization and nursing home quality measures. Specifically, our hypothesis was that there is a higher quality of care in nursing homes where the medical staff reported greater provider commitment, collaborative organizational structure, and positive interpersonal relationships.

Method

Procedure

The study received ethics approval from the University of California, San Francisco Institutional Review Board. Using a cross-sectional, descriptive design, data were collected from a survey of medical providers (medial directors and physicians) who provide care in PALTC settings. The NHMSO survey was used to explore medical provider commitment (e.g., physician attends care plan meeting), nursing home practice (e.g., physician practice style), organizational structure (e.g., decisions are made by consensus), and interpersonal relationships between the physician and other staff (e.g., staff nurses), as well as demographic information (Katz, Karuza, Intrator, Zinn, et al., 2009). The survey distribution list was derived from a list provided by a professional organization representing medical providers in geriatrics (AMDA—The Society for Post-Acute and Long-Term Care Medicine).

Based on pilot data from Katz and colleagues (Katz, Karuza, Intrator, Zinn, et al., 2009; Katz et al., 2011), it was determined that at least 200 respondents would yield a sample size that would permit the detection of a moderately sized significant R^2 of .12 with $p < .05$ powered at least .80. Dillman's method (Dillman et al., 2009) was used in follow-up for both mail and online surveys. The survey was initially deployed online in June 2018. A second round of surveys was deployed in June 2019 in both paper and online formats; those in the sample whose email address was unknown only received a paper survey, and vice versa for those whose mailing address was unknown. A third and final batch of surveys was deployed in November 2019 in online format only.

Respondents were asked to provide the name and address of their primary facility at the end of the survey, which was used to identify the facility's Federal Provider Number (FPN) on the Centers for Medicaid and Medicare (CMS) Nursing Home Compare website (https://data.medicare.gov/data/nursing-home-compare). The Nursing Home Compare website was developed by CMS to allow people to find and compare nursing homes certified by CMS,

and provides data about quality of resident care, staffing patterns, health and safety inspection results, and health/clinical outcomes. Responses were eligible for analysis if they could be linked to an FPN. In cases where respondents completed the survey multiple times, their most recent survey response was used for analysis. In cases where multiple respondents completed the survey for the same facility, the medical director's response was used for analysis.

Measures

A number of measures from the NHMSO survey and Nursing Home Compare data were used in the analysis.

Nursing Home Medical Staff Organization

Thirty-one items on the validated survey were statements that measured the character of medical staff organization in nursing homes and included the following dimensions: composition of staff; appointment process; commitment; departmentalization (e.g., physician supervision, autonomy, and interdisciplinary involvement); documentation; and interpersonal relationships (Katz, Karuza, Intrator, Zinn, et al., 2009). There are 25 items in the NHMSO instrument, most of which are measured on a 5-point Likert scale (1 = strongly disagree/poor to 5 = strongly agree/excellent), with a higher score indicating higher-quality medical staff organization.

Prior research has demonstrated that the NHMSO items can be grouped into six domains: (a) composition of staff, (b) appointment process, (c) commitment, (d) departmentalization, (e) documentation, and (f) informal dynamics (interpersonal relationships). The commitment domain has two subscales: physician cohesion and leadership turnover/capability. The departmentalization domain has three subscales: physician supervision, physician autonomy, and physician interdisciplinary involvement.

Nursing home structural and staffing characteristics

Nursing home structural and staffing characteristics were obtained from Nursing Home Compare's "Provider Information" data set. Measures included (a) ownership type, (b) number of certified beds, (c) nursing staff case-mix, and (d) nursing staff hours per resident per day.

Health/clinical outcome indicators

The health/clinical outcome indicator variables were annualized, risk-adjusted quality measures that were obtained from Nursing Home Compare's Quality Measures, Quality Measures Claims, and Skilled Nursing Facility Quality Reporting Program—Provider Data (SNFQRP) data sets. CMS collects these data on a quarterly basis from facilities, and the four most recent quarters' measures are averaged to calculate an annual measure (with the exception of the variables sourced from the SNFQRP data set, which represent a 2-year or eight-quarter average). We utilized the most recent annual measures that fell within the survey administration period (June 2018 to December 2019; in other words, Quarter 2 of 2018 to Quarter 4 of 2019) that were publicly available when we completed our analyses (March to April 2020).

