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Original Study

Impact of Advanced Practice Registered Nurses on Quality Measures: The Missouri Quality Initiative Experience



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A B S T R A C T

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Purpose: The purpose of this article is to review the impact of advanced practice registered nurses (APRNs) on the quality measure (QM) scores of the 16 participating nursing homes of the Missouri Quality Initiative (MOQI) intervention. The MOQI was one of 7 program sites in the US, with specific interventions unique to each site tested for the Centers for Medicaid and Medicare Services Innovations Center. While the goals of the MOQI for long-stay nursing home residents did not specifically include improvement of the QM scores, it was anticipated that improvement most likely would occur. Primary goals of the MOQI were to reduce the frequency of avoidable hospital admissions and readmissions; improve resident health outcomes; improve the process of transitioning between inpatient hospitals and nursing facilities; and reduce overall healthcare spending without restricting access to care or choice of providers.

Methods: A 2-group comparison analysis was conducted using statewide QMs; a matched comparison group was selected from facilities in the same counties as the intervention homes, similar baseline QM scores, similar size and ownership. MOQI nursing homes each had an APRN embedded full-time to improve care and help the facility achieve MOQI goals. Part of their clinical work with residents and staff was to focus on quality improvement strategies with potential to influence healthcare outcomes. Trajectories of QM scores for the MOQI intervention nursing homes and matched comparison group homes were tested with nonparametric tests to examine for change in the desired direction between the 2 groups from baseline to 36 months. A composite QM score for each facility was constructed, and baseline to 36-month average change scores were examined using nonparametric tests. Then, adjusting for baseline, a repeated measures analysis using analysis of covariance as conducted.

Results: Composite QM scores of the APRN intervention group were significantly better ($P = .025$) than the comparison group. The repeated measures analysis identified statistically significant group by time interaction ($P = .012$). Then group comparisons were made at each of the 6-month intervals and statistically significant differences were found at 24 months ($P = .042$) and 36 months ($P = .002$), and nearly significant at 30 months ($P = .11$).

Implications: APRNs working full time in nursing homes can positively influence quality of care, and their impact can be measured on improving QMs. As more emphasis is placed on quality and outcomes for nursing home services, providers need to find successful strategies to improve their QMs. Results of these

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analyses reveal the positive impact on QM outcomes for the majority of the MOQI nursing homes, indicating budgeting for APRN services can be a successful strategy.

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Advanced practice registered nurses (APRN) have been practicing in nursing homes since the 1970s,¹ soon after the role was developed in the United States. The nursing home setting was a research site for early research analyzing the value of the APRNs in providing care to older adults with chronic diseases living in these settings. In 1 early study, gerontological APRNs were employed in 30 Medicare-certified nursing homes in 8 western states for 2 years. Retrospective review of records from the nursing homes with APRNs and matched controls, revealed favorable changes in 2 of 8 activities of daily living measures, 5 of 18 nursing therapies, 2 of 6 drug therapies, and reduction in hospital admissions and total days.² Results suggested that APRNs had a useful and cost-effective role to play in nursing homes. About 10 years later, Ryden et al³ examined the effect of clinical outcomes for newly admitted nursing home residents when gerontological APRNs worked with nursing staff implementing protocols for incontinence, pressure ulcers, depression, and aggressive behavior. APRNs practiced in 2 nursing homes while a third nursing home served as a comparison group. Data analyzed at 6 month's post admission revealed that residents of APRN intervention experienced significantly greater improvement or less decline in incontinence, pressure ulcers, and aggressive behavior, and they had better mean composite scores across all outcomes when compared with residents receiving usual care.

In a 2008 publication, Bakerjian⁴ reviewed 38 studies about care of nursing home residents by APRNs published over the last 25 years. The studies revealed 7 positive outcomes of APRN care evident in the publications: equivalent or better management of chronic diseases; improved functional status (toileting, dressing and ambulation) and less functional decline; reduced hospitalization and emergency department use; reduced overall costs; no differences in mortality between APRN and physician care; more time spent with residents by APRNs than physicians; and more satisfaction with APRN care than physicians care. The review showed significant support for APRNs providing care in a variety of long-term care settings and states.

Similar functional outcomes can now be measured by nursing home quality measures that were initiated by federal and state licensure and certification programs since passage of the Omnibus Budget Reconciliation Act of 1987 (OBRA-87).⁵ The changes recommended in OBRA-87 led to creation of the Minimum Data Set (MDS), a summary assessment of each resident's functional and health status. Using the MDS information, outcome indicators [quality measures (QMs)] were developed as proxy measures of quality of care as part of the Nursing Home Standards for Health and Safety used during the certification (survey) process. The MDS program has undergone revisions over the years to expand and strengthen the QMs, with MDS v 3.0 currently under use. The MDS QM ratings for nursing homes has information about 15 different physical and clinical measures for nursing home residents, available in the Certification And Survey Provider Enhanced Reports report accessible by nursing home staff⁶ and also available to the public on the Centers for Medicare and Medicaid Services website. QM scores that are low (below the state and national averages) indicate better quality of care.

