



Published in final edited form as:

J Am Geriatr Soc. 2010 December ; 58(12): 2401–2406. doi:10.1111/j.1532-5415.2010.03162.x.

Effects of Nursing Practice Environments on Quality Outcomes in Nursing Homes

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Abstract

The objective of this study was to determine whether nurse staffing levels and modifiable characteristics of the nursing practice environment are associated with important quality indicators represented by the percentage of residents with pressure ulcers and numbers of deficiency citations in nursing homes. A cross-sectional design linked nurse survey data, aggregated to the facility level, with Nursing Home Compare, a publicly available federal database containing nursing home-level measures of quality. The facility sample consisted of 63 Medicare- and Medicaid-certified nursing homes in New Jersey, and the nurse survey sample comprised 340 registered nurses providing direct resident care. Characteristics of the practice environment were measured using the Practice Environment Scale of the Nursing Work Index, included in the nurse survey. The total number of deficiency citations, the percentage of residents with pressure ulcers, nurse staffing levels, and facility characteristics were extracted from the Nursing Home Compare database. Results indicated that a supportive practice environment was inversely associated with the percentage of residents with pressure ulcers and fully mediated the effect of profit status on this important outcome. The nursing practice environment and facility size explained 25% of the variance in quality deficiencies. There were no associations between staffing levels and quality indicators. Findings indicate that administrative initiatives to create environments that support nursing practice may hold promise for improving quality indicators in nursing homes.

Keywords

nursing homes; nursing practice environment; quality

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Author Contributions: Dr. Flynn, principal investigator and lead author, developed the research questions investigated in this reported study, acquired the analyzed datasets, guided and participated in data analysis and interpretation, and assumed the majority of the manuscript preparation. Dr. Liang, senior biostatistician, assumed the lead on the data analysis and significantly participated in manuscript preparation. Dr. Dickson, co-investigator, was significantly involved in the collection of the nurse survey data, directed the publicity and follow-up that contributed to a high response rate, and significantly participated in the preparation of the manuscript. Dr. L. Aiken, principal investigator of the multistate research collaborative of which this study was a part, was directly responsible for the design of the survey and survey methodology used in this study, actively participated in the interpretation of results, and significantly contributed to the development of this manuscript.

Conflict of Interest: The authors of this manuscript affirm that there are no financial, personal, or potential conflicts of interest as related to the sponsoring agent, methodology, or findings described in the submitted manuscript.

Despite greater regulatory scrutiny, the quality of care in many U.S. nursing homes remains less than optimal.¹ Most notably, the presence of pressure ulcers among residents, considered an important indicator of the quality of nursing home care, has increased over recent years, and now more than 11% of all nursing home residents nationwide have pressure ulcers.² This trend is disconcerting because pressure ulcers are a costly adverse patient event, frequently resulting in pain,³ septicemia,⁴ poor quality of life,⁵ the need for special skin or wound care, hospitalizations, and increases in healthcare expenditures.⁶

Another measure of nursing home quality in the United States that gives rise to concern is the number of deficiency citations issued during federally mandated nursing home inspections. Because deficiency citations are issued for non-compliance with federal quality standards, they are regarded as a reliable overall indicator of nursing home quality,⁷ yet many nursing homes continue to cycle in and out of deficiency status rather than implementing initiatives that result in sustained adherence to mandated levels of quality care.⁸

In an effort to inform initiatives to improve these quality-related outcomes, previous studies have investigated the effects of facility characteristics such as staffing levels, profit status, facility size, and occupancy rates on the prevalence of pressure ulcers and deficiency citations in nursing homes,^{9,10} but these studies focused on structural predictors that are not easily modifiable.

Over the last 2 decades, a body of empirical literature has developed indicating that modifiable characteristics of the work environments in which nurses practice have a significant effect on quality indicators and patient outcomes. Therefore, the purpose of this study was to determine the effects of work environment traits on the prevalence of pressure ulcers and deficiency citations in nursing homes.

BACKGROUND AND SIGNIFICANCE

The Nursing Organization and Outcomes Model¹¹ defines a supportive nursing practice environment as the presence of a core set of modifiable organizational traits that support professional nursing practice. The model posits that these core supportive organizational traits include opportunities for staff nurses to participate in organizational decisions, a supportive manager, collaborative nurse–physician relationships, a focus on quality care, and adequate resources. It has been proposed that the presence of these characteristics, influenced in large part by managerial practices, enhances the quality of nursing care processes and results in superior patient outcomes. It has also been proposed that an adequate level of nurse staffing facilitates nurses' surveillance, likewise improving patient outcomes. The model proposes that the practice environment serves as an operant mechanism, or mediator, by which facility characteristics such as size, ownership, and staffing influence the quality and outcomes of care.

