



JAMDA

journal homepage: www.jamda.com

Original Study

Randomized Multilevel Intervention to Improve Outcomes of Residents in Nursing Homes in Need of Improvement

Marilyn J. Rantz PhD, RN, FAAN^{a,*}, Mary Zwygart-Stauffacher RN, PhD, FAAN^b, Lanis Hicks PhD^c, David Mehr MD, MS^d, Marcia Flesner PhD, RN^e, Gregory F. Petroski PhD^f, Richard W. Madsen PhD^f, Jill Scott-Cawiezell RN, PhD, FAAN^g

^a Sinclair School of Nursing, University of Missouri, Columbia, Missouri

^b College of Nursing, University of Wisconsin, Eau Claire, Wisconsin

^c Department of Health Management and Informatics, School of Medicine, University of Missouri, Columbia, Missouri

^d Department of Family and Community Medicine, School of Medicine, University of Missouri, Columbia, Missouri

^e Sinclair School of Nursing, University of Missouri, Columbia, Missouri

^f Department of Statistics, School of Medicine, University of Missouri, Columbia, Missouri

^g College of Nursing, University of Iowa, Iowa City, Iowa

A B S T R A C T

Keywords:

Randomized clinical trial
nursing homes
outcomes of care
cost analysis
quality improvement
staff retention
working conditions
advanced practice nurses

Objectives: A comprehensive multilevel intervention was tested to build organizational capacity to create and sustain improvement in quality of care and subsequently improve resident outcomes in nursing homes in need of improvement.

Design/Setting/Participants: Intervention facilities ($N = 29$) received a 2-year multilevel intervention with monthly on-site consultation from expert nurses with graduate education in gerontological nursing. Attention control facilities ($N = 29$) that also needed to improve resident outcomes received monthly information about aging and physical assessment of elders.

Intervention: The authors conducted a randomized clinical trial of nursing homes in need of improving resident outcomes of bladder and bowel incontinence, weight loss, pressure ulcers, and decline in activities of daily living. It was hypothesized that following the intervention, experimental facilities would have higher quality of care, better resident outcomes, more organizational attributes of improved working conditions than control facilities, higher staff retention, similar staffing and staff mix, and lower total and direct care costs.

Results: The intervention did improve quality of care ($P = .02$); there were improvements in pressure ulcers ($P = .05$) and weight loss ($P = .05$). Organizational working conditions, staff retention, staffing, and staff mix and most costs were not affected by the intervention. Leadership turnover was surprisingly excessive in both intervention and control groups.

Conclusion and Implications: Some facilities that are in need of improving quality of care and resident outcomes are able to build the organizational capacity to improve while not increasing staffing or costs of care. Improvement requires continuous supportive consultation and leadership willing to involve staff and work together to build the systematic improvements in care delivery needed. Medical directors in collaborative practice with advanced practice nurses are ideally positioned to implement this low-cost, effective intervention nationwide.

Copyright © 2012 - American Medical Directors Association, Inc.

Researchers have thus far conducted only limited and narrowly focused intervention studies to improve quality of care in nursing facilities. To date, none have tested and reported multilevel

interventions that comprehensively address quality of care. Existing narrowly focused studies informed this multilevel intervention designed to guide clinical practice changes that need to occur to improve care quality. Some researchers have found it possible to reduce the use of physical restraints without serious injuries to residents.^{1,2} Others have shown that promoting exercise, strength training, and ambulation can be effective for nursing home residents, even those who are frail and deconditioned.^{3–5} Residents, even those with dementia, can improve functional self-care

Evaluation activities were supported by the National Institute for Nursing Research (NINR) of the National Institutes of Health (NIH) grant 5 R01 NR009040-05. Opinions are those of the authors and do not necessarily represent NINR.

* Address correspondence to Marilyn J. Rantz, PhD, RN, FAAN, S406 Sinclair School of Nursing, University of Missouri, Columbia, MO 65211.

E-mail address: [rantzm@missouri.edu](mailto:rantz@missouri.edu) (M.J. Rantz).

abilities.^{6,7} Falls and serious injuries can be reduced,^{8,9} and risks of skin breakdown and pressure ulcers can be minimized.^{10,11} Residents' nutrition and hydration can be improved and weight loss can be minimized.^{12–14}

Intervention studies have consistently demonstrated improvements in incontinence.^{15–18} However, some researchers have reported that it is difficult for nursing home staff to maintain toileting interventions after research staff leave^{19,20} and that proper follow-through with toileting care requires staff-management systems.¹⁵ Findings of these and other clinical studies were used to prepare clinical materials and the basic care systems designed in the intervention to reinforce staff follow-through with care. It is important to note that the intervention procedures used in the majority of the clinical intervention studies were of short duration—hours, days, weeks, or a few months. Although short durations are appropriate for testing narrowly focused interventions, the multilevel intervention tested in this randomized study was 2 years to ensure that managers and staff could adopt and maintain improved care-delivery practices.

There have been limited numbers of more broadly focused intervention studies in nursing homes, such as those that revealed the effectiveness of advanced practice nurses.^{21–23} Only two studies in nursing homes have attempted quality-improvement interventions focused across all care systems, and both demonstrated improvements in resident outcomes: mobility and constipation²⁴ and falls, behavioral symptoms, little or no activity, and pressure ulcers.²²

Neither of these studies systematically addressed the critical issues of leadership, communication, or commitment to group process for direct-care decision-making (key findings in our preliminary studies to prepare for this research²⁵) that are important features of this multilevel intervention. A review of the effectiveness of organizational interventions for older persons concluded that “organizational interventions are potentially powerful methods to influence healthcare and maintain health status of older people.”^{26(p.416)} The review also concluded that “changing systems of care requires major commitment and willingness to take risks by administrators and clinicians.”^{26(p.423)}

The theoretical model for the multilevel intervention tested in this study is grounded in “getting the basics of care done,” key to resident outcomes from preliminary studies.²⁷ To achieve “getting the basics of care done,” other organizational attributes are needed, including consistent nursing leadership, consistent administrative leadership, team and groups process focus, and an active quality improvement program.

Other theoretical underpinnings of the multilevel intervention are complexity theory, the emerging theory of organizations as complex adaptive systems (CAS).^{28,29} Informal networks are key to the CAS, as agents interact with each other and the environment, get input and send outputs with some or all of the others in a network, and self-organize connections among people within and across the boundaries of a network.³⁰ The intervention is based on the assumption that nursing facilities are CAS: The research nurse worked with facility staff to increase the capacity of their organizations to create sustained improvement by drawing them into interacting groups that are capable of self-organizing to implement different clinical practices to improve resident outcomes. Improvement in outcomes and organizational cost-effectiveness has been demonstrated when involving nurses, physicians, and other healthcare professionals in decision-making.^{31–33} The intervention was designed so that the research nurse involved the staff, nurses, and other healthcare professionals in decision-making as part of the intervention. The elements of Kotter's model³⁴ were also used; this model has been suggested by other researchers³⁵ as a practical guide for leading organizational change in long term care.³⁶ Using the

elements of change, the research nurse worked within the CAS of the nursing home to ensure the key elements for sustaining change were addressed.

