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Nursing Home Staffing and Its Relationship to Deficiencies

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Objectives. The authors examined the relationships between different types of nursing home staffing and nursing home deficiencies to test the hypothesis that fewer staff hours would be associated with higher numbers of deficiencies.

Methods. Data were from the On-Line Survey, Certification, and Reporting System for all certified nursing homes in the United States. Regression models examined total deficiencies, quality of care, quality of life, and other deficiencies.

Results. Fewer registered nurse hours and nursing assistant hours were associated with total deficiencies and quality of care deficiencies, when other variables were controlled. Fewer nursing assistant staff and other care staff hours were associated with quality of life deficiencies. Fewer administrative staff hours were associated with other deficiencies. Facilities that had more depressed and demented residents, that were smaller, and that were nonprofit or government-owned had fewer deficiencies. Facilities with more residents with urinary incontinence and pressure sores and with higher percentages of Medicaid residents had more deficiencies, when staffing and resident characteristics were controlled.

Discussion. Facility characteristics and states were stronger predictors of deficiencies than were staffing hours and resident characteristics. Because only a small portion of the total variance in deficiencies could be explained, much work remains to explore factors that influence deficiencies.

USING registered nurses (RNs) and other nursing personnel as well as many other types of health professionals and care providers, nursing homes in the United States provide care to about 1.6 million residents (Harrington, Carrillo, Thollaug, & Summers, 2000). Studies have documented the importance of nursing in both the process of care and the outcomes of nursing home care (Aaronson, Zinn, & Rosko, 1994; Cherry, 1991; Linn, Gurel, & Linn, l977; Munroe, 1990; Nyman, 1988; Spector & Takada, l991). Nyman (1988) found that nurse hours per patient day were positively related to facility quality measures. Munroe (1990) found a positive significant relationship between the quality (measured by deficiencies) and higher ratios of RN and licensed vocational or licensed practical nurse (LVN/LPN) hours per resident day and concluded that higher ratios of licensed nurses may be more important than total nursing hours. Cherry (1991) found that increased RN hours were positively associated with a composite of good outcome measures (fewer decubitus ulcers, catheterized residents, and urinary tract infections and less antibiotic use).

Spector and Takada (1991) reported that higher staff levels and lower RN turnover rates were related to improvements in resident functioning. Lower staffing was associated with high rates of urinary catheter use, low rates of skin care, and low resident participation in activities. Cohen and Spector (1996) found that higher ratios of RNs to residents, adjusted for resident case mix, reduced the likelihood of death and that higher ratios of LVN/LPNs significantly improved resident functional outcomes. A recent study of Minnesota nursing homes found that in the 1st year after a patient's admission to a nursing home, the licensed (but not nonlicensed) nursing hours were significantly related to improved functional ability, increased probability of discharge home, and decreased probability of death (Bliesmer, Kane, & Shannon, 1998). The role of professional nursing staff disappeared, however, for chronic care residents.

Few studies have examined other types of care staff in nursing homes such as physician and therapy services. Some of these have found a positive relationship between such services and outcomes (Chiodo, Gerety, Mulrow, Rhodes, & Tuley, 1992; Karuza & Katz, 1994; Kochersberger, Hielema, & Westlund, 1994; Mulrow et al., 1994; Przybylski et al., 1996).

In this study we had two aims. First, we described and categorized the types of federal deficiencies issued to facilities by state licensing and certification surveyors for different types of care problems. Deficiencies are evaluations of poor quality made by state surveyors under the federal nursing home certification regulations. Second, we used multiple regression analyses to test the association of facility deficiencies with facility staffing hours per resident day, resident characteristics, facility characteristics, and states. The general hypothesis we tested was that staff hours per resident day in nursing homes would be negatively associated with higher numbers of deficiencies, when controlling statistically for resident characteristics, facility characteristics, and states.

Deficiencies

Deficiencies are issued to facilities by state surveyors as a part of the federal survey process. The survey process is designed to regulate quality of care, and the deficiencies represent surveyor evaluations about the type of quality problems that exist. State survey agencies operate under contract with the Health Care Financing Administration (HCFA) to monitor nursing facilities on a periodic basis, about once a year (between 9 and 15 months). These evaluations are the only routinely collected and external source of information about quality for all facilities. The deficiencies are entered in the federal On-Line Survey, Certification, and Reporting (OSCAR) system by state staff after the surveys. If a facility fails to meet a standard or regulation, a deficiency or citation is given to the facility (coded as 1 for a deficiency and 0 for no deficiency). OSCAR reports whether a deficiency is issued for each survey item and the total number of deficiencies issued to each facility.

The OSCAR deficiency data are generally considered to be accurate reflections of the actual deficiencies issued by surveyors. The data also accurately reflect problems that exist in the facilities because deficiencies are subject to extensive review by state officials and facilities and are subject to appeal by providers through an administrative or judicial process. Because providers do not want deficiencies on their record, they challenge deficiencies they consider unwarranted.