The Missouri Quality Initiative (MOQI), a 4-year (2012–2016) federally funded research initiative, was a multifaceted intervention in 16 nursing homes in the Midwest, which embedded full-time APRNs in the participating homes.⁷ The MOQI was 1 of 7 sites nationally in the Centers for Medicare and Medicaid Services Innovations Center and Medicare-Medicaid Coordination Office funded national demonstration, *Initiative to Reduce Avoidable Hospitalizations among Nursing*

Facility Residents. The primary Initiative goals were to reduce unnecessary hospital and emergency department transfers; improve resident health outcomes; improve the process of transitioning between inpatient hospitals and nursing facilities; and reduce overall healthcare spending without restricting access to care or choice of providers. External evaluators of the Initiative, after analyzing 3 years of quantitative data (claims and assessments) compared with 6 other state sites, reported that MOQI interventions were associated with a consistent and significant reduction in the key outcomes.⁸ The results of a detailed quantitative analysis of key outcomes of the MOQI intervention was recently reported by Rantz et al.⁹ The MOQI APRNs were educated about the MDS CASPER report (available to every nursing home in the country) and its value in providing guidance for educational programs and quality improvement efforts in their assigned nursing homes. They were encouraged to work with their nursing home direct care staff to improve quality of care and care delivery systems that have potential to improve care of nursing home residents.

The purpose of this article is to review the impact of APRNs on the QM scores of the 16 MOQI nursing homes over the 3 years of full implementation of the MOQI intervention (September 2013–September 2016). APRNs focused on quality improvement strategies with potential to influence healthcare outcomes. Analyses were planned to measure the change in QM scores to discern impact on care quality of full time APRNs on QM outcomes of the MOQI nursing homes.

Methods

A 2-group comparison analysis was conducted using statewide QMs made available to the research team under appropriate Data Use Agreement and other publically available nursing home descriptive data of facility size, ownership, and location. Potential comparison group nursing homes were selected from facilities in the same counties as the intervention homes, similar baseline QM scores, size, and ownership. It was important that the comparison homes be from the same areas of the state as the intervention homes to avoid regional variations in care, staffing, state survey teams that could potentially influence the analysis. Government-operated homes were excluded from the matching as there are none in the intervention group. Also excluded from the pool of potential comparison homes were those with fewer than 89 certified beds, as this is the minimum bed-size in the intervention group. Matching was based on the Chebyshev distance.¹⁰

Next, a matched comparison group from the same counties was formed by matching with the 16 intervention homes on (1) baseline QM values of the 8 QMs selected for the national evaluation of the Initiative [selected by Research Triangle International (RTI), Durham, NC], the primary evaluation team of the national Initiative) these were falls, pressure ulcers, urinary tract infections, indwelling catheters, restraint use, activities of daily living, weight loss, and antipsychotic medication use; (2) for-profit status; and (3) number of certified beds. [Table 1](#) summarizes the Baseline QM Scores and Facility Characteristics. Note, the comparison group selected for this comparison group for this analysis is different from the comparison group selected by RTI for their evaluation due to facility anonymity.⁸

Results

[Table 1](#) summarizes descriptive statistics for each QM along with the raw difference of means, and significance levels for the group

Table 1
Baseline QM Scores and Facility Characteristics Missouri Quality Initiative Intervention (n = 16) and Comparison Group (n = 27) Nursing Homes

Baseline QM Scores and Facility Characteristics									
Groups	Variables	Mean	SD	Median	Minimum	Maximum	Significance*	Difference [†]	ASD [‡]
Comparison n = 27	Falls	3.7	2.3	3.4	0.0	10.0	0.706	−0.29	0.071
	PU	5.8	2.9	6.7	1.1	12.8	0.744	0.62	0.116
	UTI	6.5	5.7	4.1	0.0	17.6	0.580	0.64	0.115
	Cath	2.5	2.1	2.1	0.0	8.3	0.782	−0.33	0.098
	Restraints	1.0	1.4	0.5	0.0	4.5	0.461	0.25	0.111
	ADL	12.4	7.4	11.0	1.9	28.8	0.870	0.11	0.015
	Weight loss	10.0	4.4	10.8	1.3	17.8	0.269	−0.94	0.145
	APM	18.1	6.8	16.7	7.8	37.2	0.725	−0.52	0.062
	QM Composite	7.21	1.61	7.29	4.5	10.25	0.459	−0.07	0.041
	Cert beds	149	56	130	90	310	0.268	18.00	0.301
	% for profit	85.2					0.990	2.31	0.067
Intervention n = 16	Falls	3.4	2.3	3.5	0.0	8.6			
	PU	6.4	3.8	6.1	1.3	14.1			
	UTI	7.1	5.7	6.3	0.7	19.3			
	Cath	2.2	1.7	2.3	0.0	5.8			
	Restraints	1.2	3.0	0.0	0.0	11.8			
	ADL	12.5	7.6	13.1	0.0	24.6			
	Weight loss	9.0	4.2	8.8	2.2	18.8			
	APM	17.6	7.1	16.4	8.9	33.6			
	QM Composite	7.28	1.77	7.62	4.34	11.06			
	Cert beds	167	62	151	89	321			
	% for profit	87.5							

ADL, activities of daily living; PU, pressure ulcer; SD, standard deviation; UTI, urinary tract infection.

*Wilcoxon rank sum test, except Fisher exact test on for profit.

[†]Difference of mean.