Therefore, the health/clinical outcomes data are presented on a "rolling basis," in the sense that not all annual measures represent the same four quarters.

We focused the analysis on the quality measures believed most likely to be affected by physician practice patterns. These quality measures are continuous variables, most of which represent the percentage of residents at each facility experiencing such health outcomes. For both short- and long-stay resident measures, these were pneumococcal vaccination, pressure ulcers, antipsychotic medication, and influenza vaccination. For short-stay residents only, these included rehospitalization after a PALTC admission, having an outpatient emergency department visit, and returning home from a skilled nursing facility (risk-standardized discharge to community rate). For long-stay residents only, these included having one or more falls with major injury, antianxiety or hypnotic medication, urinary catheterization, number of hospitalizations per 1,000 long-stay resident days, and number of emergency department visits per 1,000 long-stay resident days. Details about the risk adjustment for these quality measures are included in the notes for Tables 4 and 5.

Statistical Analysis Methods

We began the analysis by comparing the nursing homes in our dataset with all nursing homes in the Nursing Home Compare data set. We next examined the descriptive statistics for the items in the NHMSO survey and reliability analyses (Cronbach's alpha) were also performed.

Finally, we estimated a series of hierarchical multiple regressions in which the dependent variables were nursing home quality measures and the independent variables measured nursing home facility structural characteristics and medical staff organization dimensions; there were 17 predictors in total. Three quality measures contained less than 30 events, and therefore were not analyzed due to lack of available data (number of hospitalizations per 1,000 long-stay resident days; number of outpatient emergency department visits per 1,000 long-stay resident days; long-stay residents who were physically restrained).

The outcome variables were tested for normal distributions; outcomes with normal distributions were included in a linear regression model as continuous variables, while outcomes with nonnormal distributions were categorized based on their median and included in a logistic regression model as categorical variables (see the notes for Supplementary Tables 1 and 2 for a more detailed description of this). Continuous level predictor variables were also tested for normal distributions; variables with normal distributions were included in the models as continuous variables (e.g., detail of by-laws for granting physician

practice privileges, formality of process of evaluating physician performance, extent of closed staff model in the facility), while variables with nonnormal distributions were categorized based on their median and included in the models as categorical variables (e.g., number of attending physicians, physician cohesion, physician supervision, physician autonomy, physician interdisciplinary involvement, informal dynamics, leadership turnover, number of certified beds, case-mix, and adjusted total nurse staffing). Categorical level predictor variables were also included (e.g., facility ownership, do physician extenders see residents). Correlation coefficients were also calculated for each pair of predictor variables to ensure there was no multicollinearity between variables. The estimate and standard error for each level of predictor variable were reported from the regression models. *p*-Values for each predictor variable were also reported to indicate whether each variable was significantly associated with the outcome or not; significance was defined at an alpha level of <.05. All analyses were conducted using SAS 9.4.

Results

Response Rate

The survey was deployed to 1,528 people. Eighteen people were deemed ineligible based on their employment situation;

common reasons for ineligibility included retirement, no longer practicing in PALTC, or not being a physician. A total of 566 eligible responses was received, yielding a 37% response rate, with 425 responses containing sufficient data for analysis and were matched to Nursing Home Compare data.

Findings

Among the 425 responding physicians (medical directors or attending physicians), two-thirds were male and spent an average of 20.4 years in nursing home practice with an average of 10.5 years in their current tenure as medical director. Nearly half of respondents were academically affiliated, with 46.8% reporting holding an academic appointment. The mean number of nursing home residents each physician cared for was 84.5. A comparison of demographics and facility characteristics collected both from our survey and the 2019 AMDA Membership Survey are presented in Table 1. As shown in Table 1, a greater share of respondents to our survey were the medical director at their current facility (83.53% vs 53.55%); the same was true regarding the share who were AMDA-certified medical directors (CMDs) (57.88% vs 38.43%).