A number of nursing home studies support the effects of dimensions of the practice environment, such as staff nurse participation in decision-making, supportive nursing leadership, teamwork, quality improvement initiatives, and higher levels of staffing resources, on a variety of superior resident outcomes.^{12–17} Therefore, this study investigated the relationships between facility characteristics, attributes of the nursing practice environment, and occurrences of pressure ulcers and deficiency citations in a sample of U.S. Medicare-and Medicaid-certified nursing homes in New Jersey.

METHODS

The Institutional Review Board of Rutgers University approved this study before data collection. Using a cross-sectional design, the study linked New Jersey nurse survey data collected in 2006 and aggregated to the nursing home level with secondary data from Nursing Home Compare (NHC), a publicly available national database containing nursing home-level measures from the Online Survey Certification and Reporting (OSCAR) database and the Minimum Data Set (MDS). State survey and certification agencies collect and report measures in the NHC extracted from OSCAR to the Centers for Medicare and Medicaid Services (CMS) during the nursing home's initial certification or annual recertification process. Patient outcome data, extracted from the MDS, are derived from patient assessments that nursing home staff perform and submit quarterly; CMS updates MDS data in the NHC every 3 months. To ensure temporal congruency among study variables, NHC data for New Jersey's certified nursing homes were downloaded for a 3-month period concurrent with the nurse survey data collection.

Nurse Sample

Nurse survey data were collected as part of a multistate parent study by researchers from Pennsylvania, Florida, and New Jersey. To aggregate nurses' responses to the facility level, New Jersey nurses were asked to indicate the name of the facility for which they worked from a comprehensive list included in the survey packet. The survey was mailed to a random sample of 44,343 registered nurses (RNs) licensed and living in New Jersey, representing 50% of all RNs licensed in the state. A response rate of 51% resulted in a preliminary sample of 22,406 RNs, of which 1,143 (5.1%) worked in nursing homes; a percentage similar to that reported in the 2008 National Sample Survey of Registered Nurses conducted by the Health Resources and Service Administration. Eight hundred ninety-seven RNs employed in nursing homes indicated that they provided direct resident care.

Nursing Home Sample

Nursing home inclusion was delimited to Medicare- and Medicaid-certified nursing homes located in New Jersey and represented by survey responses from four or more staff RNs who indicated that their primary position was direct resident care.¹⁸ Sixty-three of the state's 347 certified nursing homes met the criteria and constituted the facility sample. Facility size, defined according to number of beds, ranged from 54 to 552 (mean \pm standard deviation 186.6 ± 107.3); occupancy rates ranged from 29% to 100% (mean $89.4 \pm 12.1\%$), and 48% of nursing homes in the sample were classified as for-profit facilities. Although facility size and occupancy rates of the sample were consistent with nursing homes in the state, the proportion of for-profit facilities was lower than the 65.7% statewide. The study sample of 63 nursing homes yielded a total nurse sample of 340 direct-care RN respondents. The number of RN respondents per nursing home ranged from four to 16 (mean 6.4 ± 3.0).

Measures

Within the NHC data set, CMS calculated the percentage of residents with pressure ulcers among high-risk, chronic care residents¹⁹ on a numerator that included all chronic care residents residing in the nursing home for at least 3 months or longer with one or more pressure ulcers (range Stage 1 to 4) and a denominator that included all chronic care residents classified as high risk, defined as those whose most-recent quarterly assessment indicated that they were comatose, malnourished, or had impaired bed mobility.

The number of quality deficiencies, defined as nonadherence to a federally mandated quality standard, was reported in the NHC data set as the number of deficiency citations issued during the most-recent onsite state inspection. Other measures from the NHC data set

included facility characteristics such as profit status, number of beds as a measure of facility size, and occupancy rate. Also included were several metrics of nurse staffing including the number of RN, licensed practical nurse, and certified nursing assistant (CNA) minutes of care per resident day and total licensed minutes of care per resident day.