[‡]Absolute standardized difference.

comparison on each QM and facility characteristic. Also included is the absolute standardized difference (ASD), which is an effect size measure that does not depend on sample size. It is often used in propensity analysis as an alternative to significance testing to judge how balanced 2 groups are with respect to a given variable. There is no hard-and-fast rule for how small is small enough but a common rule is that an ASD <0.1 reflects good balance and an ASD >0.2 is too large. All of the baseline characteristics, with the exception of bed-size, are reasonably close to the rule. The ASD for bed size is .30, but the mean difference is 18 beds and the range of bed sizes is very similar for the 2 samples. (Formula is available upon request).

Plots of Individual Quality Measures

The following plots (Figures 1-8) of the 8 QM scores at 6-month intervals are displayed over the course of the 3 years of the full implementation of the APRN intervention. The intervention group scores in the plots are dash lines and the comparison group in solid line with circles.

As the individual plots of the QMs illustrate, 6 of the 8 QMs (pressure ulcers, urinary tract infections, indwelling catheters, activities of daily living, weight loss, and antipsychotic medication use) for the MOQI homes had more improved trajectories than the comparison homes. Two did not (falls and restraints). All 8 individual QM average differences were tested with nonparametric tests to examine for change in the desired direction between the 2 groups from baseline to 36 months. The activities of daily living QM was statistically significant ($P = .02$) and the catheter QM ($P = .05$) for the APRN intervention homes as compared to the comparison group; the others were not significantly different between groups.

Composite QM Score Analysis for Intervention and Comparison Groups

To summarize the potential effect of the MOQI Intervention with APRNs in each nursing home on quality of care, a composite score of

the QMs was calculated. The composite score is the sum of the 8 long-stay QM numerators divided by the sum of the long-stay QM denominators, and then multiplied by 100. The composite QM score is a number between 0 and 100, but it is not a simple percentage because the same residents may be counted multiple times in both denominators and numerators of the 8 QMs. Because it is based on QMs, a smaller score is a better score. This method of compiling a composite score is conceptually based on the method of the calculating quality indicators (QIs) (the fore-runners of the current QMs.¹¹ For example, each QI was expressed as a simple ratio of the number of people in a nursing home with a given condition, such as weight loss, as the numerator and the number of people in the nursing home who could potentially have the condition, as the denominator.

Using the matched control group, 2 analyses were conducted. First, the baseline to 36-month average change scores were examined using nonparametric tests as in the individual QMs reported above. Composite QM scores of the APRN intervention group were significantly better ($P = .025$) than the comparison group. Secondly, adjusting for baseline, a repeated measures analysis using analysis of covariance identified statistically significant group by time interaction ($P = .012$). Then group comparisons were made at each of the 6-month intervals and statistically significant differences were found at 24 months ($P = .042$) and 36 months ($P = .002$), and nearly significant at 30 months ($P = .11$). Table 2 displays the within group comparisons at 6-month intervals with statistically significant differences at 24, 30, and 36 months.

To better illustrate the differences between the intervention and control groups over time, Figure 9 displays a plot of the raw means (dotted lines) and the regression results (straight lines) for the intervention and control groups. The intervention group has the dashed line and control group has the solid line of regression results. Over the course of the study the expected score in the intervention group improved significantly more (declined, lower QM scores are better) than the comparison group; it declined by approximately 2 points while in the comparison group declined by about half a point.

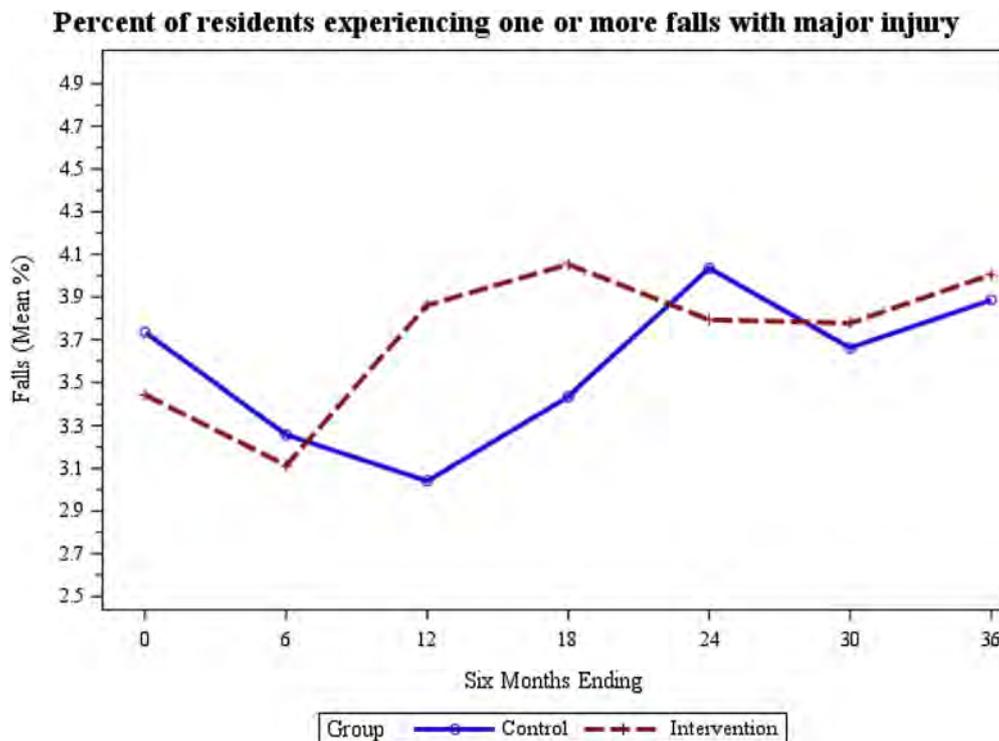


Fig. 1. Average QM Scores of Intervention and Comparison Groups for Falls.