Additional facility characteristics are presented in Table 2. Almost 60% of the 425 facilities were for-profit,

Table 1. Comparison of Sample Characteristics With 2019 AMDA Membership Survey

Characteristic	Study sample (*n* = 425)				AMDA 2019 Membership Survey (*n* = 549)			
	N	%	Mean	SD	N	%	Mean	SD
Gender								
Male	281	66.12	—	—	303	55.19	—	—
Female	143	33.65	—	—	246	44.81	—	—
Facility has a formal credentialing process for practitioners	217	51.06	—	—	153	27.87	—	—
Are the medical director at facility	355	83.53	—	—	294	53.55	—	—
Years serving as medical director (any facility)			14.89	11.22			—	—
<5	119	28.00	—	—	45	8.20	—	—
6–10	71	16.71	—	—	54	9.84	—	—
11–15	56	13.18	—	—	44	8.01	—	—
16–20	48	11.29	—	—	44	8.01	—	—
21–25	40	9.41	—	—	40	7.29	—	—
≥26	83	19.53	—	—	61	11.11	—	—
FTE medical director status							—	—
Part-time	242	68.17	—	—	213	38.80	—	—
Full-time	104	29.30	—	—	75	13.66	—	—
Are an AMDA-certified CMD	246	57.88	—	—	211	38.43	—	—
Number of attending physicians at their facility			4.84	3.45			—	—
<5	289	68.00	—	—	226	41.17	—	—
6–10	103	24.24	—	—	44	8.01	—	—
11–15	17	4.00	—	—	12	2.19	—	—
16–20	6	1.41	—	—	3	0.55	—	—
21–25	0	0.00	—	—	1	0.18	—	—
≥26	0	0.00	—	—	1	0.18	—	—

Note: AMDA = American Medical Directors Association; CMD = certified medical director; FTE = full-time equivalent.

Table 2. Comparison of Sample Characteristics to All States NHC 2019 and 2020 Data

Characteristic	Study sample (*n* = 425)				NHC 2019 and 2020 (*n* = 15,020)			
	N	%	Mean	SD	N	%	Mean	SD
For-profit facility	249	58.59			10,574	70.40		
Not-for-profit facility	138	32.47			3,480	23.17		
Government-owned facility	38	8.94			966	6.43		
Number of beds			134.30	87.81			105.47	59.61
RN hours[a]			0.75	0.52			0.69	0.52
LPN hours[a]			0.88	0.38			0.87	0.36
CNA hours[a]			2.49	0.55			2.3	0.55
RN + LPN hours[a]			1.63	0.56			1.55	0.6
Case-mix total nurse staffing[a]			3.22	0.27			3.21	0.31

Notes: CNA = certified nursing assistant; FTE = full-time equivalent; LPN = licensed practical nurse; NHC = Nursing Home Compare; RN = registered nurse.
[a]Per resident day.

32.5% were not-for-profit, and 8.9% government-owned. Thus, our sample underrepresents for-profit facilities (70.4% nationwide) and overrepresents not-for-profit (23.2% nationwide) and government-owned (6.4% nationwide) nursing homes. Nurse staffing characteristics of participating homes were similar to national averages.

Table 3 contains the descriptive statistics and Cronbach's alpha reliabilities to measure the internal consistency for each of the scales used to define the major dimensions of the NHMSO. Table 3 also presents the descriptive data for each item on the NHMSO survey. As noted, there are no ceiling or floor effects with the responses and the standard deviations indicate acceptable variance on the items. Cronbach's alphas ranged from .41 (physician autonomy) to .75 (interpersonal relationships), providing the evidence for the reliability of scales.

Multivariate Analyses

A series of multiple regressions were performed with the quality measures as the dependent variables. Results from these analyses are summarized in Table 4 for long-stay measures and Table 5 for short-stay measures. The tables present only the coefficients of variables that were statistically significant for at least one quality outcome (see Supplementary Material for extended data output). The structural characteristics of number of beds, ownership, and case-mix were statistically significantly associated with at least one quality measure, and nurse staffing was significantly associated with three of six long-stay measures and three of five short-stay measures. Specific to the domains of the NHMSO were also significantly associated with least one of the quality measures.