The federal regulations have 179 specific standards for nursing facility care in 17 major categories. In this study, we analyzed the total number of deficiencies for each facility. In addition, we grouped the deficiencies into three categories: (a) quality of care, (b) quality of life, and (c) other deficiencies. Quality of care included 72 specific items in the following federal survey categories: resident assessment, quality of care, nursing services, dietary services, physician services, rehabilitative services, dental services, pharmacy services, and infection control. For example, prevention of pressure sores, falls, and prevention of physical decline are separate requirements under the quality of care category. The quality of life category included 77 specific items on resident's rights; admission, transfer, and discharge rights (including resident rights); resident behavior and facility practices (includes resident rights); quality of life; and physical environment (which could affect quality of life). Other deficiencies included 30 specific items on administration and medical records. Because surveyors have some discretion in the specific individual deficiencies that they apply to quality problems that they detect, grouping deficiencies into a few broad categories has the advantage of reducing some variability inherent in the survey process. The three broad categories we used appeared to be conceptually separate and easier to analyze that the 17 categories used by HCFA.

Independent Variables

We expected that four important types of factors would be associated with deficiencies in nursing facilities: (a) staffing hours; (b) resident characteristics; (c) facility characteristics; and (d) state or regional factors. The specific relationships and hypotheses are presented as each independent variable is discussed.

Staffing hours.—Federal standards have been established for different types of staff in nursing facilities as a means of ensuring adequate nursing home care. Nursing home reform legislation in the Omnibus Reconciliation Act of 1987 increased the minimum standards for nursing home staffing. All nursing homes certified for Medicare and Medicaid residents must have an RN director of nursing, an RN on duty for 8 hours a day 7 days a week, and a licensed nurse (either an RN or LVN/LPN) on duty around the clock (Omnibus Budget Reconciliation Act of 1987 [OBRA], 1987). In addition, the law requires sufficient nursing staff to provide nursing and related services to residents to enable residents to reach or maintain the highest practicable level of physical, mental, and psychosocial well-being. Regulations also require social activities; medically related social services; dietary services; physician and emergency care services; and pharmacy, dental, and rehabilitation services including physical, speech, and occupational therapies (OBRA, 1987; U.S. Department of Health and Human Services, Health Care Financing Administration, 1995a, 1995b, 1995c). Facilities have discretion in going beyond the minimal federal requirements in the numbers and types of staff they use to provide care. Staffing types and hours vary considerably across facilities (Harrington & Carrillo, 1999; Harrington, Carrillo, Mullan, & Swan, 1998).

The major focus of this study was staffing hours per resident day in nursing facilities. The staffing was examined for six separate categories. First, *nursing staff* was categorized as all RN hours including nurse administrators, LVN/LPN, and nursing assistant hours separately. *Other care staff* included the professional staff and their assistants (e.g., physicians, pharmacists, dietary staff, therapists, activities staff, and social workers). All facility *administrative staff* (excluding nursing) was combined into a separate category. *Housekeeping and other staff* formed a fourth category. Finally, all these groups of staff were combined for the total staff in nursing facilities.

The general hypothesis was that staffing hours would be inversely related to deficiencies, when resident characteristics, facility characteristics, and states were controlled. Specifically, we hypothesized that fewer nursing staff hours per resident day would be associated with higher numbers of total deficiencies and with quality of care and quality of life deficiencies. We expected that fewer other care staff hours (e.g., therapists and activities staff) per resident day would be related to more quality of care and quality of life deficiencies. We expected that fewer administrative and housekeeping staff hours per resident day would be related to more deficiencies in the "other" deficiency category.

Resident characteristics.—Nursing homes vary in the types of residents they serve, typically referred to as case mix variation. A strong relationship among resident characteristics, nurse staffing time requirements, and nursing costs in nursing facilities has been shown in several studies (Arling, Nordquist, & Capitman, 1987; Fries & Cooney, 1985;

Fries et al., 1994; Schneider, Fries, Foley, Desmond, & Gormley, l988). These studies have shown the importance of activities of daily living (ADLs) and other resident characteristics on facility resource requirements.

Resident characteristics or case mix may increase the number of deficiencies that a facility receives, when staff hours and other factors are controlled. This may occur if surveyors identify the resident characteristics or case mix when they begin the survey and focus their survey attention on specific residents with problems. We expected that resident characteristics such as functional impairment, cognitive and emotional status, incontinence, and pressure sores would be positively related to deficiencies, because residents with these problems are probably at greater risk of poor outcomes and generally require more effort and expertise in caregiving. The hypothesis we tested was that higher levels of case mix would be positively associated with the number of deficiencies in total and with quality of life and quality of care deficiencies in particular, when staffing hours, facility characteristics, and states were controlled. Because of the potential complex relationship between resident characteristics and deficiencies, we examined deficiencies with and without resident characteristics in the models.

Facility characteristics.—We examined the following facility characteristics: size, whether or not a facility was hospital based, certification status, percentage of Medicaid residents, and type of ownership.