Facility-Specific Composite QM Scores for Intervention Facilities

A linear regression of the QM composite on time was fit for each facility. An Autoregressive Integrated Moving Average¹ error

structure was used to accommodate the serial correlation due to having seven measurements per facility. Table 3 displays the slope estimate (estimate column) for each facility and the P value for a test that the slope is zero. Thirteen of 16 slopes are negative in

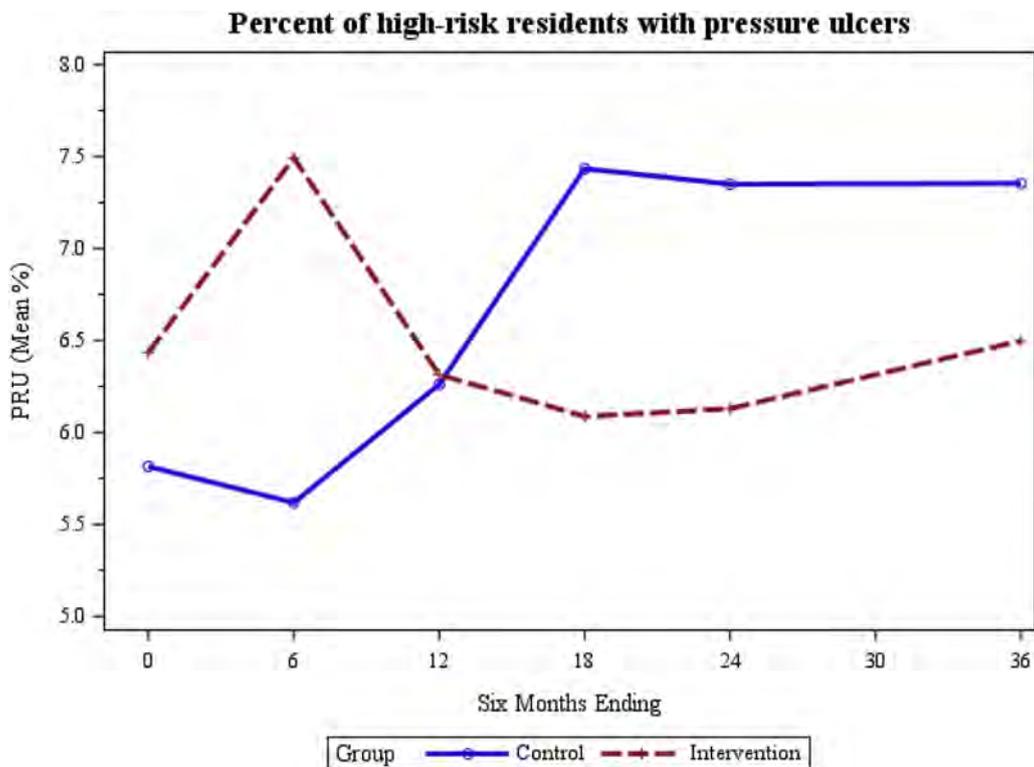


Fig. 2. Average QM Scores of Intervention and Comparison Groups for Pressure Ulcers.

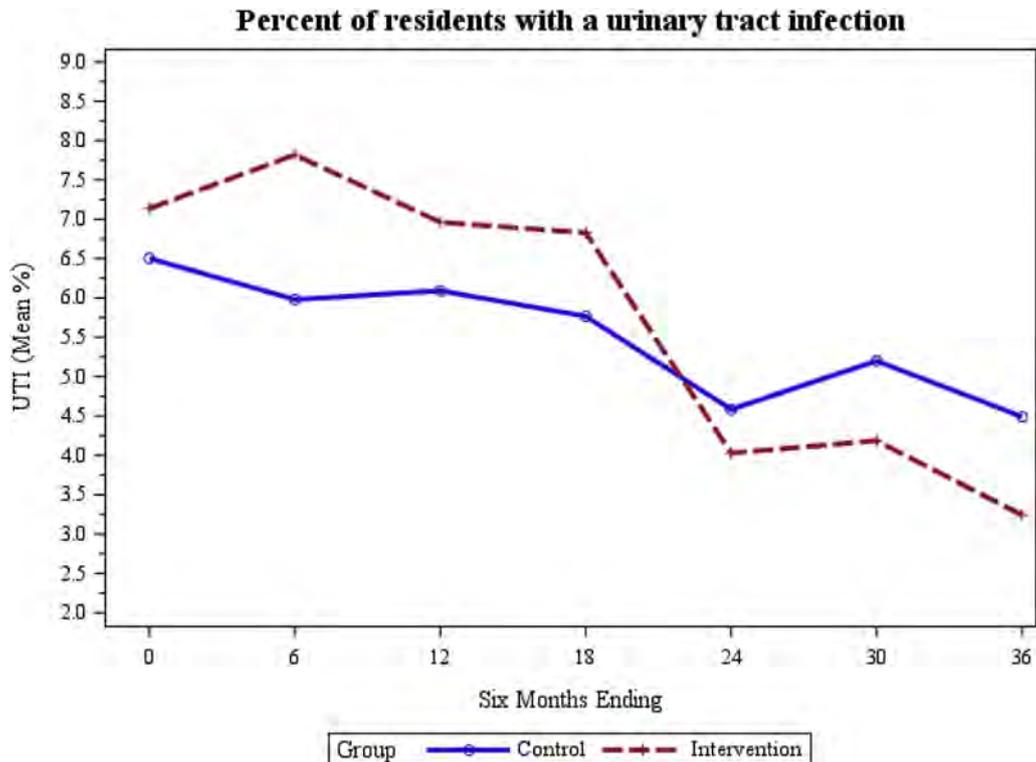


Fig. 3. Average QM Scores of Intervention and Comparison Groups for Urinary Tract Infection.

sign (in the direction of improvement), and 8 are statistically significant. Three slopes are positive in sign (in the wrong direction), and 1 of these is statistically significant.

