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An Analysis of Nursing Home Quality Measures and Staffing

Gregory L. Alexander, PhD, RN

Sinclair School of Nursing, University of Missouri, Columbia

Abstract

Purpose—The purpose of this retrospective study was to evaluate nursing home quality measures (QMs) available in a national database called Nursing Home Compare. The aim was to determine whether differences in QM scores occurred with changing staffing-level mix.

Subjects—All Missouri nursing home facilities were included for the analysis of the 14 QMs downloaded in February 2004.

Methods—Analyses of variance were used to examine differences in the dependent QM scores; the independent range of staffing levels for 3 disciplines, certified nurse assistant (CNA), licensed practical nurse (LPN), and registered nurse (RN), was analyzed on the basis of their number of hours per resident per day worked in the nursing home. Planned contrasts and post hoc Bonferroni adjustments were calculated to further evaluate significance levels. Finally, residents were used as a covariate to determine effects on significant analyses of variance.

Results—Care is proportionate to the percentage of CNA/LPN/RN staffing-level mix, with 2 long-stay QMs (percentage of residents who lose bowel or bladder control and percentage of residents whose need for help with activities of daily living has increased) and 2 short-stay measures (percentage of residents who had moderate to severe pain and percentage of residents with pressure ulcers) revealed differences in mean quality scores when staffing levels changed.

Keywords

nursing home; outcomes; quality measures; staffing

The nursing home setting is receiving heightened attention because regulatory approaches have not brought about consistent quality of care for very vulnerable and fragile elderly residents.¹ Public scrutiny has caused increased regulation; however, it remains unclear whether increased regulation has resulted in organizational performance improvements. Researchers have suggested that the current nursing home environment is one of mistrust and skepticism.² General apprehension among staff, residents, and administrators is a prevalent behavior noted in nursing home research to date.^{3,4} The quality of nursing home care has been of significant concern during the last 3 decades and continues to remain a concern at the beginning of this century.

The purpose of this retrospective study was to evaluate nursing home quality measures (QMs), which indicate areas of resident care where potential concerns exist. The QMs, derived from Minimum Data Set (MDS) evaluations, provide objective measures to compare the population (percentage) of residents who enter a nursing home facility for postacute care or long-term care. Information from this database was used to compare how well nursing home staff was able to manage different aspects of care such as pressure ulcer management,

assisting residents with activities of daily living, and for providing pain relief. Furthermore, data linking both QM outcomes with staffing from the same data set provided important clues into what skill sets are needed to maintain quality. The QMs used in this evaluation were obtained from the Nursing Home Compare national database, which contains QMs from all nursing home facilities in the United States; this analysis included only Missouri facilities. Facility-level data, downloaded from Nursing Home Compare in February 2004, were used to determine whether differences in QMs occurred with changing staffing levels (certified nurse assistant [CNA], licensed practical nurse [LPN], and registered nurse [RN]), also reported in Nursing Home Compare.

BACKGROUND

Nursing home population

Consumers of nursing home care are largely elderly persons in the oldest age groups. In 1999, 46.5% of nursing home residents were 85 years and older; 43.8% were between 65 and 85 years. Twenty-seven percent of residents stayed for 3 years or more and 30% stayed from 1 to 3 years in the nursing home.⁵ The low percentages of residents who were able to perform activities of daily living for eating (53%), walking (21%), dressing (13%), and bathing (6%) are reflective of the extensive care needs for residents in these facilities.⁵ Individuals in nursing homes fall within the following groups: short term receiving acute care management and rehabilitation; short term for terminal/hospice care; long term with primarily chronic health problems; long term with dementia; and long term with both chronic problems and dementia.⁶ Stevenson⁷ contends that the long-term care population is increasingly older, frail, and cognitively impaired.

Nursing home staffing

The Institute of Medicine⁸ identified positive relationships between nursing staffing and quality of care and reached the conclusion that there is a strong need to increase overall levels of nursing staff in nursing homes. The conclusion of the Institute of Medicine report was that more research was needed to re-fine the relationship between staffing and resident outcomes.⁸ Studies on staffing and quality of care support the contention that both the level of staffing and the mix of staff are directly related to quality.^{9–12} In nursing homes, staffing issues are often studied as costs associated with care delivery.¹³ Exploring the costs in nursing homes has led to inconsistent conclusions.^{13,14} The consideration of how staffing levels specifically should be changed in light of the highly sensitive issue of cost has precluded policy formulation and regulation.