1. Size. The number of beds in a nursing home facility (size) is expected to be directly related to deficiencies. Large facilities have been associated with higher staffing, although findings have been mixed (Davis, 1993; Nyman, 1988; Ullmann, 1987). Other studies have found a negative relationship between size and staffing (Fottler, Smith, & James, 1981). Controlling for both staffing hours and resident characteristics, we expected that larger sized nursing facilities would be related to deficiencies because larger facilities may be more difficult to manage and/or may result in a less positive environment for residents.
2. Hospital-based nursing facilities. Hospital-based nursing facilities have traditionally had substantially higher nursing staff hours and other professional staff hours (therapists, dietitians, pharmacists, and others) because hospital-based residents may have higher acuity levels. Moreover, hospital-based facilities generally may have more Medicare residents and may receive higher reimbursement rates than Medicaid residents in nursing homes. Because hospital-based facilities may have more financial and staff resources, we expected that they would have fewer deficiencies. Hospital-based facilities may have fewer deficiencies because of unmeasured variables, such as organizational philosophy, training and skill of staff, experience in caring for complex residents, and/or surveyor expectations. We therefore hypothesized that hospital-based nursing facilities would have fewer deficiencies, controlling for staffing hours, resident characteristics, and other factors.
3. Certification status. There are four federal certification categories of nursing facilities: skilled nursing facilities (SNFs) for Medicare only (Category 4); nursing facilities for Medicaid with a distinct part for SNF care (Category 3); nursing facilities dually certified for Medicaid and Medicare (Category 2); and nursing facilities certified for Medicaid only (Category 10). Medicare-only SNFs (Category 4) have been shown to be related to high levels of resident needs and staffing (Harrington et al., 1998; Kanda & Mezey, 1991), because of residents' eligibility for Medicare skilled nursing reimbursements. Medicare payment levels have traditionally been higher than those in Medicaid facilities (Buchanan, Madel, & Persons, 1991). Because SNFs have higher payment rates than other certification categories, they should be negatively related to deficiencies, whereas Medicaid-only facilities, which have the lowest reimbursement rates, may be positively associated with deficiencies. Controlling for staffing hours and resident characteristics, we expected that SNFs would have fewer deficiencies because of a number of factors not captured in the model, such as the expertise and experience of direct care staff, organizational and administrative expertise, facility support services, and other unmeasured factors.
4. Percentage of Medicaid residents. Many state Medicaid programs have attempted to keep their level of Medicaid nursing home reimbursement rates low, and Medicaid rates are generally lower than those of Medicare (Aaronson, Zinn, & Rosko, 1995; Buchanan et al., 1991; Cohen & Dubay, 1990; Dor, 1989; Holahan & Cohen, l987; Holahan, Rowland, Feder, & Heslam, 1993; Swan, Harrington, & Grant, 1993). Studies have shown that high percentages of Medicaid residents result in lower staffing levels and conversely that high percentages of Medicare residents result in higher staffing levels (Fottler et al., 1981; Harrington et al., 1998; Nyman, 1988; Zinn, 1993). Nyman (l988) found that facilities with greater proportions of Medicaid residents appeared to have lower quality of care. Facilities with greater proportions of Medicaid residents may not have to compete on quality, and such facilities may have fewer resources because Medicaid reimbursement rates are lower than those of Medicare. Therefore, we hypothesized that higher percentages of Medicaid residents would be positively associated with deficiencies even after controlling for staffing hours, resident characteristics, and other factors.
5. Ownership. Nonprofit facilities have been reported to have better nursing home outcomes in some studies (Aaronson, et al., 1994; Davis, 1993; Spector, Selden, & Cohen, 1998), so they should have fewer deficiencies. We expected that nonprofit and government facilities would have fewer deficiencies compared with for-profit facilities, controlling for staffing hours, resident characteristics, and other factors. We expected that unmeasured variables for nonprofit facilities, such as organizational philosophy, training and skill of staff, and turnover of staff, may all result in fewer deficiencies.

State or regional factors.—Although the deficiency data are generally considered accurate, there are some variations

in the surveyor procedures and practices for determining deficiencies across the 50 states and the District of Columbia. The U.S. General Accounting Office (1998a, 1998b) has been critical of the state survey agencies in their poor identification of quality of care problems and their poor records in enforcing the federal standards. The U.S. Department of Health and Human Services, Health Care Financing Administration (1998a, 1998b) also identified problems with its survey process and has been attempting to improve the process. Thus, state and regional variables were included as control variables in separate models. No hypotheses were made about particular states.

Methods

Data Sources

The secondary data used in this study were drawn from the federal OSCAR system for all certified nursing homes in the United States. OSCAR data are collected in three separate sets of files: (a) facility characteristics and staffing data, (b) resident characteristics, and (c) survey deficiencies. The OSCAR data are collected during the certification surveys conducted every 9–15 months by state agencies under contract with HCFA. Data in this article are from the surveys conducted during the period July 1, 1995, through June 30, 1996. This time period was selected because it was after HCFA implemented procedural changes in the survey on July 1, 1995, mandated by OBRA (1987) and because the data were the most recent 12-month statistics available from HCFA at the time of the study. Results from two sets of analyses for the first 6 and second 6 months of implementation did not differ significantly, so only the 12-month period is shown. The data for the study were limited to the OSCAR data because these data were available for all facilities in the United States and other data sources were not available.