The Practice Environment Scale of the Nursing Work Index (PES-NWI),²⁰ measuring the practice environment, was derived from the nurse survey. The five subscales of the PES-NWI reflect domains of the nursing practice environment as previously described. Scores on the total composite and the individual subscales indicate the extent to which respondents agree that supportive traits are present and can range from 1 (strongly disagree) to 4 (strongly agree), with higher scores indicating a more-supportive practice environment. Psychometric evaluation has established the reliability and validity of the measure in hospitals, home health agencies,²¹ and nursing homes.²²

Before aggregating PES-NWI scores to the nursing home level, internal consistency reliability of the total composite measure in the sample was assessed at the nurse level and found to be highly internally consistent ($\alpha = 0.95$), as were each of the five subscales ($\alpha = 0.83$ – 0.89). To evaluate reliability at the facility level, intraclass correlation coefficients (ICCs) for the total composite score and each of the five sub-scales were determined. The ICC(1) measures the perceptual agreement of an individual nurse's score about the nursing home mean, and the ICC(2) measures the likelihood of obtaining similar mean scores if more subgroups were drawn repeatedly from the same population within each nursing home. Both reliability measures were calculated with oneway analysis of variance (ANOVA) using the number of RN respondents as a group variable. Aggregated nursing data were deemed reliable when F statistics from the ANOVA table were all significant ($P < .05$). As presented in Table 1, all five PES subscales scores obtained an ICC(1) greater than 0.2 and an ICC(2) greater than 0.55, indicating strong agreement among nurses in each given nursing home. The ICC(2) for total composite scores exceeded 0.60, conservatively justifying aggregation to the nursing home level.²³ Furthermore, a measure of relative strength (ω^2) of each aggregated variable at the nursing home level was calculated and again indicated that the aggregated PES-NWI composite and subscale data were reliable.²⁴ Last, the effect size (η^2) of each aggregated variable measuring the proportion of variance accounted for by nursing home was calculated. Results indicated a medium effect for the PES-NWI total composite score and all five subscale scores, demonstrating good power for further analyses with the study sample.²⁵

Analyses

Total composite and subscales scores for the 31-item PES-NWI were aggregated to the nursing home-level. Pearson and Spearman correlation coefficients (r) were computed between study variables and examined for multicollinearity. Because of high intercorrelations between the subscale scores and PES-NWI total composite scores, the percentage of residents with pressure ulcers and the number of deficiency citations were modeled separately on the total composite and each of the instrument's individual subscales (Table 2). Because all explanatory variables and outcome variables had positive values, and normal assumptions were valid, linear regression models were applied because of their straightforward interpretations. The number of deficiency citations and percentage of residents with pressure ulcers were also modeled using Poisson regression and logistic regression for comparison and validation of the findings. Procedures outlined previously²⁶ were used to test for mediation effects.

FINDINGS

The percentage of residents with pressure ulcers in the sample of facilities ranged from 3% to 33% of high-risk chronic-care residents (mean $17.5 \pm 7.5\%$), and the number of reported deficiencies ranged from 0 to 17 (mean 5.3 ± 3.9). Mean minutes of care per resident day included care delivered by RNs (50.9 ± 28.6), licensed practical nurses (mean 42.7 ± 25.9), and CNAs (mean 135.2 ± 28.7), with a mean of 93.0 ± 44.1 minutes of total licensed care per resident per day. There were no significant associations between any of these metrics of nurse staffing levels and other study variables.

Descriptive statistics for facility-level composite scores for the total PES-NWI are presented in Table 1. Linear, Poisson, and logistic regression models were applied to estimate the association between the PES-NWI total composite and subscale scores and the two quality outcome indicators. Because similar and consistent findings were obtained across regression models, linear regression results are presented in Table 2, indicating that the nursing practice environment was a significant predictor of the percentage of residents with pressure ulcers and the number of deficiency citations. The PES-NWI total composite score and four of the five subscale scores were inversely associated with the percentage of residents with pressure ulcers, and the total composite score and five subscale scores were inversely associated with deficiency citations.