The Centers for Medicare & Medicaid (CMS) has funded research to investigate how innovative information technologies implemented in nursing homes enabled all levels of nursing staff to deliver quality resident care. In the CMS study, nursing home quality increased because of improved charting of sensitive care actions of nurses and nurse assistants documented at the bedside.¹⁵ The consideration of how staffing and quality are linked was also considered by Bowers and colleagues¹¹; inadequate staffing prevented the nursing staff from developing or demonstrating relationships with residents, thus preventing high-quality care. The prevailing view of consumers is that nursing homes must have enough staff, consistent staff, and low turnover.¹⁶ Researchers completing this study hypothesized that nursing home staffing levels and mix would directly influence QMs.

Quality measurements

The CMS began an initiative on Nursing Home Compare in 2002 to develop an enhanced set of QMs that would make it easier for consumers to compare quality, deficiency, and staffing information about the nation's 17 000 Medicare- and Medicaid-certified nursing homes.¹⁷

Currently, there are 19 total QMs available in Nursing Home Compare, including 14 long-stay and 5 short-stay measures (Table 1). Long-stay measures are obtained on patients who enter a nursing home because they are not able to care for themselves at home.¹⁸ These residents usually remain in the nursing home for several months to several years. Short-stay measures are obtained on patients who are admitted to a nursing home facility for a stay less than 30 days. Acute care patients typically are just released from a hospital or involve high-intensity rehabilitation or clinically complex care.¹⁹

The Nursing Home Compare database provides vital information that is available to all researchers, consumers, and nursing home facilities to compare nursing home services rendered. The database contains facility-level information generated from quarterly reports; examples of data available are staffing information, facility survey dates and citation histories of reported deficiencies in care delivery, demographic data such as ownership type, percentage of occupied beds, total number of residents, etc. At the time of this research, the national database, also known as the Minimum Data Set Repository, contained information about 14 QMs collected in nursing homes.¹⁹ Five more QMs have been implemented and are required to be reported by nursing homes since this study was conducted. The MDS is collected at regular intervals for every resident in a Medicare- or a Medicaid-certified nursing home. Information is collected on the resident's health, physical functioning, mental health status, and general well-being. These data are used by the nursing home to assess the needs and develop a plan of care unique to each resident. All of these data are reported by the nursing homes themselves. They are reviewed by nursing home inspectors, but not formally audited to ensure that they are accurate.¹⁷

METHODS

Sample

For this retrospective study, the national database was downloaded from the Nursing Home Compare site in February 2004. Access, a relational database, was used to query the large data set to capture all the QM information for Missouri nursing homes ($N = 510$). Four folders within the database were included in the data set and used for this study. These folders hold information about nursing homes, nursing home residents, nursing home inspection results, and nursing home staffing.

Procedures

Initially, all 14 QMs were evaluated to determine mean scores for each QM across the range of providers in the data set. Facilities in the data set that reported having no information available or whose numbers of residents were too small to report were not included in this analysis. Omitting facilities with little or no data reported was necessary because there was no way to distinguish between facilities that have no information available and facilities that have low QM scores. This was a limitation for this study.

As a gross estimate, the mean QM scores (reported as percentage of residents) were used to determine QMs that would be included in this analysis. Only QMs that had a more than 10% resident's mean score were included, indicating greater than 10% of the residents within the facilities reporting fell into that category. Staffing data described in hours per resident per day for each of 3 disciplines CNA, LPN, and RN were recoded by using 3 cut points to create 3 staffing levels for each discipline (Table 2). Using cut points, the range of staffing hours for each discipline was divided into thirds to establish low, medium, and high staffing levels for each discipline. Staffing data and QM data from the February 2004 data set were analyzed for this study.

Analyses of variance (ANOVAs) using SPSS (SPSS Inc, Chicago, Illinois) were used to determine differences in dependent QM scores; the range of staffing levels for CNA/LPN/RN staff based on their number of hours per resident per day that each discipline worked in the nursing home was the independent variable. If significance levels were detected, planned contrasts using simple contrast and post hoc Bonferroni adjustments were calculated to further evaluate the significance levels. In the final analysis, the number of residents was used as a covariate to determine its effects on the differences detected in significant ANOVAs.