Data Cleaning

All federally certified nursing facilities for Medicare and Medicaid in the United States were included in this study, except for the trust territories and Puerto Rico. Intermediate care facilities for the mentally retarded were excluded. We eliminated duplicate provider records by matching facility records by state, city, facility name, address, and telephone number (372 facilities were eliminated). Another 1,496 facilities with survey dates prior to or after the study period were removed. Facilities with incomplete information were also removed (26 facilities). At that point, the resulting sample was 15,536 facilities. We corrected errors in reporting of total beds and residents by setting the maximum number to the number of certified skilled nursing beds in the facility (for 2,315 facilities).

Staffing data.—We cleaned staffing data using the total nursing data. Because facilities with 15 or fewer residents had significantly higher staffing hours than did larger facilities, to an extent judged to be unlikely to be accurate, 1,054 such facilities were eliminated. We then used means and standard deviations to examine staffing for the four certification categories. Because the staffing data showed a number of outliers that appeared to be erroneous and resulted in skewed distribution, all facilities that reported staffing of more than two standard deviations above the mean were removed (159 facilities). Thus, the total number of facilities in the study was 13,770. Excluded facilities were smaller, more likely to be hospital based, more likely to be SNFs, and had a lower proportion of Medicaid residents.

Each of the categories of staff included all the full-time, part-time, and contract staff for that category. To compute the staffing hours per resident day, we multiplied the total staffing payroll full-time employees reported for a 2-week period by 70 h and then divided by the total number of residents and by the 14 days in the reporting period (the procedure used by HCFA). The staffing data were collected at the time of each regular survey and were not audited by state surveyors.

Resident characteristics.—Several variables were selected for resident characteristics from the OSCAR file. We summed the scores for each of three ADLs (eating, toileting, and transferring) to construct an ADL index (1 = lowest need for assistance, 2 = moderate need, 3 = greatest need). Thus, the summary ADL scale ranged from 3 to 9 with a score of 9 being the most dependent. Three mobility variables were used for a mobility index: 1 = independent in ambulation, 2 = in a chair all or most of the time, and 3 = bedfast all or most of the time, based on the number of residents at each level. The percentages of residents reported with depression, dementia, behavioral symptoms, incontinence, and pressure sores were calculated for the study.

Other independent variables.—For the size of a nursing facility, the total beds were reported from OSCAR in a set of four dichotomous variables: those with less than 60 beds, with 60–119 beds, with 120–160 beds, and with more than 160 beds. A dichotomous variable indicated whether or not the facility was hospital based. For certification status, nursing facilities for Medicaid with a distinct part for SNF care (Category 3) and nursing facilities dually certified for Medicaid and Medicare (Category 2) were combined and used as the comparison category. We used three dichotomous variables to indicate each facility's certification for SNFs, facilities with a combination of Medicare and Medicaid residents, and facilities with Medicaid-only residents. Nonprofit and government-owned facilities were combined and indicated by a dichotomous variable and compared with profit-making facilities. We included state dummy variables in the model to take into account state variation in deficiencies. Census regions were indicated by a set of four dichotomous variables (midwest, northeast, south, and west) and were examined separately from states.

Analytic Approach

We used bivariate analyses to examine relationships between key variables and deficiencies. Pearson product correlations were conducted between the independent variables. Although some of the independent variables showed relationships with each other, the correlations were modest, suggesting that multicollinearity was not likely to be problematic. Tolerance tests in the regression analysis also did not show multicollinearity to be a problem.

There is no general agreement on the best way to measure and analyze deficiencies, so we tested several approaches. We used ordinary least squares (OLS) regression modeling with SPSS (1998) to examine factors associated with the number of deficiencies issued to each facility to test the hypotheses for the study. We inspected the residual normality of the total deficiencies distribution and found that there was no strong violation of the normality assumptions for OLS modeling. In this case, the distribution of residuals was found to be more symmetric than the dependent variable. The skewness in the dependent variable was due largely to skewness in the distribution of the independent variables and not to non-normality of the residuals.

We found the same distribution pattern when we used a logistic regression to analyze whether any deficiency was cited (deficiency = 1, no deficiency = 0). Then, using the log of deficiencies, we computed an OLS regression on the deficiencies excluding those facilities with zero deficiencies. The findings, which were similar, are reported in the Results section.

Finally, we also conducted alternative logistic regressions including (a) whether the facility was in the quartile with the greatest number of deficiencies (i.e., more than eight deficiencies were cited) and (b) whether any deficiencies were evaluated by surveyors as indicating substandard care. The pseudo R^2 statistic for binary response variables is the proportion of variation in the dependent variable "explained" by the independent variables in the model. The logistic regressions were significant and informative but not as effective and useful in targeting facilities with outlying deficiencies as the OLS regressions.

Results

The means and standard deviations of all dependent and independent variables are shown in Table 1. The mean number of total deficiencies per facility was 5.92 during the period, the median was 4.0, and the standard deviation was 6.17. A total of 81,534 deficiencies were cited for all facilities during the 1-year study period. Of these, 48,431 deficiencies were in the quality of care category, 28,368 were in the quality of life category, and 4,735 were in the other deficiency category (data not shown).