For-profit status was the only facility characteristic associated with the percentage of residents with pressure ulcers ($r = 0.295$, $P = .03$). For-profit status was also inversely associated with the nursing practice environment ($r = -0.278$, $P = .03$). To further explore these associations, an ANOVA confirmed that for-profit nursing homes had a significantly lower mean practice environment score (2.7 ± 0.3) than nonprofit nursing homes (2.8 ± 0.3) ($F(1,62) = 5.11$, $P = .03$) and a significantly higher mean percentage of residents with pressure ulcers (19.6 ± 7.0) than nonprofit nursing homes (15.2 ± 7.5) ($F(1,56) = 5.24$, $P = .03$). There were no significant differences between for-profit and nonprofit nursing homes in mean number of deficiency citations or in any facility characteristic with the exception of CNA minutes per resident per day. In for-profit nursing homes, the mean number of CNA minutes per resident day (124.1 ± 26.0) was significantly lower than in nonprofit facilities (145.6 ± 27.5) ($F(1,60) = 9.68$, $P = .003$).

Three regression analyses were performed to test the extent to which the nursing practice environment mediated the relationships between for-profit status and the percentage of residents with pressure ulcers. The two predictor variables—*for-profit status* and the *practice environment*—explained 17% of the variance in percentage of pressure ulcers. As presented in Table 3, the nursing practice environment fully mediated the effect of for-profit status on pressure ulcer prevalence.

Facility size was the only facility characteristic associated with deficiency citations ($r = 0.29$, $P = .02$). Simultaneous multiple regression estimated the net effects of facility size ($\beta = 0.23$, $P = .04$) and the nursing practice environment ($\beta = -0.41$, $P = .001$) on the number of deficiencies, and each predictor uniquely contributed to the variance in this outcome when controlling for the other predictor. Together, the nursing practice environment and facility size explained 25% of the variance in the number of deficiencies. The lack of a significant relationship between facility size and the practice environment precluded mediation testing.

DISCUSSION

Consistent with previous nursing home research, these findings indicate that a more-supportive nursing practice environment is associated with better outcomes, specifically, a lower percentage of residents with pressure ulcers and fewer quality deficiency citations.

The nursing practice environment mediated the effect of profit status on the percentage of pressure ulcers in residents, suggesting that improvements in nurse practice environments, particularly in for-profit facilities, may hold promise for improving quality of care and resident outcomes.

This finding supporting the mediation role of the nursing practice environment is important given controversies regarding the quality of care in for-profit nursing homes. Although a recent meta-analysis of studies investigating nursing home quality concluded that nonprofit nursing homes demonstrate higher care quality, including a lower prevalence of pressure ulcers,²⁷ findings are markedly inconsistent in that some studies reported mixed results, and a few others reported better quality outcomes in for-profit nursing homes. Given these inconsistencies, some researchers have speculated that unmeasured factors such as organizational behavior must explain the contradictory results.²⁸ Findings from this study inform this debate and suggest that it is the extent to which the practice environment in nursing homes supports staff nurses in their important work and not profit status, per se, that affects quality indicators such as pressure ulcer prevalence and deficiency citations.

This finding is fortunate in that characteristics of the practice environment are modifiable and can be enhanced using administrative policy initiatives, such as providing managerial training for front-line nurse managers, increasing nurses' opportunities to participate in organizational decisions, fostering the continuity of patient care assignments, enhancing nurses' continuing education opportunities, and ensuring that the chief nursing administrator is highly visible, accessible, and responsive to nurses' concerns and enforces high standards of nursing care. Moreover, accreditation by the American Nurses Credentialing Center Magnet Recognition Program has been empirically shown to be an important strategy that significantly improves all dimensions of the nursing practice environment.²⁹ Although all healthcare organizations, including nursing homes, are eligible to apply for Magnet accreditation, few nursing homes have pursued this strategy for creating and sustaining a supportive nursing practice environment. In light of these findings, nursing home administrators dedicated to improving care quality might give careful consideration to leading their facility on a Magnet accreditation journey.

Nurse staffing levels were not associated with quality outcomes in this sample. A possible explanation is that state-mandated nurse staffing ratios in New Jersey are higher than in other states and perhaps created a ceiling effect. Although other staffing levels were characteristic of nursing homes in New Jersey, mean RN minutes per patient day were slightly higher in the study sample (50.9 ± 28.6) than the state average (43.7 ± 28.9). A competing explanation is that state survey agencies do not validate staffing levels in the OSCAR data set, reported by facilities, which may be inaccurate.¹⁰

The limited risk-adjustment methodology that CMS uses in determining the percentage of residents with pressure ulcers in nursing homes is a limitation of this study. Nursing home quality indicators calculated in the CMS datasets may not be adequately adjusted for resident characteristics and comorbidities.³⁰ Furthermore, distinctions between nursing home-acquired pressure ulcers and those present on residents' admission to the facility are not available in the CMS data. Although this is an important limitation, pressure ulcers present on facility admission would be included in residents' outcome data only if they remained unresolved after a stay of 3 months or more in the nursing home. Despite these limitations, CMS data are the only source of accessible outcome data available on most nursing homes and, thus, are frequently used in nursing home research.