Based on these theoretical underpinnings and research findings, a randomized clinical trial was designed to test an experimental intervention focused on building organizational capacity to create and sustain improvement in quality of care and, subsequently, improve resident outcomes in nursing homes in need of improvement. Six hypotheses were proposed. Experimental (intervention) facilities will have:

1. Higher quality of care than control facilities
2. Better resident outcomes for bladder and bowel incontinence, weight loss, pressure ulcers, and decline in ADL than control facilities
3. More organizational attributes of improved working conditions than control facilities
4. Higher staff retention than control facilities
5. Staffing and staff mix that are similar to control facilities
6. Lower total and direct-care costs than control facilities

Methods

A randomized, two-group, repeated-measures design was used to test the 2-year multilevel intervention in nursing homes needing to improve quality of care and resident outcomes.

Sample

The population of nursing homes was limited to those in Missouri within a 103-county, 3-hour driving radius of the project-coordinating site. This area encompassed two large urban cities, St. Louis and Kansas City, as well as rural and metropolitan areas. Qualified homes were those that needed to improve resident outcomes of care as measured by Minimum Data Set (MDS) Quality Indicator (QI) scores above the 40th percentile on at least three of four selected resident outcome measures for two consecutive 6-month periods of MDS data. Because QIs are problem-based scores, low scores are better, so requiring that facilities scored above the 40th percentile ensured study homes had sufficient room for improvement to detect the effect of the intervention. Using two consecutive 6-month periods of MDS data enhanced QI score stability for the selection process.³⁷ The four QIs, bladder and bowel incontinence, weight loss, pressure ulcers, and decline in ADL, are sufficiently prevalent in nursing homes, amenable to nursing intervention, and sensitive to quality of care.³⁷ Based on this analysis, 155 of the 356 certified skilled nursing homes within the 103-county driving radius were qualified for recruitment.

To avoid facilities from the same owner being assigned to both intervention and control groups, we first randomly assigned owners of facilities in the population of qualified facilities to either control or intervention groups. Then, we randomly contacted qualified facilities to participate and, when they agreed, assigned them to the group designation based on owner. We continued random assignment until the groups were full. The enrollment was rolling, which allowed for oversampling as some homes dropped out due to changes in leadership/ownership after initially agreeing to participate. We oversampled to 38 intervention and 34 controls to ensure we had a minimum of 29 to complete the 2-year intervention to achieve 80% power for outcome analysis. This plan was successful and 29 facilities in each group finished the study.

Table 1 displays the remarkably similar facility demographics of the intervention and control groups. Acuity of the residents in the nursing homes in each group was not significantly different

Table 1
Facility Demographics for Intervention and Control Groups

	Finished Study	Bed Range	Member of Chain	For Profit	Not for Profit	Government	Metropolitan	Urban	Rural	Baseline Acuity RUGs III
Control	29	36–300	16	20	6	3	16	9	4	.97
Intervention	29	52–246	15	19	5	5	14	10	5	.98

RUGs III, resource utilization groups.

($P = .51$) at the beginning of the study using the Resource Utilization Group hierarchical classification method (www.interrai.org)³⁸ that is commonly used in nursing homes. Nor were there group, time, or interaction effects at study end using ANOVA that was corrected to accommodate the nested data structure of residents within homes.³⁹

Intervention

The multilevel intervention was designed to guide nursing home staff to build systems of good care practices and develop leaders in the facility to foster organizational working conditions shown to enhance staff performance and improve resident outcomes. The multilevel intervention targeted three levels of staff responsible for operating a nursing facility: owners, nursing and administrative facility staff, and direct-care staff. First, the research nurse met with facility administrators and owners selected for the intervention to explain it and gain their cooperation for the 2-year study. Owners were asked, at least for the duration of the study, to (1) provide consistent nursing and administrative leadership, (2) adopt the elements of change (EC) into their management practices, and to actively support and encourage (3) the use of team and group processes for decision-making affecting resident care, (4) the use of a quality-improvement program and (5) the efforts of staff to focus on performing the basics of care, including ambulation, nutrition and hydration, toileting, bowel regularity, preventing skin breakdown and managing pain. (Note, these are the theoretical elements from our prior research.^{25,27}) Figure 1 illustrates the intervention in a scenario that also annotates the use of the Kotter's Elements of Change.³⁴

A detailed Intervention Manual designed with quality improvement tools to guide the intervention and two textbooks^{40,41} were provided to leadership of each intervention facility. Further detail of stakeholder participation, key intervention components, the reinforcement processes, and the theoretical underpinnings for the multilevel intervention are given in Appendix 1 (posted online at www.jamda.com). Facilities were assigned a research nurse who consulted monthly on-site for 1 to 4 hours (average was 2 hours). Hours varied depending on day-to-day events at facilities; for example, staffing problems sometimes interfered with scheduled meeting plans or state survey staff would arrive unannounced. The research nurse would flexibly shift to more on-unit observation or more face-to-face informal interaction with team members and leaders, rather than specific meetings away from the units. Team members were solicited by facility leaders, typically by the Director of Nursing and/or the administrator. Teams often included the MDS coordinator, who helped by printing federal quality indicator reports from the MDS information transmitted by the facility. These reports were used by the teams to identify their facility's specific potential problems with resident outcomes, such as incontinence, weight loss, etc.

The attention control group received monthly videotaped in-services and reading materials about aging and physical assessment of elders, topics that were NOT directly related to quality-improvement strategies. These educational materials were designed to be of sufficient value to attention control facilities to retain them in the study. Contact with control facilities paralleled

the intervention group. Educational materials were mailed monthly to each facility, and the co-principal investigator called each facility monthly to answer any questions about the materials. These monthly contacts avoided advising the use of quality-improvement strategies or the focus on the care basics required in the intervention group.

Analyses and Results

Quality of Care

It was anticipated that quality of care would improve in intervention facilities. The Observable Indicators of Nursing Home Care Quality (OIQ) is an instrument developed to measure quality of care following a brief 30-minute inspection of a nursing home.^{42–44} The OIQ has been field tested in 530 nursing homes in three states, undergone psychometric testing and reduction to 30 reliable and discriminating items that are scored 1 to 5 with higher scores indicating better quality of care. It has seven first-order factors that group into two second-order factors of Structure and Process that are, in turn, the third-order factor of Quality of Care. Internal consistency is strong, with Cronbach's alphas ranging from .74 to .93 for subscales; interrater and test-retest reliabilities are acceptable for the Process, Structure, and Total scales ranging from .64 to .76 and from .75 to .77, respectively. The OIQ has strong evidence of construct validity with facility survey citations from federal inspections of the facilities for every subscale and total scale, some construct validity with quality indicators, and known groups' validity with citations.⁴⁴ Scores are not normally distributed for this instrument, so nonparametric methods were used for analysis.