Descriptive Statistics

Table 1 shows that the total staff hours per resident day was 5.70 for all nursing facilities. RNs were 0.59 hr per resident day, LVN/LPNs were 0.67 hr per resident day, and nursing assistants were 2.14 hr per resident day. Total nursing staff was 3.4 hr, or 60% of total staff hours. Other care staff hours per resident day were 1.26 hr. These included dietary personnel, activity staff, physical therapists, social workers, occupational therapists, and others (22% of total hours; see Table 1). Housekeeping and other staff were 13% of total hours per resident day (0.76 hr). Administrative staff was 5% of the total, or 0.28 hr per resident day.

Table 1 shows the distribution of resident characteristics. On a 9-point scale, the mean ADL index was 5.78. The mean resident mobility was 1.42 on a 3-point scale. Half of the residents had urinary incontinence, 42% had dementia, 26% had behavioral symptoms, 18.6% had depression, and 6.5% had pressure sores. Most nursing homes (62%) had fewer than 119 beds. Only 8.7% of facilities were hospital based, and 3.76% were SNFs. Eighteen percent were certified as nursing facilities with Medicaid-only residents. The majority of residents were on Medicaid (65.6%), with 9.7% on Medicare and the remainder private pay. Of the facilities, 68% were for-profit.

Table 1. Means and Standard Deviations for Dependent and Independent Variables for 1995–96

Characteristic and Variable	*M*	*SD*
Deficiencies		
Quality of care	3.52	3.75
Quality of life	2.06	2.51
Other	.34	.77
Total	5.92	6.17
Staff		
Total staff (hours per resident day)	5.70	2.93
Nursing staff (hours per resident day)	3.40	1.77
Registered nurses	.59	.73
LVN/LPNs	.67	.62
Nursing assistants	2.14	1.14
Other care staff (hours per resident day)	1.26	.99
Administrative staff (hours per resident day)	.28	.57
Housekeeping and other staff (hours per resident day)	.76	.81
Resident Characteristics		
ADL index (range 1–9, with 9 the most dependent)	5.78	.72
Mobility index (range 1–3, with 3 the most dependent)	1.42	.41
Depression (% of residents)	18.60	13.54
Dementia (% of residents)	42.39	18.04
Behavioral symptoms (% of residents)	26.31	18.00
Urinary incontinence (% of residents)	50.35	16.86
Pressure sores (% of residents)	6.54	5.14
Facility Characteristics		
Fewer than 60 beds (yes = 1)	19.37	
60–119 beds (yes = 1)	43.01	
120–160 beds (yes = 1)	21.69	
More than 160 beds (yes = 1)	15.94	
Hospital based (yes = 1; n = 1,198)	8.70	
SNF/NF (Category 2, 3; yes = 1; n = 10,726)	77.89	
SNF (Category 4; yes = 1; n = 517)	3.76	
NF (Category 10; yes = 1; n = 2,527)	18.35	
% Medicare	9.68	16.83
% Medicaid	65.57	23.74
% private pay	24.75	19.87
% for-profit	68.01	46.65
Region		
Midwest (yes = 1)	34.42	
Northeast (yes = 1)	16.86	
South (yes = 1)	32.86	
West (yes = 1)	15.86	

Notes: Data are from the On-Line Survey Certification and Reporting System for all nursing homes for July 1, 1995–June 30, 1996, Health Care Financing Administration. n = 13,770 nursing facilities. ADL = activities of daily living; LVN/LPN = licensed vocational nurse/licensed practical nurse; NF = nursing facility; SNF = skilled nursing facility.

Regression Models for Deficiencies

Table 2 shows the results of OLS regression models of deficiencies. As expected, lower levels of RN staff were significantly associated with total care deficiencies and quality of care but not with quality of life deficiencies and other deficiencies. LVN/LPN hours were not related to deficiencies. Lower levels of nursing assistant staff were associ-

Table 2. Ordinary Least Squares Regression Model of Staffing, Resident Characteristics, Facility Characteristics, and States as Predictors of Nursing Home Deficiencies (SE in Parentheses)