Long-stay significant quality measures
Among long-stay residents, facilities with a formal process of granting physician privileges reported smaller percentages of patients who received an influenza vaccine or a pneumococcal vaccine, and a larger percentage of patients with a pressure ulcer. The informal dynamics composite score, which was a categorical variable, was significantly associated with a higher share of residents having one or more injurious falls; facilities with an informal dynamics composite score less than or equal to 4.25 reported lower numbers of falls with major injury. A higher score for physician autonomy was significantly associated with a lower percentage of patients receiving an influenza vaccine. In long-term stay patients, with those who scored lower on the physician autonomy score reporting fewer percentage of patients who received the vaccine. Facilities for which the NHMSO respondent was an attending physician had a larger percentage of residents who received antipsychotic medications compared to facilities for whom the respondent was the medical director.

Short-stay significant quality measures
Nursing homes in which respondents reported that there were detailed by-laws had significantly higher rates of pressure ulcers, and also higher percentages of residents who had received an influenza vaccine. Respondents who reported having a formal process for granting privileges had significantly fewer emergency visits and significantly higher rates of pneumococcal vaccine receipt. Similarly nursing homes for which the respondent indicated that providers were employed directly had significantly lower emergency department visits. In facilities where physician extenders (i.e., physician assistants/nurse practitioners) saw residents, there was a significantly higher rate of risk-standardized discharge. This also was the case for facilities in which the physician supervision score was higher.

Discussion

This research sought to examine the importance of medical providers in nursing homes, in order to guide efforts to enhance the quality of care for residents in PALTC settings. Our findings indicate a number of important,

Table 3. Descriptive Statistics and Reliability Analysis (*n* = 425)

Dimension	Mean	SD	α (standardized)
1. Composition of staff			
How many attendings provide care	4.84	3.45	
Residents seen by nurse practitioner or physician assistant	88.47%		
Residents cared for by medical director or directly employed by the nursing home	58.92%		
2. Appointment process			
Formal process for granting attending privileges	51.06%		
Does nursing home have a written contract with physicians?	29.88%		
Does the nursing home employ physicians directly?	22.12%		
Detail of by-laws	2.23	1.10	
3. Commitment (a)			
Physician cohesion	**3.78**	**0.63**	**.67**
Collegial relationships among the physicians	3.89	0.89	
Decision-making process is consensus building	3.69	0.93	
Great deal of organizational loyalty	3.79	0.88	
Identifiable practice style which we all try to adhere	3.8	0.86	
Leadership turnover/capability	**2.53**	**1.27**	**.66**
Administrator turnover in the past 5 years	2.34	1.32	
Director of nursing turnover in the past 5 years	2.71	1.61	
4. Departmentalization (a)			
Physician supervision	**3.48**	**0.85**	**.57**
Leadership style as involves checking up on physician	3.31	1.17	
Quality of each physician's work is monitored closely	3.64	0.87	
Physician autonomy	**4.03**	**0.74**	**.41**
Leadership style allows the attending physician greater freedom to act independently	4.04	1.08	
Emphasis on physician individuality	4.02	0.78	
Physician interdisciplinary involvement	**3.44**	**0.82**	**.60**
Physician is primary nursing home representative for families	3.58	0.96	
Physicians are expected to attend care plan meetings	3.14	1.27	
Physicians are expected to assume the leadership role in team meetings	3.57	1.05	
5. Documentation			
Formal review process to evaluate physicians	27.06%		
6. Informal dynamics (interpersonal relationships)[a]	**4.04**	**0.82**	**.75**
Quality of your relationship between medical director and administrator	4.15	1.06	
Quality of your relationship between medical director and the director of nursing	4.27	0.99	
Relationship between physicians and licensed nurses	4.13	0.87	
Medical staff gets no respect in the nursing facility[b]	3.6	1.47	

Note: Bold: not reported in a reliabilty analysis. [a]On the survey, respondents were asked to rate on a 5-point Likert scale the degree to which they agreed with the statements under this domain being representative of their facility's work culture (1 = strongly disagree, 5 = strongly agree). [b]Because of its negative phrasing, this statement was reverse-coded because it was part of the informal dynamics composite score. A score of 3.6 here indicates that, on average, respondents were neutral or disagreed with this statement.

albeit mixed, conclusions that provide insight into the role that medical providers play and how sensitive their input is in ensuring quality of care. The most notable result was that direct employment of physicians by facilities was associated with significantly fewer emergency department visits. Of all of the outcome measures, emergency department visits may be most under the control of the medical provider. There is a growing body of research on the role that medical providers play in preventing emergency room transfers, finding that a large amount of transfers are avoidable with provider involvement (Ouslander et al., 2016; Trahan et al., 2016). Additional research reports that when physicians are directly assigned to a nursing home, there is a lower

monthly probability of a preventable hospitalization (Weatherall et al., 2019). Physicians who have their primary care setting in PALTC also may have a greater sense of "investment" in the overall clinical care in a facility compared to providers who have a small panel of residents or who spread themselves out across a number of settings (Ryskina et al., 2019, p. 571).