The OIQ was collected by an independent nurse observer (blind to the intervention) at baseline and at the end of years 1 and 2 in

Randomized Multilevel Intervention to Improve Outcomes of Residents in Nursing Homes in Need of Improvement

The research nurse observed direct-care staff members at work as relationships were built between them. She then met with them and nursing administrative staff in quality-improvement teams. These groups tailored care systems and practices outlined in the intervention manual to fit their situation, anchoring them into their facility's care routines. Kotter Elements of Change are noted in () throughout the scenario.

One scenario: A facility's residents were losing too much weight, as noted on their federal quality indicator facility report. The research nurse observed that there was little adaptive equipment to help residents eat independently, that most residents were fed in groups of 7 to 8 per staff member and that most residents were eating in their wheelchair. Within the quality improvement team, the research nurse pointed out the weight loss problem (establish a sense of urgency) then suggested that staff collect observational data using the tools in the intervention manual (create the guiding coalition). Data included the number of residents with weight loss, number using adaptive equipment, number being fed by staff and number eating in their wheelchair. The quality improvement team collected the suggested data, then met to discuss their observational data and made plans to correct the care practices they found (develop a vision and strategy). They prioritized their plans and decided to (1) focus on getting residents individualized adaptive equipment to encourage them to eat better and (2) identify residents who can sit in a dining chair, rather than wheelchair, for meals. The team worked with other staff to implement the changes (empower broad-based action) and then marked progress by making follow-up measurements of their observations (generate short-term wins). Once staff saw improvements coming from this system, their enthusiasm grew, and further changes became somewhat easier (consolidate gains and produce more change). During monthly site visits, the research nurse reinforced the direct-care staff to implement more changes, make follow-up measurements, and be sure the changes in practice were incorporated into facility care routines so they consistently happen as planned (anchor new approaches in the culture). The research nurse coached administrative staff by telephone and during monthly site visits to help them learn to manage the change process and work with and through the teams (communicate the change vision). The research nurse urged the leaders to use a consistently reinforcing positive message in order to foster lasting changes in care practices that reduced weight loss (anchor new approaches in the culture).

Fig. 1. Intervention scenario illustrating the elements of change (EC). (Adapted from Kotter.³⁴)

the intervention group and baseline and end of year 2 in the control group as an overall measure of quality of care. The Wilcoxon rank sum test was used to make baseline comparisons of intervention and control groups with respect to each of the OIQ scales. There were *no statistically significant differences at baseline*.

Median change scores from baseline through study end were examined (Table 2), revealing improved scores in the intervention group, while control group OIQ scores worsened. Using Wilcoxon rank sum test, intervention and control groups were compared for group differences; *P* values were adjusted for multiple testing using the False Discovery Rate (FDR) method.⁴⁵ The care subscale was statistically significant (FDR *P* = .022) as the intervention group had significantly better change scores than the control group (see Table 2). There are also raw *P* values of *P* = .05 for the communication subscale and the process measures, reflecting the median change scores that also improved in the intervention group but not in the control group for those subscales.

Resident Outcomes

It was anticipated that resident outcomes would improve in intervention facilities. Four MDS QIs, bladder and bowel incontinence, weight loss, pressure ulcers, and decline in ADL, were selected as the outcome measures for this study because these clinical problems are sufficiently prevalent in nursing homes, amenable to nursing intervention, and sensitive to quality of care.³⁷ These four QIs also matched the clinical content of the basics of care component of the multilevel intervention (see Appendix 1), had been found to be valid and reliable measures of care quality in nursing homes,^{35,44–48} and were effective outcome measures in other intervention studies.^{22,49} Findings from validation studies revealed that the “QIs have a high degree of accuracy, or reliability. Average facility accuracy rates for the QIs ranged from 72% to 95%.”^{48(p.254)} The four MDS QIs were calculated using standard algorithms^{50,51} for analysis. Additionally, the publically available MDS Quality Measures (QMs)⁵² that have similar algorithms applied to MDS data were analyzed.

QI scores were analyzed by quarter over the 2-year study duration for intervention and control facilities. Repeated-measures analysis used logistic regression methods with the preintervention QI score as a covariate. The dependent variable was the QI score for each follow-up quarter. The independent variables were group membership, time (measured in quarters from enrollment), and a term for the group-by-time interaction. To adjust for facility variation in initial status, the QI score for the first quarter following enrollment was used as a covariate. Repeated observations of the same facility result in correlated observations and so the method of generalized estimating equations³⁹ was used to provide correct

standard errors for the regression analysis. In these analyses, it was expected, at some point, that the intervention facilities would show a trend toward better QI scores while the control homes would remain flat. However, there were no statistically significant group-by-time interactions and only one main effect, pressure ulcers (*P* = .053). Table 3 displays the results of the repeated-measures analysis. Plots were used to confirm the direction of any trends of outcomes. Only one outcome, pressure ulcers, showed improvement of 1.7 points in the intervention group, while the control group remained the same. In the power analysis for the study, an improvement of 2.0 in pressure ulcer score was judged as clinically significant for facility improvement.

The regression methods used for the analysis of QI data were also applied to the QM outcomes (incontinence, weight loss, late loss ADLs, bedfast, and pressure ulcers for high- and low-risk residents). There were no statistically significant interactions or main effects, except for a time effect (Qtr) for the weight loss QM (*P* = .048). Again, plots were used to confirm the direction of any trends. Only one outcome, weight loss, showed improvement of 3.4 points in the intervention group while the control group remained the same. In the power analysis for the study, an improvement of 2.0 in weight loss score was judged as clinically significant for facility improvement.