Characteristic and Variable	Total Care Deficiencies	Quality of Care Deficiencies	Quality of Life Deficiencies	Other Deficiencies
Constant	4.412**	2.626**	1.473**	.106
	(1.081)	(.667)	(.444)	(.147)
Staff				
Registered nurses	−.184*	−.128**	−.047	−.008
	(.079)	(.049)	(.032)	(.011)
LVN/LPNs	.131	.087	.042	.002
	(.084)	(.052)	(.034)	(.011)
Nursing assistants	−.127**	−.072*	−.052**	−.004
	(.046)	(.028)	(.019)	(.006)
Other care staff	−.104	−.063	−.048*	.007
	(.058)	(.036)	(.024)	(.008)
Administrative staff	−.008	.045	−.028	−.025*
	(.087)	(.054)	(.036)	(.012)
Housekeeping and other staff	−.106	−.071	−.024	−.012
	(.061)	(.038)	(.025)	(.008)
Resident Characteristics				
ADL index	.009	.091	−.072*	−.011
	(.084)	(.052)	(.035)	(.011)
Mobility index	−.002	.012	.021	−.035*
	(.127)	(.078)	(.052)	(.017)
Depression	−2.075**	−.894**	−1.022**	−.161**
	(.387)	(.239)	(.159)	(.052)
Dementia	−1.342**	−.701**	−.516**	−.126**
	(.299)	(.185)	(.123)	.041
Behavioral symptoms	.402	.007	.403**	−.008
	(.302)	(.186)	(.124)	(.041)
Urinary incontinence	.942**	.417*	.442**	.084
	(.337)	(.208)	(.138)	(.046)
Pressure sores	13.636**	8.444**	4.107**	1.078**
	1.042	(.643)	(.428)	.141
Facility Characteristics				
Fewer than 60 beds	−1.528**	−1.011**	−.493**	−.024
	(.166)	(.103)	(.068)	(.023)
60–119 beds	−.880**	−.506**	−.349**	−.026
	(.127)	(.079)	(.052)	(.017)
More than 160	.718**	.362**	.318**	.038
	(.158)	(.097)	(.065)	(.021)
Hospital based	.135	.081	.051	.003
	(.219)	(.135)	(.090)	(.030)
SNF (Category 4)	.042	−.152	.212	−.018
	(.340)	(.210)	(.139)	(.046)
Nursing Facility (Category 10)	−.148	−.110	−.020	−.019
	(.147)	(.091)	(.061)	(.020)
% Medicaid	2.747**	1.153**	1.403**	.192**
	(.286)	(.176)	(.117)	(.039)
% Medicare	−.863	−.502	−.249	−.115
	(.488)	(.301)	(.200)	(.066)
Nonprofit and government	−.629**	−.316**	−.267**	−.047**
	(.120)	(.074)	(.049)	(.016)
State ($df = 50$) F value	56.88**	51.39**	48.35**	17.46**
F	52.062**	44.951**	46.380**	16.682**
Adjusted R^2	.211	.187	.192	.076

Notes: Comparisons: Beds 120–159; nonhospital; Category 2, 3; private pay residents; for-profit; and Wyoming. $n = 13{,}770$. ADL = activity of daily living; LVN/LPN = licensed vocational nurse/licensed practical nurse; SNF = skilled nursing facility.

*$p < .05$; **$p < .01$.

ated with more total care deficiencies, quality of care deficiencies, and quality of life deficiencies but not with other deficiencies. Lower levels of other care staff were associated with increased quality of life deficiencies but not with total deficiencies or quality of care deficiencies. As expected, lower levels of administrative staff were associated with higher deficiencies in the "other" category that included administrative deficiencies. Contrary to the hypotheses, lower levels of housekeeping and other staff had no relationship to deficiencies.

Also contrary to our hypotheses, the average ADL dependence index was negatively associated with quality of life

deficiencies, but there was no relationship with quality of care deficiencies. Facilities with proportionately fewer residents with mobility limitations had higher rates of other deficiencies. Facilities with higher percentages of residents with depression and dementia had significantly fewer deficiencies of all types. Facilities with a higher percentage of residents with behavioral symptoms had more quality of life deficiencies. Facilities with more incontinent residents had more total deficiencies and more quality of care and quality of life deficiencies. The percentage of residents with pressure sores was positively associated with total care deficiencies and deficiencies in all deficiency categories. Because some of the resident characteristics in the model could also be considered outcomes or related to deficiencies, we ran the regression models excluding the percentages of residents with depression, dementia, behavioral symptoms, incontinence, and pressure sores. The regression models were stable with and without these variables, although including these characteristics added somewhat to the model.

Smaller facilities (16–60 beds and 60–119 beds) were less likely to have quality of care and quality of life deficiencies and had fewer total deficiencies than larger facilities. Neither hospital affiliation nor certification status was associated with deficiencies. Facilities with greater percentages of Medicaid residents were more likely to have deficiencies of all types. Nonprofit and government facilities had fewer deficiencies of all types than for-profit facilities.

States were also significant predictors of deficiencies (see Table 2 for summary F value). The regression model was also tested with the four census regions as substitutes for the state dummy variables (data not shown). The midwest, south, and west each had higher numbers of all types of deficiencies than did the northeast comparison group. The highest coefficients were found in the western region.

Table 3 shows the alternative regression models for deficiencies. A logistic regression shows the findings for facilities that had any deficiency; these findings were similar to those in Table 2 except that LVN/LPN hours were significant and nurse assistant hours were not. When the regression for the log of deficiencies (excluding those facilities with no deficiencies) shown in Table 3 was compared with the OLS regression for the total deficiencies (Table 2), the findings were similar. With respect to staffing levels, RN and nurse assistant hours were negative predictors of deficiencies. Overall, the alternative models yielded the same general conclusions and showed the robustness of the OLS model.

Staffing hours alone predicted less than 1% of the total variance in deficiencies (data not shown). Staffing and resident characteristics were significant predictors of total deficiencies but only explained 3% of the variance when facility characteristics were not included (data not shown). When facility characteristics and region were added to the model as shown in Table 2, the proportion of variance explained increased to 21.1%.