Following Table 3 of the linear regression results is Figure 10 with plots of the QM composite scores by facility with a facility-specific

linear regression line superimposed. Facilities are identified by the same number on Table 3 and Figure 10 QM score plots to facilitate comparison. As the plots illustrate, 13 of the nursing homes had slopes of improving (declining) QM composite scores; 2 were relatively stable; and 1 was worse.

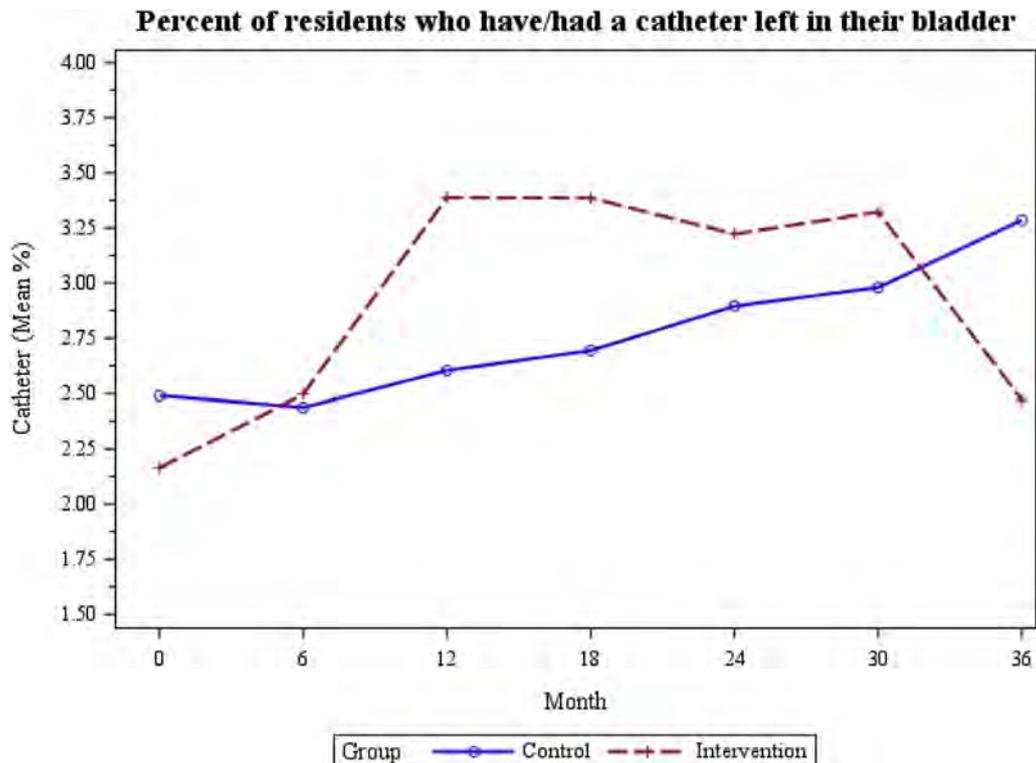


Fig. 4. Average QM Scores of Intervention and Comparison Groups for Catheters.