Organizational Working Conditions

It was anticipated that there would be organizational attributes of improved working conditions in intervention facilities. The “Tell Us About Your Nursing Home” survey is based on measuring communication, leadership, and teamwork using an adaptation of Shortell and colleagues’ Organization and Management Survey.^{53,54} Earlier nursing home research suggested that it was the interplay of these organizational elements that created a culture and climate that influenced an organization’s capacity to create and sustain improvement.^{55,56} The adapted subscales have been discussed in earlier publications and are labeled as connectedness (7 items), organizational harmony (10 items), clinical leadership (4 items), and timely and understandable information (5 items).⁵⁷

All staff members were asked to complete the survey at baseline and at the end of the study. A total of 7712 staff completed the survey: 4150 at baseline and 3562 at the end of the study. The average return rate for intervention facilities was 71% at baseline and 63% at study end; for controls, it was 65% and 53%, respectively. Subscale and total scores for the facility are formed by averaging the staff scores (possible range 1 to 5 with higher scores meaning staff perception of improved working conditions) for the facility by staff group: RN/LPN, CNA, other, administrative, and job category “not given” by the participant. Cronbach’s alpha was calculated using all

Table 2
Median Change Scores and Significance Levels Testing Group Differences in Observable Indicators of Quality (OIQ) Change Scores from Baseline through Study End

Scale and Number of Items n	Possible Score Range	Control Group Median Change Score	Intervention Group Median Change Score	Group Differences Raw <i>P</i> Value	Group Differences FDR <i>P</i> Value
Process Subscales		−5.0	4.5	0.050**	0.172
Care (6)	6–30	−3.0	0.5	0.002**	0.022*
Communication (6)	6–30	−2.0	1.5	0.052**	0.172
Grooming (2)	2–10	1.0	0.5	0.434	0.483
Environment—Access (4)	4–20	0.0	0.5	0.495	0.496
Homelike (5)	5–25	−1.0	0.5	0.275	0.393
Structure Subscales		2.0	1.0	0.122	0.243
Environment—Basics (5)	5–25	1.0	1.0	0.435	0.483
Odor (1)	2–10	1.0	0.0	0.086	0.215
Total (30)	30–150	−4.0	4.0	0.173	0.289

*Significant improvement difference using FDR *P* < 0.05.

**Improved difference using raw *P* < 0.05.

Table 3
Logistic Regression Results for QI Outcomes by Quarter for Study Duration

QI	Parameter	Parameter Estimate	Significance	Odds Ratio	Odds Ratio Lower 95%	Odds Ratio Upper 95%
Bladder/Bowel Incontinence	IntvGrp	-.044	.476	.96	.85	1.08
	Qtr	-.008	.37	.99	.98	1.01
	IntvGrp*Qtr	.005	.75			
	qi8_0	.036	.00	1.04	1.03	1.04
Low Risk: Incontinence	IntvGrp	-.051	.44	.95	.83	1.08
	Qtr	.000	.99	1.00	.98	1.02
	IntvGrp*Qtr	.008	.63			
	qi8lr_0	.036	.00	1.04	1.03	1.04
High Risk: Incontinence	IntvGrp	-.192	.46	.83	.50	1.37
	Qtr	-.034	.61	.97	.85	1.10
	IntvGrp*Qtr	.029	.74			
	qi8hr_0	.093	.00	1.10	1.08	1.12
Weight Loss	IntvGrp	-.113	.37	.89	.70	1.14
	Qtr	-.028	.16	.97	.94	1.01
	IntvGrp*Qtr	-.028	.40			
	qi14_0	.023	.02	1.02	1.00	1.04
Decline in Late Loss ADLs	IntvGrp	-.039	.76	.96	.75	1.24
	Qtr	-.005	.72	.99	.97	1.02
	IntvGrp*Qtr	-.005	.86			
	qi18_0	.013	.01	1.01	1.00	1.02
Low Risk: Decline in ADL	IntvGrp	-.015	.91	.98	.75	1.30
	Qtr	-.003	.86	1.00	.96	1.03
	IntvGrp*Qtr	-.006	.86			
	qi18lr_0	.014	.01	1.01	1.00	1.02
High Risk: Decline in ADL	IntvGrp	.024	.88	1.02	.76	1.39
	Qtr	-.006	.80	.99	.95	1.04
	IntvGrp*Qtr	.009	.80			
	qi18hr_0	.008	.01	1.01	1.00	1.01
Stage 1–4 Pressure Ulcers	IntvGrp	.205	.05*	1.23**	1.00	1.51
	Qtr	.008	.60	1.01	.98	1.04
	IntvGrp*Qtr	-.019	.45			
	qi29_0	.064	.00	1.07	1.04	1.09
Low Risk: Pressure Ulcers	IntvGrp	.371	.15	1.45	.87	2.40
	Qtr	.014	.79	1.01	.91	1.13
	IntvGrp*Qtr	-.080	.29			
	qi29lr_0	.050	.06	1.05	1.00	1.11
High Risk: Pressure Ulcers	IntvGrp	.145	.20	1.16	.92	1.45
	Qtr	.002	.89	1.00	.97	1.03
	IntvGrp*Qtr	-.013	.61			
	qi29hr_0	.044	.00	1.05	1.03	1.06

*Significant result $P < 0.05$.

**Odds ratio for interpretation of significant result.

complete survey responses from both pre- and post-intervention periods ($N = 6232$). Surveys with some items missing were excluded. Alpha for the full scale is .961.

The actual score changes were small but consistently showed drifting of the means toward improving (higher) scores for both intervention and control groups. The pattern of highest (most favorable views of the organization) to the lowest were consistently: administrative, RN/LPN, other, CNAs, then “not given.” Similarly, the length of employment had a pattern of consistent scores: highest (better) were new employees (less than 1 year), then over 3 years, then 1 to 3 years, and lowest (poorer) were the “not given.” The years working with the elderly had the highest (better) scores for those less than 1 year, then 1 to 3 years, over 3 years, and “not given” were the lowest (poorer) scores. ANOVA methods were applied to each subscale to test for time and intervention effects. *There were some significant time effects suggesting pre to post improvements within each group in areas of clinical leadership ($P = .035$), organizational harmony ($P = .023$), and timely information ($P = .030$) but no significant differences between the groups.*

Staff Retention

The costs to organizations for staff turnover are extraordinary,^{40,58} with some estimates of more than 100% turnover of

nursing assistants annually.⁵⁹ It was anticipated that staff retention would improve in intervention facilities, compared to control, as leaders learned to involve staff in decision-making and improvement teams (reinforced in the intervention, see Appendix 1). Staff retention was measured using a method developed by Madsen⁶⁰ for estimating staff turnover and calculating staff retention by using payroll date-of-hire and job-classification data that are readily accessible in nursing homes. The “turnover” statistic (TOR) (or retention statistic) was calculated for each home, each time period (baseline, end of year 1, end of year 2), each job category (nursing assistants, RNs/LPNs, administrators/others), and full-time or part-time.

ANOVA was done using the mixed-model procedure that accounts for dependencies inherent in examining the same facilities over time. Anticipating an intervention effect at the end of year 1 and/or end of year 2, one would expect a group-by-time interaction. *There was no evidence of a group effect.* In both groups, there was evidence of job category differences with the administrators/others category having lower (better) TOR means compared to the RN/LPN or nursing assistant categories ($P < .0010$ in all cases).