Discussion

Consistent with the hypotheses and previous studies (see Institute of Medicine, Committee on the Adequacy of Nurse Staffing in Hospitals and Nursing Homes, 1996), fewer RN staff hours were associated with more quality of care deficiencies. Fewer nursing assistant hours, as expected, had a consistent, significant negative relationship with total, quality of care, and quality of life deficiencies. Fewer other care staff hours were associated with more quality of life deficiencies. On the other hand, staffing hours and resident characteristics did not explain much of the variation in deficiencies when case mix and facility characteristics and other factors were controlled for in the model. Because we were able to explain only a small portion of the variance, much work remains to explore these important relationships with deficiencies.

The relationship between resident characteristics and deficiencies was complex. Contrary to our hypotheses, lower scores on ADL impairment were also related to more quality of life deficiencies, perhaps because surveyors considered that more independent residents need more activities and stimulation than more impaired residents. Surprisingly, depression and dementia were also associated with reductions in the number of deficiencies. This finding raises questions about whether quality problems associated with the psychosocial characteristics are difficult for surveyors to identify; or perhaps surveyors are less concerned about quality of care and life for cognitively impaired residents, and this is reflected in fewer deficiencies.

As expected, pressure sores were related to increased numbers of deficiencies of all types because they are visible and quantifiable measures of poor quality. As expected, urinary incontinence was also associated with more deficiencies. Urinary incontinence is a treatable problem in nursing homes and has also been the focus of the survey process, which may explain the association with deficiencies. On the other hand, surveyors may tend to cite facilities when they observe problems that may be more of an indicator of case mix than of quality problems. In other words, it may be difficult for surveyors to determine when poor outcomes are related to the disease process or to poor and inadequate care.

As expected, higher percentages of behavioral problems, urinary incontinence, and pressure sores were positively associated with quality of life deficiencies. These easily observable problems may have a negative impact on individual residents and could also have a negative impact on the overall environment of the facility. Future studies should examine these relationships in greater detail.

Consistent with our hypothesis, larger facilities were associated with more deficiencies (when staffing and residents were controlled), perhaps because larger facilities are less able to monitor and ensure both quality of care and quality of life requirements for residents. Alternatively, surveyors' judgments may not be very sensitive to facility size. As expected, facilities with more Medicaid residents were associated with more deficiencies, even when we controlled for staffing and resident characteristics, suggesting poorer care in such facilities. This finding is consistent with previous studies by Nyman (1988) that suggest poorer quality of care occurs in facilities with higher proportions of Medicaid residents, especially in areas where there is excess demand for services. The findings may be related to the reduced need to compete on the basis of quality or to lower Medicaid reimbursement rates compared with Medicare and pri-

Table 3. Comparison of Alternative Regression Models Predicting Deficiencies

Independent Variable	Has Any Deficiencies (Yes = 1; n = 13,770)	Log of Deficiencies Without Zero Deficiencies (n = 11,708)	More Than Eight Deficiencies (Yes = 1; n = 13,770)	Any Substandard Care Deficiency (Yes = 1; n = 13,770)
Staff				
Nursing staff				
Registered nurses	.877**	−.028*	.983	.686**
LVN/LPNs	1.156*	.005	1.011	1.02
Nursing assistants	.953	−.017*	.965	0.924
Other care staff	0.954	−.018	.974	0.986
Administrative staff	1.026	−.004	.991	0.944
Housekeeping and other staff	.950	−.019*	.916*	0.911
Resident Characteristics				
ADL index	1.122*	.004	.964	.864*
Mobility index	1.117	.003	1.018	0.875
Depression	.380**	−.271**	.375**	0.654
Dementia	.851	−.187**	.593**	0.914
Behavioral symptoms	1.244	.028	1.104	1.631*
Urinary incontinence	.703	.106*	1.311	2.723**
Pressure sores	12.439**	2.091**	221.457**	191.586**
Facility Characteristics				
Fewer than 60 beds	.775**	−.207**	.568**	.592*
60–119 beds	.842*	−.128**	.711**	.780**
More than 160 beds	1.222*	.070**	1.239**	1.282*
Hospital based	.971	.031	1.101	0.906
SNF (Category 4)	.944	−.048	.622*	0.461
Nursing facility (Category 10)	.981	−.030	.903	1.024
% Medicaid	3.250**	.367**	2.778**	2.974**
% Medicare	1.107	−0.102	.607	2.852
Nonprofit and government	.787**	−.074**	.813**	0.932
State (df = 50) F value	38.14**	45.59**	35.75**	6.82**
Constant		1.21		
Adjusted/pseudo R^2	.102	.181	.152	0.035

Notes: Regression coefficients are shown for the ordinary least squares (OLS) model of total deficiencies without the zero deficiencies. All other numbers are odds resulting from logistic regressions. The adjusted R^2 is given for the OLS model. A pseudo R^2 is shown for the logistic regression models. ADL = activity of daily living; LVN/LPN = licensed vocational nurse/licensed practical nurse; SNF = skilled nursing facility.