RESULTS

Sample distributions

The QM scores were checked for outliers and normality. The QM associated with low-risk residents who lose bowel or bladder control (incontinent) was the only QM that indicated normality was present using the Komogorov-Smirnov statistic ($P = .080$). The remainder of the plots appeared to be positively skewed.

Seven QMs had mean scores above 10 (see Table 1). This included 5 QMs from the long-stay category: (1) percentage of residents whose need for help with activities of daily living has increased, (2) percentage of high-risk residents who have pressure sores, (3) percentage of residents who have become more depressed or anxious, (4) percentage of low-risk residents who were incontinent, and (5) percentage of residents whose ability to move in and around their room got worse; and 2 QMs from the acute category: (6) percentage of short-stay residents who had moderate to severe pain and (7) percentage of short-stay residents with pressure sores. The highest percentage of residents were long-stay residents (35.8%) who fell into the category of being low risk and were incontinent, followed by short-stay residents (24.8%) who were experiencing moderate to severe pain during their stay in the nursing home.

Using our cut points, staffing levels for CNAs in Missouri nursing homes are much higher than either LPN or RN staffing levels, ranging from less than 2.14 hours per resident per day to more than 2.59 hours per resident per day in some facilities. LPNs have nearly a 2:1 ratio of hours per resident per day in comparison with RNs in Missouri nursing home facilities. RNs spend a little less than 1 hour per resident per day in some of the most highly staffed facilities, whereas spending less than ½ hour in facilities with less RN staffing (see Table 2).

Analyses of variance

The ANOVA for the QM percentage of residents whose need for help with activities of daily living showed some significant main effects in the RN and LPN groups, $F_{2,374} = 3.48$, $P = .032$ and $F_{2,374} = 3.45$, $P = .033$, respectively (Table 3). Levene's test for normality was not met, indicating that the groups did not have homogeneous variance. Effect size was small at 0.02; power was 0.6. The adjusted R^2 value was in-significant at 3%, indicating that little of the variance in scores could be explained by the differences in number of hours per resident per day worked by each group. Planned contrasts for the RN group indicated a statistically significant difference in level 3 from levels 1 and 2, $F_{2,374} = 3.48$, $P = .032$. Planned contrasts for the LPN group also showed significant differences in level 3 from levels 1 and 2, $F_{2,374} = 3.45$, $P = .03$. Post hoc Bonferroni test also indicated a significant difference in levels 1 and 3 of the RN and LPN groups, $P = .005$ and $P = .03$, respectively. Figure 1 illustrates the means plots for these findings.

The ANOVA for the QM percentage of high-risk residents with pressure sores did not detect significant interactions. Levene's test for normality of variance was not significant ($P = .824$), which indicated that there is homogeneity of variance across the groups. Independence

of observations was presumed in the sample. The interaction between CNAs, LPNs, and RNs was not significant, $F_{8,152} = 0.539$, $P > .05$. The effect size was between small and medium; partial η^2 value was 0.04.

ANOVAs for both the percentage of residents who were more depressed or anxious and the percentage of residents whose ability to move in and around their room got worse were not significant. Levene's test for normality of variance was met in both cases ($P > .05$).

ANOVAs for the QM percentage of low-risk residents who were incontinent indicated significant differences in levels of the CNA group, $F_{2,318} = 3.94$, $P < .05$. Observed power was calculated at 0.70. Effect size was small 0.02. Levene's test for normality of variance was nonsignificant ($P > .05$). Planned contrasts revealed that there was a significant difference between the means for CNAs with high hours per resident per day and the medium and low hours per resident per day. Post hoc Bonferroni test revealed a significant difference between levels 1 and 3 of the CNA group ($P = .001$). Estimated marginal means plots in Figure 1 show a complex set of plots for this QM, which illustrates the variability in scores for CNAs in comparison with other groups. ANOVA measures are displayed in Table 3.