The limited association between medical staff organization characteristics and other quality outcomes is not surprising. The majority of quality measures are not specific to medical providers, which has led to the development of more discipline-specific measures of quality (Mays et al., 2018). The roles of nursing home staff—such as licensed nurses and certified nursing assistants—may be more

Table 4. Multiple Regression Analyses of Long-Stay Residents Outcome Measures

Predictor variables[a]	Catheterization (≤1%)[b,c]	One or more falls with major injury (≤3%)[c]	Pressure ulcers	Antipsychotic medication	Influenza vaccine	Pneumococcal vaccine
Role						
Attending physicians	−4.0 (248.81)	−4.2 (280.55)	−3.7 (4.19)	7.9 (5.41)**	1.3 (4.64)	−6.8 (7.69)
Medical directors	−4.1 (248.81)	−1.6 (280.55)	−1.9 (3.91)	0.2 (1.38)	0.3 (4.33)	−6.0 (7.17)
Adjusted total nurse staffing hours per resident day (≤3.75)	−0.3 (0.36)	−0.4 (0.74)	2.4 (1.07)*	0.2 (1.38)	−3.9 (1.16)**	−4.9 (1.96)*
Number of beds (≤120)	0.8 (0.34)*	−1.7 (0.69)*	−0.2 (0.95)	0.0 (1.23)	−1.1 (1.05)	−0.8 (1.75)
Ownership	*					
For-profit	0.7 (0.48)	1.1 (0.63)	0.9 (1.04)	−0.6 (1.35)	0.0 (1.15)	1.1 (1.91)
Government	−1.6 (0.64)	0.1 (0.69)	−.06 (1.41)	0.3 (1.82)	1.8 (1.55)	−0.4 (2.59)
Formal process for granting privileges	−0.4 (0.39)	−0.4 (0.39)	3.6 (1.12)**	0.6 (1.44)	−3.2 (1.24)*	−4.4 (2.05)*
Informal dynamics (≤4.25)	−0.2 (0.34)	1.9 (0.68)**	−1.9 (0.95)	−0.1 (1.23)	0.2 (1.05)	0.3 (1.75)
Physician autonomy (≤4)	0.1 (0.32)	0.1 (0.32)	1.8 (0.92)	1.6 (1.20)	−2.8 (1.02)**	−3.4 (1.70)

Notes: Coefficient estimate (*SE*). Outcome variables examined for long-stay residents include the percentage who were physically restrained, had pressure ulcers (high-risk residents), had one or more falls with major injury, received an antipsychotic medication, received an antianxiety or hypnotic medication, catheterized, received the influenza vaccine, received the pneumococcal vaccine; as well as the number of hospitalizations per 1,000 long-stay resident days and number of emergency department visits per 1,000 long-stay resident days. Only the outcome variables found to have statistically significant relationships with any of the predictor variables are included in this table. Please refer to Supplementary Table 1 for the results of the statistical analyses for all long-stay outcome variables.
[a]Predictor variables examined include role, total number of attending physicians in the facility, whether the nursing home has a written contract with a group of physicians, whether the facility has a formal process for granting attending privileges, how detailed are the by-laws for granting physician practice privileges, how formal is the process of reevaluating physician performance, do physician extenders see residents, the extent of the closed staff model (percentage of residents whose attending provider is not a community-based practitioner), whether the nursing home employs physicians directly, physician cohesion, physician supervision, physician autonomy, physician interdisciplinary involvement, informal dynamics, and leadership turnover. Only predictor variables found to have statistically significant relationships with outcome variables are included in this table. [b]The outcome variable measures used in these regressions were risk-adjusted. Except for the share of long-stay residents who were catheterized, all outcome measures examined for long-stay residents were adjusted to reflect the facility-level observed quality measure score; in other words, the prevalence of the outcome across all residents in a nursing facility excluding residents whose outcomes are outside nursing facility control (e.g., the outcome is evidenced on admission to the facility) or cases in which the outcome is unavoidable (e.g., the resident is comatose). The risk-adjusted share of long-stay residents who were catheterized was calculated using logistic regression employing resident-level covariates that are found to increase the risks of that outcome (frequent bowel incontinence on prior assessment and pressure ulcers at stages II–IV). [c]All outcome variables were tested for normal distributions. These variables had nonnormal distributions, and were therefore categorized based on their median and included in the logistic regression model as categorical variables.
*Statistically significant at the $p < .05$ level. **Statistically significant at the $p < .01$ level.