*$p < .05$; **$p < .01$.

vate pay rates. Confirming our hypothesis and the findings from other studies, nonprofit and government facilities were associated with fewer deficiencies (Aaronson et al., 1994; Cohen & Spector, 1996). These facilities may be providing higher quality of care than the for-profits because they may reinvest their net revenues into the facilities. These facilities may have more staff expertise and lower turnover rates and other characteristics that were unobserved variables. On the other hand, surveyors may be more sympathetic to nonprofit and government nursing homes than the for-profit facilities.

State variations in deficiencies confirm that HCFA should pay greater attention to achieving uniformity in the state survey procedures. Lower levels of deficiencies in the northeastern region compared with other regions may indicate that facilities in the northeast have higher quality of care or that the region has weaker survey procedures. Regional differences could also be a proxy for other market factors not included in the model. It would be troubling if the differences were related to different survey procedures and/or less enforcement, because the federal program strives to ensure standard procedures and enforcement across regions. The U.S. Department of Health and Human Services, Health Care Financing Administration (1998a, 1998b) has admitted it has problems with the effective implementation of its survey process. HCFA should use findings from this study to examine the differences in deficiencies across states and regions and to eliminate variation in the survey and enforcement process.

There are important issues to be addressed concerning the quality of OSCAR data. The staffing data reported in OSCAR are collected for only a 2-week period at the time of the annual survey and generally are not audited by surveyors. Some facilities may increase their staff during the period around the survey. Thus, the reports may overstate the actual staffing in facilities. Unfortunately, no other data source on staffing across states is available. We have compared the average staffing hours reported on OSCAR for all facilities in California for the 1996–97 period with the annual staffing data submitted to California on the facility cost reports for the same period. This comparison did show that the annual nursing staffing was on average only 0.1 h lower than the OSCAR data, suggesting that the data are similar. Another limitation is that the available staffing data do not capture differences in education levels, capability, motivation, and experience of staff. It may be that these unmeasured factors—such as educational level, experience, number of nurses in advanced practice, turnover rates, and other information—are more important than the hours and spe-

cific types of staff used. Staffing reports made on a quarterly basis would be more informative than those made for a 2-week period. Thus, if staffing has a limited effect, it may reflect some limitations in the data. Given the importance of the issues surrounding staffing and its relationship to quality, HCFA should undertake a more detailed, rigorous study of the appropriateness of current staffing data and the accuracy and representativeness of OSCAR staffing data.

Another issue is whether the deficiencies are an accurate reflection of quality in the facilities. The identification of quality problems in nursing homes is a difficult task for surveyors. As discussed previously, there are good reasons to believe that the deficiencies reported do identify problems within the facilities. However, there may be additional problems that are not reflected in any deficiencies. The U.S. General Accounting Office (1998b) had independent surveys conducted by a reputable research team. The research team conducted surveys concurrently with California state surveyors and found additional deficiencies that were not identified by the California state survey agency, but they did not identify false positive deficiencies. Thus, there may be false negatives in surveyors' identification of deficiencies (see also U.S. General Accounting Office, 1999). There may, of course, also be false positives with deficiencies that are undetected.

Deficiencies for quality violations are relatively infrequent, as we have shown. Moreover, the average number of deficiencies per facility has been declining steadily from 8.8 deficiencies in l991 to 4.9 in l997 (Harrington & Carrillo, 1999; U.S. Office of the Inspector General, Department of Health and Human Services, 1999). Thus, the accuracy and measurement issues of deficiencies are even more important. If HCFA is able to improve the reliability and consistency of the survey process and the citing of deficiencies within and across states, then the relationships between independent and dependent variables may be improved.

Finally, the technology of appropriately identifying quality problems in nursing facilities can be improved. It is hoped that the use of new quality indicators (QIs) will improve the identification of problems (Zimmerman, et al., 1995). These indicators, developed by Zimmerman and colleagues (1995), identify 30 resident problems with data from the Minimum Data Set (MDS) assessment forms that must be completed for each resident upon admission and annually, with changes in conditions reported to HCFA on a quarterly basis. Such MDS data on individual residents, although it is also not regularly audited by state surveyors, should be more accurate than the resident data reported on the OSCAR report. Once the MDS data become available for researchers, the data should be a valuable tool in studying the relationships between staffing, resident characteristics, and facility characteristics.

The reporting of QIs will allow surveyors and researchers to identify the condition of residents upon admission and then over time. Future studies should examine changes in resident conditions over time, controlling for the initial condition of residents. This may improve the accuracy of detecting true quality problems that are the result of poor care, taking into account the resident's initial condition and/or resident co-morbidities. Surveyors can use the QIs to target individual residents in facilities where potential quality of care may be occurring so that surveyors can examine these residents during the survey process. Surveyors can also use the QIs to identify specific facilities with higher or lower proportions of residents with potential quality problems, and this technology may improve the accuracy of identifying problems and issuing deficiencies. Researchers should continue to explore the relationships among staffing, resident characteristics, facility characteristics, and quality. As databases are improved, perhaps the relationships may become more clearly understood.

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