The ANOVA for the QM percentage of short-stay residents who had moderate to severe pain indicated significant differences in levels of the LPN group, $F_{2,231} = 4.74$, $P = .01$ (see Table 3). Levene's test for homogeneity was not significant ($P = .088$). The adjusted R^2 value was only 5%. Effect size was between small and medium at 0.04. Power was 0.78. Planned contrasts revealed a significant difference, $F_{2,231} = 4.74$, $P = .010$, between LPNs with a high number of hours per resident per day worked in comparison with LPNs with a medium and low number of hours per resident per day worked. There were also significant differences in levels of the LPN group that had medium and low numbers of hours per resident per day worked. A significance of $P = .008$ was found for each level. Post hoc Bonferroni correction analysis also indicated significant differences between each level of LPNs, with significance levels ranging from $P = .002$ to $P = .008$. Bonferroni corrections to $P = .01$ was also significant for differences between levels 1 through 3. Figure 1 contains the plots of the interactions between 3 LPN levels with other nursing groups. The interactions that are noted on the plots in Figure 1 indicate that as the RNs' number of hours per resident per day decrease, the hours are being replaced by LPNs and subsequently there is an increase in the mean scores of approximately 12 points. The significance with post hoc Bonferroni correction analysis was $P = .05$ and $P = .01$, respectively. Figure 1 demonstrates the interactions occurring between selected QMs and staffing levels.

Finally, results of the ANOVA for the QM percentage of short-stay residents with pressure ulcers found significant differences between levels of the RN group, $F_{2,320} = 4.05$, $P < .05$, and the LPN group, $F_{2,262} = 3.32$, $P < .05$; furthermore, there was significant differences between QM scores of facilities and number of hours per resident per day worked by LPNs and CNAs, $F_{4,191} = 2.41$, $P = .05$. Post hoc Bonferroni correction analysis indicated significant differences between levels of the RN group with low and high staffing rates and between levels of the RN group with medium and high staffing rates ($P \leq .004$); no significant differences in QM scores existed between low and medium staffed facilities. Among the levels of the LPN group, post hoc Bonferroni correction analysis indicated significant differences in QM scores between facilities with medium and high staffing levels ($P = .002$).

An ANOVA with the covariate, number of residents per facility, was investigated to determine if there were any differences in the mean percentages of groups already analyzed previously. The only significant interaction noted with the covariate occurred in the QM

percentage of short-stay residents who had moderate to severe pain. The number of residents per facility was significant ($P = .001$).

DISCUSSION

Statistical measures in nearly half of the nursing QMs evaluated in this study revealed significant differences between the mean percentages of residents, with a quality concern in facilities with contrasting staffing levels. Specifically, QMs most sensitive to staffing measures in this study include long-stay, low-risk residents who had become incontinent, residents whose need for help with activities of daily living has increased, short-stay residents who are having moderate to severe pain, and short-stay residents with pressure ulcers. For each of these QMs, plots shown in Figure 1 reveal differences in the means of CNA and RN/LPN groups, respectively. For example, the plots for low-risk residents who were incontinent indicate that as the level of RN staffing is held constant and the number of CNA staff increases, the percentage of residents who were incontinent also increases (~5%). The same phenomenon persists when the number of LPN hours per resident per day is held constant as the number of CNA staff increases.

More residents were noted who had increased need for help with activities of daily living when licensed nurses were available to assess their status. The plots of significant findings in Figure 1 indicate that as RN levels rose enabling licensed staff members to spend at least 15 more minutes per day with residents, they were able to detect more resident needs that needed to be met; in addition, as LPN levels rose, they were also able to assess more needs, although it appears to take less time for a more highly trained person to evaluate needs than other kinds of staff.

Likewise, the percentage of short-stay residents who have moderate to severe pain appears to increase dramatically (~10%) in facilities that have constantly lower levels of RN staffing (<0.30 hours per resident per day). In these same facilities, the percentage of short-stay residents with pain continues to rise, despite even higher levels of LPN staffing. In facilities that are mostly staffed by LPNs and CNAs, fewer short-stay residents with pain issues are found when both of these disciplines are understaffed; when LPNs and CNAs consume most of the hours per resident per day, there is a substantial increase in the number of short-stay residents experiencing pain.

Facilities reporting having 45 minutes or less of RN time per resident appear to have fewer pressure ulcers than facilities reporting higher RN staffing levels. Extreme levels of LPN staffing from low to high appear to also adversely affect the occurrence of pressure ulcers in short-stay residents (Fig 1). When comparing the occurrence of pressure ulcers in short-stay residents, as LPN time is held constantly at the lower end (<0.53) and CNAs hours per resident per day increase, the frequency of pressure ulcers in short-stay residents increases by more than 6%. In contrast, as licensed LPNs are consistently employed more often at rates greater than 0.73 hours per resident per day and the number of CNAs is also increased, the outcome is reversed, resulting in 3% less short-stay residents experiencing pressure ulcers.