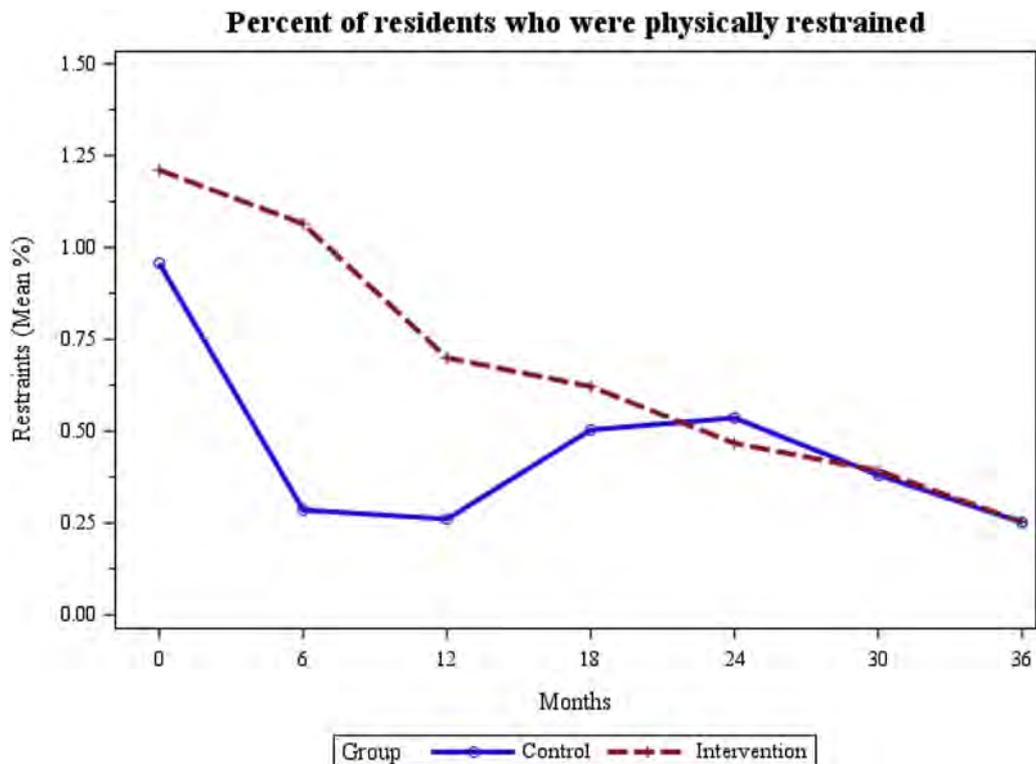


Fig. 5. Average QM Scores of Intervention and Comparison Groups for Restraints.

Discussion

APRNs were embedded full-time in 16 nursing homes in the MOQI Initiative and were expected to help the nursing home staff and leadership reduce unnecessary hospital and emergency room

transfers; improve resident health outcomes; improve the process of transitioning between inpatient hospitals and nursing facilities; and reduce overall healthcare spending without restricting access to care or choice of providers. As reported, data from the MOQI Initiative supports that these goals were achieved.^{8,9} Results of this QM

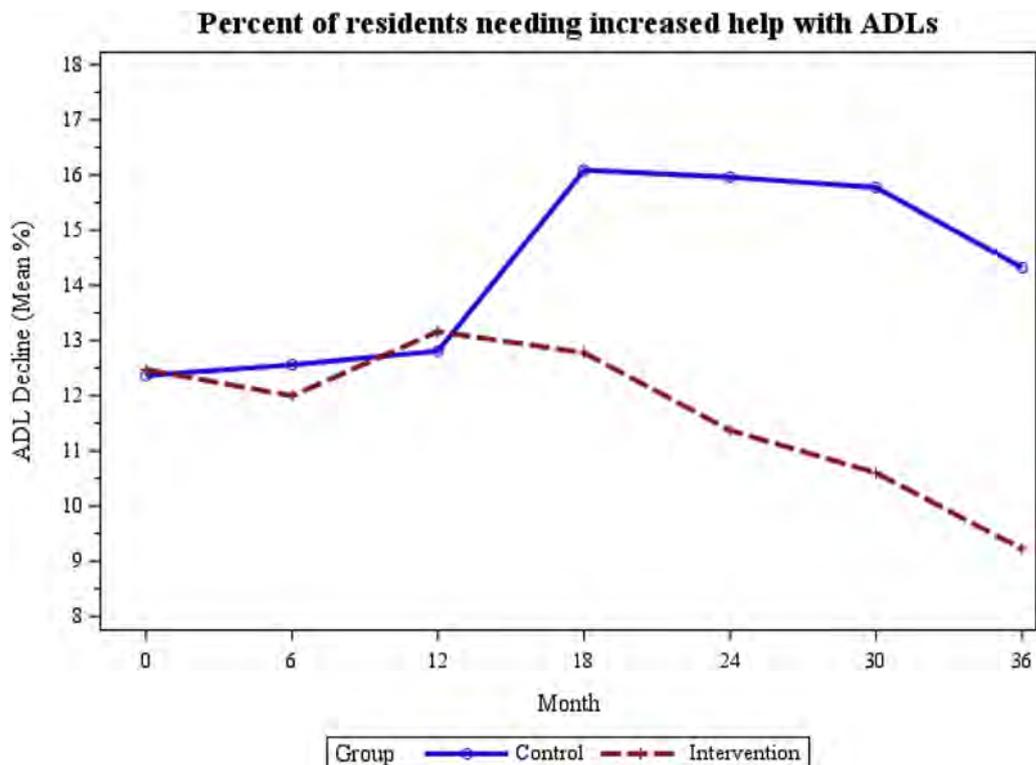


Fig. 6. Average QM Scores of Intervention and Comparison Groups for Activities of Daily Living.