important in determining the quality outcomes included in this study (Castle & Ferguson, 2010). Relationships between medical and nursing staff also may have significant impacts on nursing home residents' care. Most recently, the NHMSO was modified and tested among a sample of Directors of Nursing (DON) perceptions regarding physician roles in nursing home care. In this study, DONs reported close collegial relationships with their medical director colleagues, especially related to quality improvement activities; however, medical director involvement in staff training and resident admissions was considered sub optimal. Medical providers often do not have a full understanding of the federal regulations and policies governing PALTC settings and therefore are not optimally involved (Wagner et al., 2019). This may include their understanding of publicly reported quality measures and how their role as a primary care provider or medical director can play in ensuring that residents are vaccinated, receive limited antipsychotics, and have pressure ulcer prevention processes. The need for a competent provider workforce led AMDA to develop competencies for medical providers in PALTC (Katz et al., 2014).

Our respondents were well seasoned to provide and oversee PALTC care, with an average of over 20 years of experience providing care in this setting and an average of 10 years as medical director. Our respondents were also affiliated with a national association focused on medical care in PALTC, 44 % were board certified in geriatrics, and 58 % were a CMD. While specialization of providers is increasing nationally, there are still regional variations in the rate of adoption (Ryskina et al., 2017). Testing this survey among a group of new-to-PALTC medical providers and medical directors would help to illuminate their perceptions of the training and mentoring they have received and their perceptions of the NHMSO dimensions.

Limitations

There are a number of limitations to our study. The survey respondents included in this analysis (*n* = 425) represent a small portion of PALTC settings in the United States. Similar to an earlier publication (Katz et al., 2011), the inconsistent relationships between the NHMSO domains and the quality measure outcomes could be due to a

Table 5. Multiple Regression Analyses of Short-Stay Residents' Outcome Measures

Predictor variables[a]	Outpatient ED visits[b]	Return home: risk standardized discharge to community[b]	Pressure ulcers[c]	Influenza vaccine[b]	Pneumococcal vaccine[b]
Adjusted total nurse staffing hours per resident day (≤3.75)	–3.0 (1.18)*	–0.3 (0.39)	–0.6 (0.44)	3.0 (0.83)**	2.6 (0.77)**
Case-mix (≤3.2)	–0.2 (1.08)	–1.2 (0.34)**	–1.0 (0.47)*	0.6 (0.41)	0.1 (0.39)
Detailed by-laws (1 = not at all, 5 = very detailed)	–0.1 (0.58)	0.3 (0.18)	0.8 (0.38)*	0.9 (0.38)*	0.5 (0.35)
Formal process for granting privileges	–2.9 (1.3)*	0.3 (0.41)	–0.2 (0.43)	0.8 (0.50)	1.1 (0.52)*
Nursing home employs physicians directly	–2.5 (1.13)*	–0.1 (0.37)	–0.8 (0.43)	0.0 (0.40)	–0.3 (0.37)
Physician autonomy (≤4)	–1.1 (1.10)	–0.3 (0.36)	–0.2 (0.37)	0.9 (0.44)*	0.9 (0.42)*
Physician extenders see residents	0.3 (3.29)	2.1 (0.85)*	0.5 (0.91)	1.6 (1.01)	–0.3 (0.73)
Physician supervision (≤3.5)	1.2 (1.19)	1.1 (0.38)**	0.2 (0.41)	0.2 (0.42)	0.6 (0.39)

Notes: Coefficient estimate (*SE*). Outcome variables examined for short-stay residents include the percentage at each facility who had new or worsened pressure ulcers, received the pneumococcal vaccine, received the influenza vaccine, who newly received an antipsychotic medication, were rehospitalized after a nursing home admission, had an outpatient emergency department visit, and returned home after a stay in the facility. Only the outcome variables found to have statistically significant relationships with any of the predictor variables are included in this table. Please refer to Supplementary Table 2 for the results of the statistical analyses for all short-stay outcome variables.