CONCLUSION

These findings support the applicability of the Nursing Organization and Outcomes Model¹¹ in nursing homes and indicate that, similar to hospital settings, a supportive nursing practice environment is associated with better resident outcomes. Furthermore, findings indicate that the nursing practice environment in nursing homes is an operant mechanism explaining how profit status affects quality of care. Therefore, initiatives aimed at creating and maintaining an environment that supports professional nursing practice may provide an important pathway through which the quality and outcomes of care for the fragile and vulnerable nursing home population are improved.

Acknowledgments

This study was funded by Grant 053071 awarded to Dr. Linda Flynn by the Robert Wood Johnson Foundation. Survey items were developed under grant NR004513 from the National Institute of Nursing Research awarded to Dr. Linda Aiken.

Sponsor's Role: None.

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Table 1

Reliability Indices of the Practice Environment Scale (PES) in Study Sample

Characteristic	Mean ± Standard Deviation	Range	ICC(1)	ICC(2)	η^2	ω^2
Nurse participation	2.53 ± 0.34	1.83–3.19	0.27	0.61	0.13	0.82
Competent nurse manager	2.74 ± 0.36	1.94–3.57	0.26	0.59	0.08	0.51
Registered nurse–physician relationships	3.09 ± 0.34	2.17–4.0	0.23	0.55	0.11	0.67
Foundations for quality	2.93 ± 0.32	2.11–3.6	0.43	0.75	0.14	0.79
Resources and staffing	2.63 ± 0.43	1.81–3.61	0.24	0.55	0.084	0.88
PES total composite score	2.79 ± 0.60	1.19–4.00	0.35	0.68	0.14	0.83

Note: Scores indicate extent to which respondents agree that supportive traits are present (range 1 (strongly disagree) to 4 (strongly agree)), with higher scores indicating more-supportive environments).
 ICC = intraclass correlation coefficient.

Table 2

Effects of Dimensions of the Practice Environment on Quality Outcomes

Adverse Event and Practice Environment Dimension	Standardized β	Coefficient of Determination	F
Percentage of pressure ulcers			
Total composite score	-0.37**	0.13	8.50
Quality foundations	-0.38**	0.14	9.13
Resource adequacy	-0.35**	0.12	7.67
Participation in facility affairs	-0.31*	0.10	6.02
Registered nurse-physician relationships	-0.28*	0.08	4.72
Supportive manager	-0.24	0.06	4.21
Deficiencies			
Total composite score	-0.44***	0.20	15.00
Quality foundations	-0.36**	0.13	9.00
Resource adequacy	-0.43***	0.19	13.90
Participation in facility affairs	-0.38**	0.10	6.00
Registered nurse-physician relationships	-0.32*	0.10	6.95
Supportive manager	-0.37**	0.14	9.71

Note: Scores indicate extent to which respondents agree that supportive traits are present (range 1 (strongly disagree) to 4 (strongly agree), with higher scores indicating more-supportive environments).

* $P < .05$

** $P < .01$.

Table 3
Confirmatory Tests of Mediation for Practice Environment and Pressure Ulcers

Equation	Mediator	IV	DV	β	P-Value
1	Practice environment	Profit status	Pressure ulcer prevalence	-0.28	.03
2	Practice environment	Profit status	Pressure ulcer prevalence	0.29	.03
3	Practice environment	Profit status	Pressure ulcer prevalence	-0.31	.02
		Profit status	Pressure ulcer prevalence	0.21	.11

Note: Practice environment scores indicate extent to which respondents agree that supportive traits are present (range 1 (strongly disagree) to 4 (strongly agree), with higher scores indicating more-supportive environments). Tests for mediation.

Equation 1. Independent variable (IV) must be a significant predictor of mediator.

Equation 2. IV must be a significant predictor of dependent variable (DV).

Equation 3. Entering the mediator and IV in the equation, the mediator must be a significant predictor of the DV, and the effect of the IV on the DV must be reduced or not significant.