Although the administrator retention was better than the other job categories, leadership turnover during the 2-year study was alarmingly high, particularly for the intervention group. Control facilities had better administrator retention (24 controls had same administrator throughout the study, only 17 intervention facilities

had the same administrator). Similarly, 16 control facilities had the same director of nursing compared to only 9 intervention facilities with the same director of nursing. There was extreme turnover of administrators in 2 intervention facilities (1 had 7 different administrators, another had 4 during the 2-year intervention); extreme turnover of directors of nursing happened in 6 intervention facilities (2 had 6, 1 had 5, and 4 had 4 different directors of nursing during the 2 years). Control facilities had less administrative turnover; 1 facility had 4 different administrators; 1 had 7 directors of nursing, 1 had 6, and 1 had 4 different directors of nursing. As displayed in Table 4, intervention facilities had 50% more turnover of directors of nursing and 44% more administrator turnover than control facilities. Although control facilities had less administrative turnover, they had nearly twice the number of ownership changes than intervention facilities.

Staffing and Staff Mix

Staff hours for RNs, LPNs, and CNAs are a standard part of Medicaid cost reports provided by each facility to Missouri's Medicaid program and are calculated as hours per resident per day. It was hypothesized that staffing and staff mix would be similar in both intervention and control groups as the intervention focused on improving care and overall involvement of staff in decision-making about care.

As Table 5 displays, median RN staffing in the intervention facilities was slightly higher than in control facilities. LPN staffing at baseline in the intervention facilities was lower than in controls and increased to a similar staffing level by the end of the study. Median aide hours were consistently higher in intervention facilities than in controls.

The Wilcoxon rank sum test (a nonparametric analog of the two-sample *t*-test) was used to test for group differences with respect to change (year 2 minus baseline). Significance levels were adjusted by the FDR technique for multiple testing. As can be seen in Table 5, only one key variable, LPN hours per patient per day, had significant within-group changes during the study ($P = .045$) as intervention facilities had significant increases LPN hours. *Tests for group differences, however, revealed no significant differences*, although the LPN hours approached the level of significance.

Facility Costs

Total costs and direct resident care costs were calculated from the Medicaid cost reports; total patient days are also reported so costs per patient day were calculated. It was hypothesized that cost efficiencies would be gained while improving quality of care, involving staff in decision-making, improving staff retention, and achieving other benefits of improving organizational capacity. These cost efficiencies were likely to be detected in total costs, direct care costs, and staffing costs; however, all cost categories reported in the cost reports were examined in detail.

Costs were analyzed in light of patient days, payer mix, staff hours per patient day, staff costs per patient day, median direct care, and total costs with changes from baseline through study end. Total bed and patient days for the intervention group were slightly higher (32,414 baseline; 33,012 study end) than the control (26,150

and 27,853); both groups experienced a small increase (2% and 7%, respectively) during the study. At baseline, both groups served the Medicaid (61.5% intervention and 60.7% control) and Medicare (10% intervention and 8.6% control) populations, with similar percentages. Both increased the Medicare patients served during the study, with the control group increasing to 11.2%, near the level of the intervention (11.7%) at the end of the study.

Table 6 displays summary information for cost outcome variables for the intervention and control groups. Total costs per patient per day increased 6% in the intervention group and decreased –3% in the control; total direct care costs increased in the intervention 9% but remained flat in the control. Total direct care costs as a percentage of total cost actually improved by 2% in both groups, indicating a trend in direct care cost efficiency in both. As previously stated in Sample, the baseline comparison of resident acuity was not significantly different nor were there group, time, or interaction effects.

The Wilcoxon rank sum test was used to test for group differences with respect to change (year 2 minus baseline). Significance levels were adjusted by the FDR technique for multiple testing. As can be seen in Table 6, some key variables had significant within-group changes in costs during the study. *Tests for group differences, however, revealed only one significant change in total LPN cost, as the intervention group experienced a 9% increase in LPN staffing costs*. This is likely a reflection of the low LPN staffing level at baseline in the intervention facilities (0.59 hour per patient per day, as in Table 5) compared to control (0.71); at study end the hours per patient day were nearly the same: 0.69 for intervention and 0.70 for control.

Discussion

Helping nursing homes in need of improvement is essential as our country faces the largest surge in history of older adults in need of such care. Testing comprehensive organizational interventions, such as the one in this randomized study, is critical to most effectively guide the distribution of scarce resources that are allocated to improve nursing homes. We have learned in this study that it is possible to build the organizational capacity to create and sustain improvement during a 2-year consultation period in nursing homes in need of improvement. The intervention facilities were able to improve their overall quality of care (as measured by the OIQ) and improve important clinical outcomes of pressure ulcers and weight loss. The intervention of monthly on-site consultations by a nurse with graduate education in gerontological nursing is an effective method to help nursing homes improve clinical care and sustain it beyond limited interventions previously tested.^{5,16,20,22,61} Discovering that clinical outcomes can improve with consistent monthly consultation that involves direct care staff and leaders in implementing evidence-based systems of care, even for facilities that struggle to embrace quality improvement, is key to preparing all nursing homes for future demands.

While staffing and staff mix remained similar in the intervention and control groups, as was anticipated, so did staff retention, organizational working conditions, and direct and total costs, which were anticipated to improve. Cost efficiencies were anticipated to result from improved care processes and improved quality

Table 4
Leadership Turnover and Buyouts During 2-year Study Duration

	N	Total No. Directors of Nursing	Turnover Director of Nursing, %	Total No. NHAs	Turnover NHA, %	Same Director of Nursing	Same NHA	Total No. of Buyouts
Control	29	58	100%	37	28%	16	24	7
Intervention	29	71	150%	50	72%	9	17	4

Table 5
Median Hours of Staffing per Patient Day and Significance Testing

Outcome	Group	Baseline	Year 2	Change	FDR <i>P</i> Within-Group	FDR <i>P</i> Between-Group
RN hours	Control	.33	.34	3%	.949	
	Intervention	.35	.37	5.7%	.362	.225
LPN hours	Control	.71	.70	–1.4%	.949	
	Intervention	.59	.69	17%	.045*	.060
Aide hours	Control	2.54	2.52	–.8%	.452	
	Intervention	2.67	2.70	1.1%	.970	.200

*Significant result $P < 0.05$.

of care, based on our preliminary work.^{25,27} However, that was not the case for this random sample of nursing homes needing improvement. Prior studies addressed random samples of a complete population of nursing homes, including the full range of care quality as measured by their facility MDS quality indicators (excellent performance percentile scores through poor performance scores). Apparently, the comprehensive multilevel intervention was not sufficient to result in the anticipated organizational improvements in cost efficiencies, staff retention, or organizational working conditions when targeted only to nursing homes in need of improvement. It could be that for these homes, expecting them to be able to address not only quality of care but also those broader organizational improvements requires more intensive intervention. Administrative interventions such as intensive management education and coaching may be needed in combination with the on-site monthly care improvement consultations tested in this study. Such a combination may require more frequent consultation or the use of distance-mediated and on-site assistance to be a cost-effective approach to improvement. One distance-mediated approach has been pilot tested in an intervention to improve incontinence and has demonstrated to be effective and low cost in facilitating improvement.⁶²