[a]Predictor variables examined include role, total number of attending physicians in the facility, whether the nursing home has a written contract with a group of physicians, whether the facility has a formal process for granting attending privileges, how detailed are the by-laws for granting physician practice privileges, how formal is the process of reevaluating physician performance, do physician extenders see residents, the extent of the closed staff model (percentage of residents whose attending provider is not a community-based practitioner), whether the nursing home employs physicians directly, physician cohesion, physician supervision, physician autonomy, physician interdisciplinary involvement, informal dynamics, and leadership turnover. Only predictor variables found to have statistically significant relationships with outcome variables are included in this table. [b]All outcome variables were tested for normal distributions. These variables had nonnormal distributions and were therefore categorized based on their median and included in the logistic regression model as categorical variables. [c]The outcome variable measures used in these regressions were risk-adjusted. Except for the share of short-stay residents who had new or worsened pressure ulcers, all outcome measures examined for short-stay residents were adjusted to reflect the facility-level observed quality measure score; in other words, the prevalence of the outcome across all residents in a nursing facility excluding residents whose outcomes are outside nursing facility control (e.g., the outcome is evidenced on admission to the facility) or cases in which the outcome is unavoidable (e.g., the resident is comatose). The risk-adjusted share of short-stay residents who had new or worsened pressure ulcers was calculated using logistic regression employing resident-level covariates that are found to increase the risks of that outcome (requiring limited or more assistance in bed mobility, bowel incontinence, having diabetes or peripheral vascular disease or peripheral arterial disease, and low body mass index based on height and weight).

*Statistically significant at the $p < .05$ level. **Statistically significant at the $p < .01$ level.

small sample size and skewed responses. Furthermore, the respondents were members of a professional organization, thereby introducing sampling bias into our results because the providers may be a more highly motivated group to respond and also may be providing medical care in higher-quality facilities. This could reduce the variation within our data, thus limiting our ability to identify relationships between the NHMSO characteristics and differences in quality. We only included skilled nursing facilities in this analysis. Following the IMPACT Act of 2014, recommendations to explore medical provider-sensitive quality measures across all PALTC settings would better allow for comparisons using a standardized approach on the impacts of care transitions given medical provider presences varies across the various PALTC sites (Centers for Medicare & Medicaid Services, 2018).

Further psychometric testing of the NHMSO is necessary to determine acceptable internal consistency reliability since several of the domain scores were lower than at the acceptable range. In addition, expanding and testing this survey to be valid and reliable for other providers, such as physician assistants and nurse practitioners, is equally important given the emerging and expanding role these providers play in providing medical care in PALTC settings (Himmerick et al., 2017).

Our statistical model excluded holding specialty certification in geriatrics and being an AMDA-CMD as predictor variables. These variables were excluded for parsimony. This decision was also informed by the fact that many physicians who hold geriatric certifications do not have formal fellowship training in geriatrics. For instance, only 44% of respondents to a 2005 survey of directors of geriatric academic programs reported completing formal geriatric medicine fellowship training and earning board certification (Warshaw et al., 2007).

Moreover, many of our statistical comparisons increased our risk for Type 1 errors and several of our positive associations contradict existing literature. Given the exploratory nature of our analysis, further research would need to adjust for multiple comparisons and large sample sizes.

Continued research is needed to fully explore the role of medical staff and directors in enhancing the quality

in PALTC settings. Medical staff play an essential role in reducing rates of high-morbidity, high-cost outcomes such as emergency department visits, and medical staff organization aspects are associated with other quality outcomes. Ultimately, by specifying the quality measures that are truly sensitive to medical provider input, targeted approaches can be implemented to achieve better resident outcomes.

Supplementary Material

Supplementary data are available at *The Gerontologist* online.

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Conflict of Interest

None declared.

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