These findings would be consistent with the level of care that is required of staff to care for persons who are incontinent, residents who have increased support needs, persons experiencing increased pain, and persons developing pressure ulcers. Specifically, toileting activities and assistance with activities of daily living (ie, bathing, eating, etc), while evaluated by RNs, are mostly carried out by CNAs. Therefore, lower staffing levels in this category of staff would adversely affect the scores. This may also be evident in the interaction between the different staffing levels of RNs and LPNs, as shown in Figure 1, where the scores appear to

increase significantly with higher staffing levels of LPNs rather than the more highly trained RNs. Furthermore, persons who are experiencing pain typically require the assistance of professional nursing personnel to assist in pain relief measures (ie, medication administration). Lower levels of staffing hours per resident would adversely affect the scores associated with this parameter because if there is no staff to provide pain relief measures, patients will experience more pain.

LIMITATIONS

Limitations of this evaluation are that the nursing homes included in this study were not controlled for by ownership level or bed size. Therefore, nursing homes that are privately owned versus nursing homes that are nonprofit making, large or small, were compared with each other. There may be significant differences in how these types of nursing homes manage their patients organizationally. This may be a confounding variable in the findings. Another limitation is that nursing homes that have frequent citations for deficiencies in care versus nursing homes that have infrequent citations in deficiencies were not controlled. This information is available as another data set in Nursing Home Compare. There may be significant differences in the care provided by nursing homes that have frequent citations for deficiencies. It is an assumption that these nursing homes would have higher QM scores because they are receiving deficiency notices issued by the state for inadequate care. This study is also limited in generalizability because it includes facilities in 1 state only. Finally, it is limited in scope; the data include information reported only during the first quarter of 2004. More longitudinal work over successive quarters is needed to see whether staffing continues to affect QMs in these nursing homes.

CLINICAL IMPLICATIONS

This study provides further evidence of the importance of staffing levels and mix when caring for the extensive needs of the nursing home patients. All types of health care providers are needed in the right staff-to-resident ratio to meet the needs of frail elders in nursing homes. Inadequate staffing affects the ability of residents to receive the basic care that they need to maintain the highest level of well-being possible.⁹

One possible solution for nursing home leaders is to embrace new ideals for operating their homes, instituting new methods of getting work done, and capitalizing on the intellectual capital in the facility. Nursing home staff armed with appropriate knowledge, tools, and administrative support can readily overcome some of the barriers encountered for individual residents before problems arise.²⁰ For example, providing training about and access to current evidence-based practice guidelines for commonly recognized problems could provide the health care provider with a set of responses or clinical paths to consider for treatment of residents more quickly and effectively before problems arise. Access to these tools enables better decision making for care that should be delivered to the right resident, at the right time, and in the right situation.

Although overlooked in most nursing homes,^{21,22} expectations for information technology are that they would improve staff productivity, reduce errors, and improve health of residents.²³ Improvements in staff productivity would occur because of enhanced connectivity between health care providers at the point of care.²¹ Improved communication through wireless handheld communications could provide more efficient use of staff time by reducing the face-to-face contact that nursing home staff now needs to communicate about residents. Furthermore, this form of communication could be structured to include evidenced-based messages that inform providers about recommended procedures, policies, and for training purposes. Redesigning care delivery services in this way allow staff

members to organize their time so they spend more time with patients at the bedside. Information systems are now being implemented in nursing homes that have messaging systems that enable all types of health care providers to send messages electronically about resident care from anywhere in the nursing home.²⁴ Research in these settings have shown that although costs may increase during the implementation of these information technology systems, better patient outcomes can be achieved because of improved efficiencies.¹⁵

CONCLUSION

Nursing home QMs are an important means to determine the level of quality being offered by nursing homes. QMs offer a standardized means to evaluate the quality of care given by a facility. Furthermore, consumers, researchers, and organizations that work closely with nursing homes can access large data sets that provide information regarding quality of nursing care. This information can have great impact on a consumer's ability to choose a nursing home or develop best practice standards within the nursing home setting.

It is important to continue to evaluate quality of care in nursing homes with these newly modified QMs. Strategies for quality improvement must go beyond the basic regulatory approach. Utilization of large data sets such as Nursing Home Compare can help us build strategies for quality improvement within the nursing home community.