Shifting organizational working conditions, a closely linked concept to organizational culture, may be more difficult than was hypothesized, also an important finding. Both intervention and control facilities had remarkably stable working condition perspectives within their facilities. While the survey used in this study has been used widely in facilities providing the full range of care quality,^{55,56,57,63} it has not been used in a longitudinal study to date to measure employee perspectives in changes in organizational working conditions. One of the few studies to promote culture change used an 18-month coaching intervention in nine nursing homes; some facilities made excellent progress, some moderate, and others minimal.⁶⁴ As other researchers have pointed out, further study about the effect of culture and interventions to promote it is clearly needed.^{65,66}

Table 6
Median Facility Costs per Patient Day Percent Change and Significance Testing

Outcome	Group	Baseline	Year 2	Relative % Change from Baseline	FDR <i>P</i> Within-Group	FDR <i>P</i> Between-Group
% Total direct care	Control	68.95%	70.14%	2%	.027*	
	Intervention	71.75%	73.14%	2%	.388	.380
Total direct care cost	Control	\$83.63	\$83.82	0%	.027*	
	Intervention	\$82.06	\$89.32	9%	.000*	.090
Total costs	Control	\$123.10	\$119.66	–3%	.155	
	Intervention	\$118.12	\$124.90	6%	.000*	.098
Total aide cost	Control	\$22.81	\$23.28	2%	.620	
	Intervention	\$24.95	\$26.18	5%	.148	.380
Total LPN cost	Control	\$10.45	\$10.61	2%	.543	
	Intervention	\$10.32	\$11.23	9%	.001*	.050*
Total RN cost	Control	\$7.29	\$7.80	7%	.048*	
	Intervention	\$7.69	\$8.45	10%	.841	.200

*Significant result $P < 0.05$.

There are some possible explanations for the lack of cost-efficiency gains in the intervention facilities. During the 2-year intervention, despite recruitment procedures that included owners and administrators who agreed to keep leadership stable for the duration, there was actually 50% more director of nursing turnover and 44% more administrator turnover in intervention facilities than in control facilities. With leadership turnover, business operations can falter, leading to uncertainty about “Who will be the leader? How will the new leader affect my job?” Uncertainty may cause employees within the organization to consider job changes that they might not normally consider; uncertainty may affect employee performance and may lead to increased operating costs. With increased leadership turnover in the intervention facilities, any potential cost efficiencies gained from the improvement in quality of care appears to have been washed away by increased turnover and resulting increased costs.

Other researchers have found similar increases in costs with leadership turnover.⁶⁷ Direct care staff and administrator turnover is associated with a negative effect on quality of care.⁶⁸ In another study, turnover of less than 30% for RNs, 50% for LPNs, and 40% for CNAs were identified as potential targets needed to improve quality of care to residents.⁶⁹ In our study, these low turnover targets recommended by Castle and colleagues for the clinical staff were not achieved, leadership turnover was excessive (150% director of nursing and 100% administrator), and operational cost efficiencies were derailed.

While cost efficiencies were not achieved as hypothesized in this intervention study, *there were no increased costs* to participating facilities to improve quality of care. As their teams worked on adopting evidence-based care practices, revising systems of care, they did not increase overall care or staffing costs compared to the control group. This finding that improving quality of care does not have to cost more confirms other research with similar results.^{25,27,41,70} Obviously, there were costs associated with the actual intervention of the consultation of the research nurse. These would include the nurse time (1 to 4 hours per month, 2 average) and travel time. The balance of the expense of the intervention was spent in research documentation about the content and process of each site visit and other research activities.

Lessons learned from this intervention study can be readily transferred to nursing homes nationwide. Nursing home leaders, using the readily available, facility-specific, QI reports, can engage staff to consider different (evidence-based) ways of approaching the care, engage them to actively watch each other in care delivery, measure how they are doing, and apply new best practice approaches to care. Ultimately, this is the only way to change care to markedly improve resident outcomes.⁷¹ To accomplish this, there needs to be a champion who engages and encourages staff to

strive for better resident care. Medical directors can provide that spark to engage leadership and direct care staff. Medical directors in collaborative practice with advanced practice nurses (APNs) are ideally positioned to take up this challenge to improve the quality of care in our nation's nursing homes.

As we demonstrated in this study, nurses with graduate education in gerontological nursing are successful coaches who can, in very few hours per month, be the catalyst for improvement. This is feasible in medical director/APN collaborative practice arrangements and could be negotiated in health care services contracts with nursing facilities. Each month, a consistent APN coach could encourage leaders to engage direct care staff in quality improvement teams, observe and critically analyze the way that they are providing direct care to their residents, and systematically connect practice changes to "the way we do things here" for each individual facility. Embedding practice changes in day-to-day care delivery sustains the better care practices that ultimately lead to improved resident outcomes. With leadership and practice changes embedded, and the systematic monthly follow-up of medical directors and their collaborative practice partners, homes in need of improvement can become homes that continuously embrace improvement.

From a public policy perspective, this study provides a partial answer to the questions, "How much time is needed to support change in nursing homes that need improvement?" and "Is there a need to continuously focus resources on improvement?" Across the intervention group, about 2 hours per month enabled some statistically significant improvement. Some states, like Missouri, have a voluntary clinical consultation program to help diffuse best practices into nursing homes.^{49,72} To sustain the improvement throughout the 2-year study duration, continuous monthly consultations were needed. These results validate the need for ongoing support from such a clinical consultation system in states as well as the ongoing focus of medical directors and their collaborative practice partners to be the catalyst for continuously improving care.

This randomized control study has limitations to consider when interpreting results. The study was limited to one state within a 3-hour, one-way driving radius. While the area included both rural and urban facilities, increasing generalizability, a multistate study may have produced different results. The sample was selected using MDS quality indicators. Although there is significant research using quality indicators for measurement of care quality, the data must be acknowledged as collected by facility staff and some government reports have recommended steps to improve accuracy.⁷³ This was the first study in nursing homes to undertake a bundled multilevel intervention targeted to improving care delivery and cost outcomes. Not only did the research plan undertake a complex intervention, but it also attempted to apply it in a sample of nursing homes in need of improvement. The results of the study have to be interpreted for homes in need of improvement, not generalized to the full range of nursing homes that would include those providing better quality of care.

This comprehensive multilevel intervention was tested to build organizational capacity to create and sustain improvement in quality of care and subsequently improve resident outcomes in nursing homes in need of improvement. From the quantitative analysis of this randomized trial, we have learned that helping some facilities in need of improvement to actually improve care quality and improve some resident outcomes can be done effectively, *while not increasing staffing and costs of care within the facility*. Although this was achieved, many questions remain. Future research should focus on strategies for leadership skill improvement and retention in leadership positions; retention of nursing home staff, particularly direct care staff; involvement of direct care

staff in decision-making about their work and care processes; and, importantly, the needs and wants of the long term care consumers.