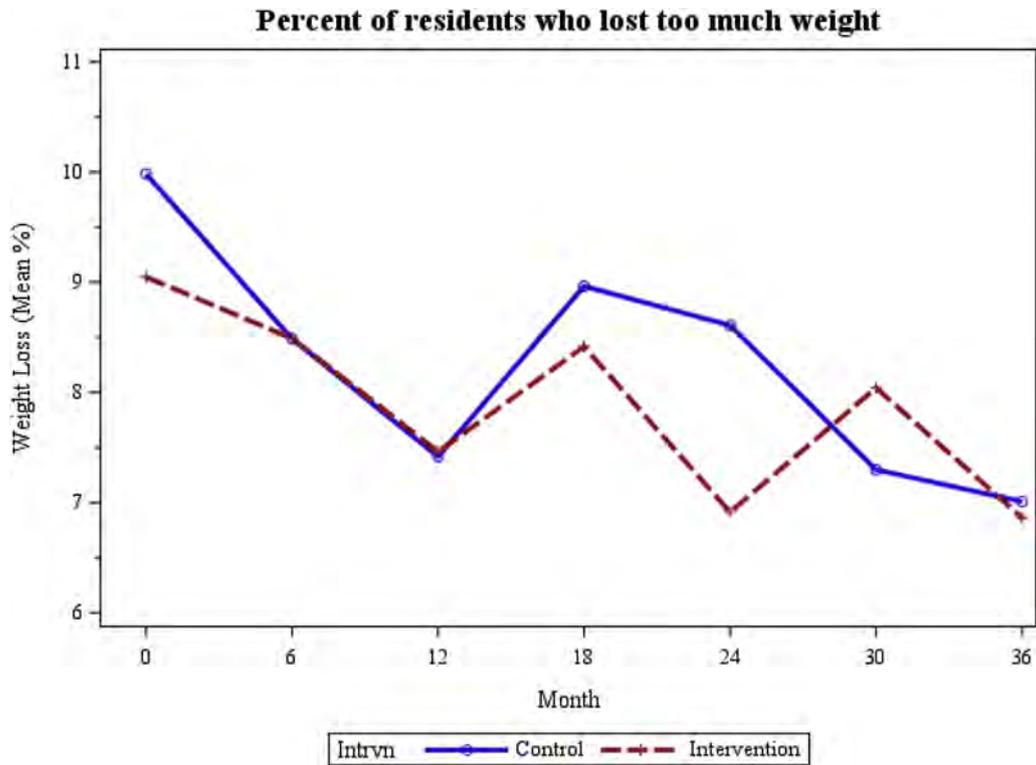


Fig. 7. Average QM Scores of Intervention and Comparison Groups for Weight Loss.

analysis confirm that significant improvement in QM scores occurred during the course of this multiyear intervention participating nursing homes in MOQI. APRNs specifically worked with direct care staff and leadership of each facility to improve early illness recognition, help

staff improve care delivery systems such as those for hydration, nutrition, mobility restoration, skin integrity, and elimination. They coached staff and role modeled advanced practice assessment skills while proactively managing changes in health status and using the

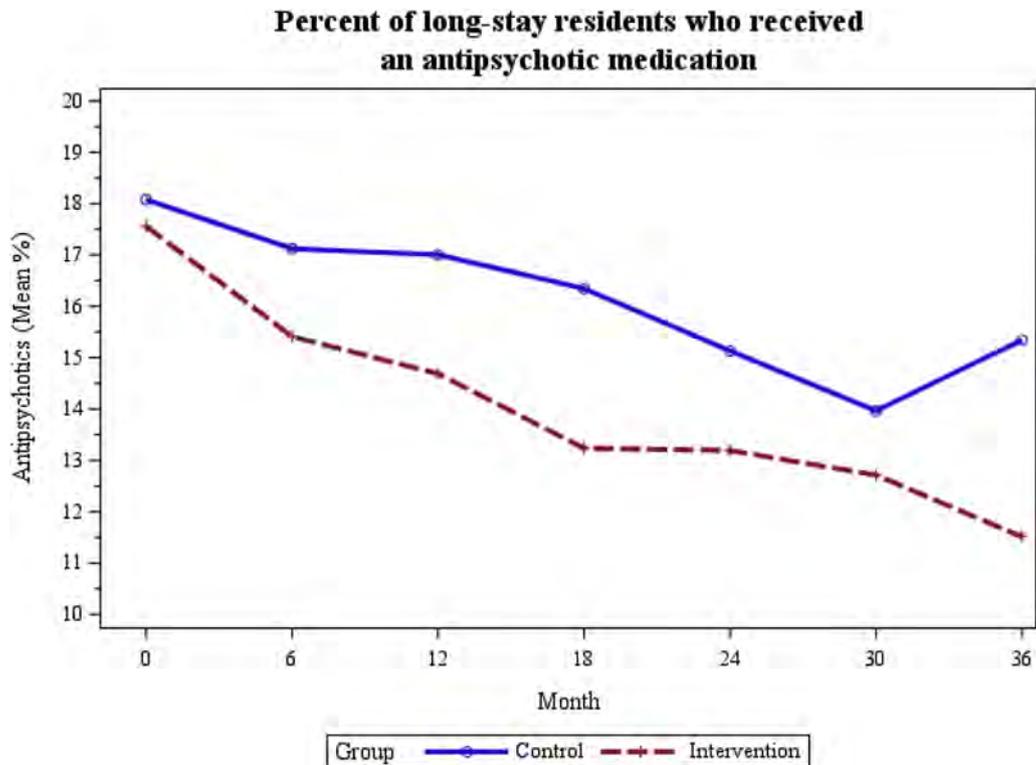


Fig. 8. Average QM Scores of Intervention and Comparison Groups for Antipsychotic Medication.