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References

1. Kovner C. The impact of staffing and the organization of work on patient outcomes and health care workers in health care organizations. *Jt Comm J Qual Improv* 2001;27(9):458–468. [PubMed: 11556255]
2. Vogelsmeier A, Scott-Cawiezell J. A just culture: the role of nursing leadership. *J Nurs Care Qual* 2007;22(3):210–212. [PubMed: 17563588]
3. Singh DA, Schwab RC. Predicting turnover and retention in nursing home administrators: management and policy implications. *Gerontologist* 2000;40(3):310–319. [PubMed: 10853525]
4. Kash BA, Castle NG, Phillips CD. Nursing home spending, staffing and turnover. *Health Care Manag Rev* 2007;32(3):253–262.
5. Decker, FH. *Nursing Homes, 1977–1999: What Has Changed, What Has Not?*. Baltimore: National Center for Health Statistics; 2005.
6. Kane, R.; Ouslander, J.; Abrass, I. *Essentials of Clinical Geriatrics*. 4. New York: McGraw-Hill; 1999.
7. Stevenson DG. Is a public reporting approach appropriate for nursing home care? *J Health Polit Policy Law* 2006;31(4):774–810.
8. Institute of Medicine. *Improving the Quality of Long-Term Care*. Washington DC: National Academies Press; 2001.
9. Dyck MJ. Nursing staffing and resident outcomes in nursing homes: weight loss and dehydration. *J Nurs Care Qual* 2007;22(1):59–65. [PubMed: 17149087]
10. Cherry RL. Agents of nursing home quality of care: ombudsmen and staff ratios revisited. *Gerontologist* 1991;31(3):302–308. [PubMed: 1879706]
11. Bowers BJ, Esmond S, Jacobson N. The relationship between staffing and quality in long-term care facilities: exploring the views of nurse aides. *J Nurs Care Qual* 2000;14(4):55–64. [PubMed: 10881450]

12. Scott-Cawiezell J, Pepper GA, Madsen RW, Petroski G, Vogelsmeier A, Zellmer D. Nursing home error and level of staff credentials. *Clin Nurs Res* 2007;16(1):72–78. [PubMed: 17204809]
13. Hicks L, Rantz MJ, Petroski GF, Mukamel DB. Nursing home costs and quality of care outcomes. *Nurs Econ* 2004;22(4):178–192. [PubMed: 15382393]
14. Hicks LL, Rantz MJ, Petroski GF, et al. Assessing contributors to cost of care in nursing homes. *Nurs Econ* 1997;15(4):205–213. [PubMed: 9282032]
15. Rantz MJ.; Scott-Cawiezell, J.; Alexander, GL., et al. Evaluation of the Use of Bedside Technology to Improve Quality of Care in Nursing Facilities. Preliminary Report to the Centers for Medicare & Medicaid Services; Baltimore, MD: 2006. Report No. RFP-CMS-03-001/DB
16. Rantz MJ, Zwygart-Stauffacher M, Flesner M. Advances in measuring quality of care in nursing homes: a new tool for providers, consumers, regulators, and researchers. *J Nurs Care Qual* 2005;20(4):293–296. [PubMed: 16177578]
17. Centers for Medicare & Medicaid. Nursing Home Compare. [Accessed February 4, 2005]. <http://www.medicare.gov>
18. Medicare Quality Improvement Organization Program. Nursing Home Quality Initiative: Quality Measures Resource Manual. [Accessed May 28, 2006]. Version 5.0. <http://medqic.org>
19. Abt Associates I. National Nursing Home Quality Measures User Manual. v1.2. Cambridge, MA: US Department of Health & Human Services, Centers for Medicare & Medicaid Services; 2004.
20. Smyer M, Brannon D, Cohn M. Improving nursing home care through training and job redesign. *Gerontologist* 1991;32(3):327–333. [PubMed: 1499997]
21. Courtney KL, Demiris G, Alexander GL. Information technology: changing nursing processes at the point of care. *Nurs Adm Q* 2005;29(4):315–322. [PubMed: 16260995]
22. Alexander GL. An analysis of an integrated clinical decision support system in nursing home clinical information systems. *J Gerontol Nurs* 2008;34(2):15–20. [PubMed: 18286788]
23. Zuckerman D. Technology in health care: survey taps provider IT strategies. *Provider* June;2007 : 59–65. [PubMed: 19606782]
24. Alexander GL, Rantz MJ, Flesner M, Diekemper M, Siem C. Clinical information systems in nursing homes: an evaluation of initial implementation strategies. *Comput Inf Nurs* 2007;25(4): 189–197.