Acknowledgments

The research team gratefully acknowledges the research nurses, De Minner and Margie Diekemper for their work and dedication to the nursing homes. We express our gratitude to Jessica Mueller for her amazing data base and project management skills. We also acknowledge the staff and leaders of the nursing home participants; they are truly committed to improving care delivery and quality of services to older people.

Supplementary Data

Supplementary data associated with this article can be found in the online version at doi:[10.1016/j.jamda.2011.06.012](https://doi.org/10.1016/j.jamda.2011.06.012)

References

- Evans LK, Strumpf NE, Allen-Taylor SL, et al. A clinical trial to reduce restraints in nursing homes. *J Am Geriatr Soc* 1997;45:675–681.
- Neufeld RR, Libow LS, Foley WJ, et al. Restraint reduction reduces serious injuries among nursing home residents. *J Am Geriatr Soc* 1999;47(10):1202–1207.
- Fiatarone MA, O'Neill EF, Doyle N, et al. The Boston FICSIT study: The effects of resistance training and nutritional supplementation on physical frailty in the oldest old. *J Am Geriatr Soc* 1993;41(3):333–337.
- Hagen B, Armstrong-Esther C, Sandilands M. On a happier note: validation of musical exercise for older persons in long-term care settings. *Int J Nurs Stud* 2003;40(4):347–357.
- Morris JN, Fiatarone M, Kiely DK, et al. Nursing rehabilitation and exercise strategies in the nursing home. *J Gerontol: Med Sci* 1999;54A(10):M494–M500.
- Beck C, Heacock P, Mercer SO, et al. Improving dressing behavior in cognitively impaired nursing home residents. *Nurs Res* 1997;46(3):126–132.
- Blair CE. Effect of self-care ADLs on self-esteem on intact nursing home residents. *Iss Ment Health Nurs* 1999;20(6):559–570.
- Cameron ID, Venman J, Kurlle SE, et al. Hip protectors in aged-care facilities: A randomized trial of use by individual higher-risk residents. *Age Ageing* 2001;30(6):477–481.
- Ray WA, Taylor JA, Meador KG, et al. A randomized trial of a consultation service to reduce falls in nursing homes. *JAMA* 1997;278(7):557–562.
- Geyer MJ, Brienza DM, Karg P, et al. A randomized control trial to evaluate pressure-reducing seat cushions for elderly wheelchair users. *Adv Skin Wound Care* 2001;14(3):120–132.
- Groen HW, Groenier KH, Schuling J. Comparative study of a foam mattress and a water mattress. *J Wound Care* 1999;8(7):333–335.
- Edwards NE, Beck AM. Animal-assisted therapy and nutrition in Alzheimer's disease. *West J Nurs Res* 2002;24(6):697–712.
- Simmons SF, Alessi C, Schnelle JF. An intervention to increase fluid intake in nursing home residents: prompting and preference compliance. *J Am Geriatr Soc* 2001;49(7):926–933.
- Simmons SF, Osterweil D, Schnelle JF. Improving food intake in nursing home residents with feeding assistance: A staffing analysis. *J Gerontol Med Sci* 2001;56A(12):M790–M794.
- Burgio LD, McCormick KA, Scheve AS, et al. The effects of changing prompted voiding schedules in the treatment of incontinence in nursing home residents. *J Am Geriatr Soc* 1994;42(3):315–320.
- Ouslander JG, Al-Samarrai N, Schnelle JF. Prompted voiding for nighttime incontinence in nursing homes: Is it effective? *J Am Geriatr Soc* 2001;49(6):706–709.
- Schnelle JF, Cruise PA, Alessi CA, et al. Individualizing nighttime incontinence care in nursing home residents. *Nurs Res* 1998;47(4):197–204.
- Schnelle JF, Kapur K, Alessi C, et al. Does an exercise and incontinence intervention save healthcare costs in a nursing home population? *J Am Geriatr Soc* 2003;51(2):161–168.
- Ouslander JG, Schnelle JF, Uman G, et al. Predictors of successful prompted voiding among incontinent nursing home residents. *J Am Geriatr Soc* 1995;27(17):1366–1370.
- Schnelle JF, Alessi CA, Simmons SF, et al. Translating clinical research into practice: A randomized controlled trial of exercise and incontinence care with nursing home residents. *J Am Geriatr Soc* 2002;50(9):1476–1483.
- Kane RL, Garrard J, Skay C, et al. Effects of a geriatric nurse practitioner on process and outcome of nursing home care. *Am J Pub Health* 1989;79(9):1271–1277.
- Rantz MJ, Popejoy L, Petroski GF, et al. Randomized clinical trial of a quality improvement intervention in nursing homes. *Gerontologist* 2001;41(4):525–538.