Figure 1.
Means plots for selected nursing home quality measures.

Table 1**NURSING HOME COMPARE QUALITY MEASURES WITH DESCRIPTIVE STATISTICS**

	<i>n</i>	Mean (SD)
Long-stay quality measures		
Percentage of residents whose need for help with activities of daily living has increased ^a	401	13.1 (8.14) ^b
Percentage of residents who have moderate to severe pain ^a	411	7.4 (7.30)
Percentage of high-risk residents who have pressure sores ^a	179	13.4 (7.60) ^b
Percentage of low-risk residents who have pressure sores ^a	264	2.7 (2.76)
Percentage of residents who are physically restrained ^a	419	7.7 (6.94)
Percentage of residents who are more depressed or anxious ^a	414	11.7 (7.60) ^b
Percentage of low-risk residents who lose control of their bowel or bladder ^a	345	35.8 (13.23) ^b
Percentage of residents who have/had a catheter inserted and left in their bladder ^a	411	5.3 (4.09)
Percentage of residents who spent most of their time in bed or on a chair ^a	418	2.3 (2.80)
Percentage of residents whose ability to move in and around their room got worse ^a	356	10.4 (6.78) ^b
Percentage of residents with urinary tract infection ^a	419	8.6 (5.60)
Percentage of long-stay residents given influenza vaccination during the influenza season		
Percentage of residents who were assessed and given pneumococcal vaccination		
Percentage of residents who lose too much weight		
Short-stay quality measures		
Percentage of short-stay residents with delirium ^a	252	4.8 (6.34)
Percentage of short-stay residents who have moderate to severe pain ^a	259	24.8 (15.07) ^b
Percentage of short-stay residents with pressure sores ^a	215	17.8 (9.42) ^b
Percentage of short-stay residents given influenza vaccination during the influenza season		
Percentage of short-stay residents who were assessed and given pneumococcal vaccination		

^a Quality measures available at the time of this study.

^b Mean score more than 10%, indicating more than 10% of residents reported to have this condition.

Table 2

CUT POINTS FOR CNA, LPN, AND RN HOURS PER RESIDENT PER DAY

Nursing homes (<i>N</i> = 510)	CNA hours per resident per day	LPN hours per resident per day	RN hours per resident per day
1 = Low staffing	<2.14	<0.53	<0.30
2 = Medium staffing	2.14–2.59	0.53–0.73	0.30–0.44
3 = High staffing	>2.59	>0.73	>0.44

Table 3

ANOVAs FOR SELECTED QUALITY MEASURES

Staffing mix	Low-risk residents who lose bowel control				Residents whose need for help with activities of daily living increased				Short-stay residents with moderate to severe pain				Short-stay residents with pressure ulcers			
	df	Σ^2	M ²	F	P	Σ^2	df	M ²	F	P	Σ^2	df	M ²	F	P	P
RN	2.00	459.48	229.74	1.36	.26	447.15		223.58	3.48	.032 ^a	902.41		451.21	2.08	.13	.019 ^a
LPN	2.00	431.45	215.73	1.28	.28	442.51		221.25	3.45	.033 ^a	2060.29		1030.15	4.74	.010 ^a	.038 ^a
CNA	2.00	1328.46	664.23	3.94	.020 ^a	111.53		55.76	0.87	.42	321.34		160.67	0.74	.48	1.00
RN + LPN	4.00	631.73	157.93	0.94	.44	301.56		75.39	1.17	.32	875.81		218.95	1.01	.40	.49
RN + CNA	4.00	284.44	71.11	0.42	.79	173.70		43.43	0.68	.61	421.41		105.35	0.49	.75	.27
LPN + CNA	4.00	436.42	109.11	0.65	.63	363.59		90.90	1.42	.23	418.19		104.55	0.48	.75	.050 ^a
RN + LPN + CNA	8.00	1840.32	230.04	1.37	0.21	567.52		70.94	1.11	.36	1787.37		223.42	1.03	0.42	.54
Error		53558.01	318	168.42		24009.56	374	64.20			50 192.40	231	217.28			14 809.40
Total		503263.00	345			95 451.00	401				217793.00	258				86926.00

^aP < .05.