23. Ryden MB, Snyder M, Gross CR, et al. Value-added outcomes: The use of advanced practice nurses in long-term care facilities. *Gerontologist* 2007; 40(6):654–662.
24. Mohide EA, Tugwell P, Caulfield PA, et al. Randomized trial of quality assurance in nursing homes. *Med Care* 1988;26(6):554–565.
25. Rantz MJ, Hicks L, Grando VT, et al. Nursing home quality, cost, staffing, and staff-mix. *Gerontologist* 2004;44(1):24–38.
26. Reuben D. Organizational interventions to improve health outcomes of older persons. *Med Care* 2002;40(5):416–428.
27. Rantz MJ, Grando V, Conn VS, et al. Getting the basics right: Care delivery in nursing homes. *J Gerontol Nurs* 2003;29(11):15–25.
28. Marion R. *The Edge of Organization: Chaos and Complexity Theories of Formal Social Systems*. Thousand Oaks (CA): Sage Publications; 1999.
29. Zimmerman B, Lindberg C, Plsek P. *Edge Ware: Insights From Complexity Science of Health Care Leaders*. Irving (TX): VHA; 2001.
30. Stacey R. The science of complexity: an alternative perspective for strategic change processes. *Strat Manage J* 1995;16(6):477–495.
31. Anderson R, McDaniel R. RN participation in organizational decision making and improvements in resident outcomes. *Health Care Manage Rev* 1999;24(1):7–16.
32. Issel L, Anderson R. Intensity of case managers' participation in organizational decision making. *Res Nurs Health* 2001;24(5):361–372.
33. Ashmos D, Huonker J, McDaniel R. Participation as a complicating mechanism: The effect of clinical professional and middle manager participation on hospital performance. *Health Care Manage Rev* 1998;23(4):7–20.
34. Kotter JP. *Leading Change*. Boston (MA): Harvard Business School Press; 1996.
35. Morris JN, Moore T, Jones R, et al. Validation of long-term and post-acute care quality indicators. Executive summary of report to CMS. Contract 500-95-0062/TO#2; 2002.
36. Ronch J. Leading culture change in long-term care: A map for the road ahead. In: Weiner AS, Ronch JL, editors. *Culture Change in Long-Term Care*. New York (NY): The Haworth Social Work Practice Press; 2003. p. 65–80.
37. Rantz MJ, Hicks L, Petroski GF, et al. Stability and sensitivity of nursing home quality indicators. *J Gerontol Med Sci* 2004;59A(1):79–82.
38. InterRAI. <http://www.interrai.org/section/view/> Accessed June 2011.
39. Zeger S, Liang L. Longitudinal data analysis using generalized linear models. *Biometrika* 1986;73:13–22.
40. Pillemer K. *Solving the Frontline Crisis in Long-Term Care: A Practical Guide to Finding and Keeping Quality Nursing Assistants*. New York (NY): Delmar Cengage Learning; 1996.
41. Rantz MJ, Flesner MK. *Person Centered Care: A Model for Nursing Homes*. Washington (DC): American Nurses Association; 2004.
42. Rantz MJ, Mehr D, Popejoy L, et al. Nursing home care quality: A multidimensional theoretical model. *J Nurs Care Qual* 1998;12(3):30–46.
43. Rantz MJ, Zwiygart-Stauffacher M, Mehr D, et al. Nursing home care quality: A multidimensional theoretical model integrating the views of consumers and providers. *J Nurs Care Qual* 1999;14(1):16–37.
44. Rantz MJ, Zwiygart-Stauffacher M, Mehr D, et al. Field testing, refinement and psychometric evaluation of a new measure of nursing home care quality. *J Nurs Meas* 2006;14(2): 129–148(20).
45. Benjamini Y, Yekateuli D. The control of the false discovery rate in multiple testing under dependency. *Ann Stat* 2001;29:1165–1188.
46. Rantz MJ, Zwiygart-Stauffacher M, Popejoy L, et al. The Minimum Data Set: No longer just for clinical assessment. *Ann Long-Term Care* 1999;7(9):354–360.
47. Karon S, Sainfort F, Zimmerman DR. Stability of nursing home quality indicators over time. *Med Care* 1999;37(6):570–579.
48. Zimmerman DR. Improving nursing home quality of care through outcomes data: The MDS quality indicators. *Int J Geriatr Psychiatry* 2003;18:250–257.
49. Rantz MJ, Vogelsmeier A, Manion P, et al. Statewide strategy to improve quality of care in nursing facilities. *Gerontologist* 2003;43(2):248–258.
50. Center for Health System Research and Analysis, University of Wisconsin-Madison. *Quality Indicators for MDS 2.0, Version 6.3* 1997.
51. Zimmerman DR, Karon SL, Arling G, et al. Development and testing of nursing home quality indicators. *Health Care Financ Rev* 1995;16(4):107–127.
52. Centers for Medicare & Medicaid Services. (2005). *Nursing home quality initiative overview*, University of Wisconsin-Madison. Available at: http://www.cms.hhs.gov/NursingHomeQualityInits/01_overview.asp.
53. Shortell SM, Rousseau DM, Gillies RR, et al. Organizational assessment in intensive care units (ICUs): construct development, reliability, and validity of the ICU nurse-physician questionnaire. *Med Care* 1991;29(8):709–726.
54. Shortell SM, Zimmerman JE, Rousseau DM, et al. The performance of intensive care units: Does good management make a difference? *Med Care* 1994;32(5): 508–525.
55. Scott-Cawiezell J, Schenkman M, Moore L, et al. Exploring nursing home staff's perceptions of communication and leadership to facilitate quality improvement. *J Nurs Care Qual* 2004;19(3):242–252.
56. Scott-Cawiezell J, Main DS, Vojir CP, et al. Linking nursing home working conditions to organizational performance. *Health Care Manage Rev* 2005; 30(4):372–380.
57. Scott-Cawiezell J, Jones K, Moore L, et al. Nursing home culture: A critical component in sustained improvement. *J Nurs Care Qual* 2005;20(4): 341–348.
58. Straker JK, Atchley RC. *Recruiting and Retaining Frontline Workers in Long-Term Care: Usual Organizational Practices in Ohio*. Oxford (OH): Scripps Gerontology Center, Miami University; 1999.
59. American Health Care Association. *Results of the 2002 AHCA Survey of nursing staff vacancy and turnover in nursing homes*, Health Services Research and Evaluation 2003. Available at: <http://www.ahca.org>.
60. Madsen R. *Proceedings from American Statistical Association: Section on Nonparametric Statistics [CD-ROM]*. Alexandria (VA): American Statistical Association; 2005. 1660–1667.
61. Rosen J, Mittal V, Degenholtz H, et al. Ability, incentives, and management feedback: Organizational change to reduce pressure ulcers in a nursing home. *Am Med Dir Assoc* 2006;7:141–146.
62. Rahman AN, Schnelle JF, Yamashita T, et al. Distance learning: A strategy for improving incontinence care in nursing homes. *Gerontologist* 2010;50(1): 121–132.
63. Forbes-Thompson S, Scott-Cawiezell J, Dunton N. An exploration of nursing home organizational processes. *West J Nurs Res* 2006;28(8):935–954.
64. Crandall LG, White DL, Schuldheis S, et al. Initiating person-centered care practices in long-term care. *J Gerontol Nurs* 2007;33(11):47–56.
65. Mueller C. *Research in culture change in nursing homes [Presentation]*. Nurses Involvement in Culture Change, Hartford Institute for Geriatric Nursing; 2008. Available at: http://hartfordign.org/uploads/File/issue_culture_change/Culture_Change_Background_Mueller.pdf
66. Rahman AN, Schnelle JF. The nursing home culture change movement: Recent, past, present, and future directions for research. *Gerontologist* 2008;48(2): 142–148.
67. Castle NG. Administrator turnover and quality of care in nursing homes. *Gerontologist* 2001;41(6):757–767.
68. Castle NG. State differences and facility differences in nursing home staff turnover. *J Appl Gerontol* 2008;27(5):609–630.
69. Castle NG, Engberg J, Men A. Nursing home staff turnover: Impact on nursing home compare quality measures. *Gerontologist* 2007;47(5):650–661.
70. Hicks LL, Rantz MJ, Petroski GF, et al. Nursing home costs and quality of care outcomes. *Nurs Econ* 2004;224:178–192.
71. Rantz MJ, Flesner MK, Zwiygart-Stauffacher M. Improving care in nursing homes using quality measures/indicators and complexity science. *J Nursing Care Qual* 2010;25(1):369–376.
72. Rantz MJ, Cheshire D, Flesner M, et al. Helping nursing homes “at risk” for quality problems: A statewide evaluation. *Geriatric Nursing* 2009;30(4): 238–249.
73. GAO. *Nursing homes: Federal efforts to monitor resident assessment data should complement state activities*, GAO-02–279. February 2002.