Table 2
Within-Group Comparisons Repeated Measures Analysis of Covariance

Within-Group Comparisons With 6-Mo Time Points					
Differences are Mo 6-Mo 12, 18, 24, 30, and 36					
Groups	Mo	Estimate	P	Lower	Upper
Control	12	0.14	.618	-0.42	0.70
	18	-0.34	.318	-1.00	0.33
	24	-0.19	.566	-0.84	0.46
	30	0.23	.497	-0.43	0.89
	36	0.24	.441	-0.37	0.84
Intervention	12	0.11	.724	-0.53	0.75
	18	0.23	.486	-0.42	0.89
	24	1.07	.013	0.23	1.91
	30	1.05	.021	0.16	1.95
	36	1.72	.000	0.84	2.61

latest evidence-based practice information for the care of older people.¹²

An important feature of the MOQI Initiative is building the use of Interventions to Reduce Acute Care Transfers II, particularly Stop and Watch and Situation, Background, Assessment, Recommendation,¹³ into routine care delivery in each facility. The APRNs and MOQI staff reinforced the use of Stop and Watch by all direct care staff, families, and other staff (eg, housekeeping). Using Stop and Watch systematically helps to report to a nurse any resident changes noticed by most people working or visiting the nursing home. The nurse can assess the resident for a change in health status and start early treatment if needed. Then, nurses use SBAR to gather necessary information as they assess a resident with a change in health status to report more complete findings to primary care providers. Using INTERACT II increases the accuracy and completeness of assessment so early treatment of the change in health status is likely more effective.

Table 3
QM Composite Score by Facility With 6 Month Intervals Slope Estimates by Individual Intervention Facility (n = 16)

Facility Number	Effect	Estimate	Standard Error	t Value	P Value
1	Slope	-0.036	0.004764	-7.55	.0006
2	Slope	-0.049	0.0067	-7.29	.0008
3	Slope	-0.053	0.0153	-3.47	.0178
4	Slope	-0.138	0.05368	-2.57	.0502
5	Slope	-0.027	0.01934	-1.4	.2195
6	Slope	-0.147	0.05435	-2.71	.0421
7	Slope	-0.098	0.03201	-3.06	.0280
8	Slope	-0.052	0.01499	-3.44	.0185
9	Slope	0.02	0.01627	1.24	.2683
10	Slope	-0.025	0.01992	-1.26	.2623
11	Slope	-0.03	0.02605	-1.16	.2981
12	Slope	-0.047	0.02122	-2.2	.0786
13	Slope	0.005	0.03013	0.18	.8660
14	Slope	-0.163	0.02853	-5.72	.0023
15	Slope	0.055	0.01082	5.09	.0038
16	Slope	-0.039	0.02287	-1.7	.1507

The MOQI Initiative was also designed with an interdisciplinary focus and team to support all 16 nursing facilities with their APRNs.^{7,9,12} To facilitate INTERACT/Quality Improvement, there is a full time (QI) Coach (nurse with skills to facilitate quality improvement and use of INTERACT); a health information technology coordinator (nurse with health information technology skills) who focuses on improving secure health information exchange through technology; and a care transitions coach (Master of Social Work-prepared social worker with skills to facilitate end of life decision-making, quality improvement activities around transitions, and psychosocial care). The MOQI medical director (physician with expertise in geriatrics and nursing home practices) works part-time with the project and full-time in practice with older adults. This support team is key to helping balance the

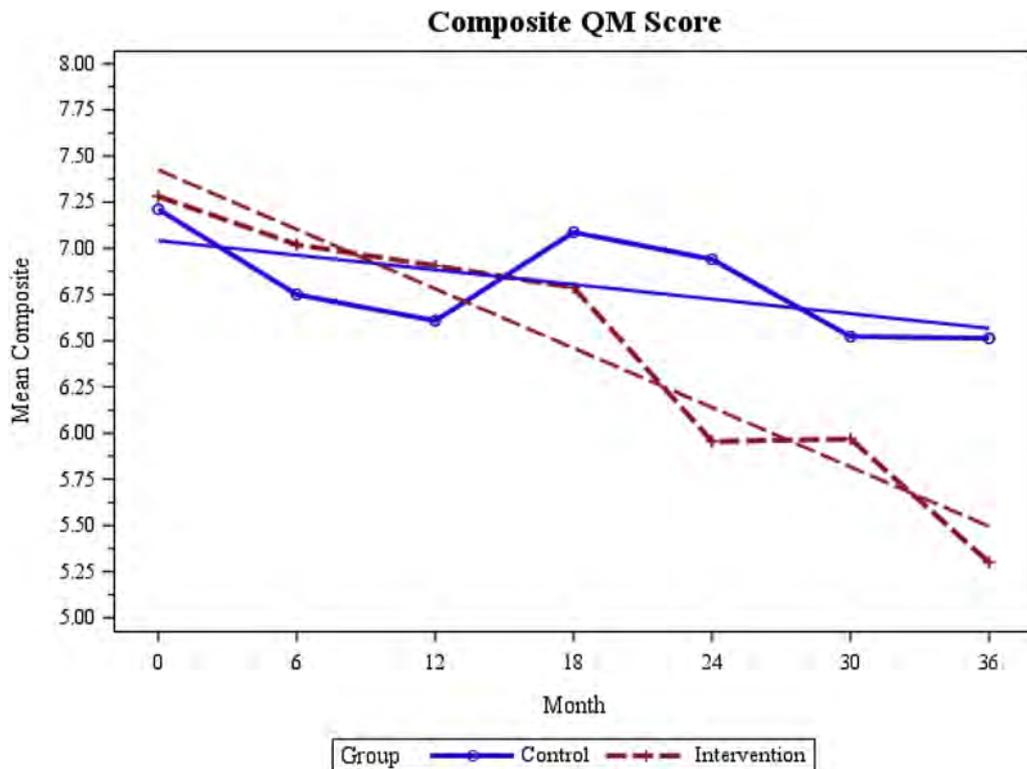


Fig. 9. QM composite score for Missouri Quality Initiative intervention and comparison group nursing homes.

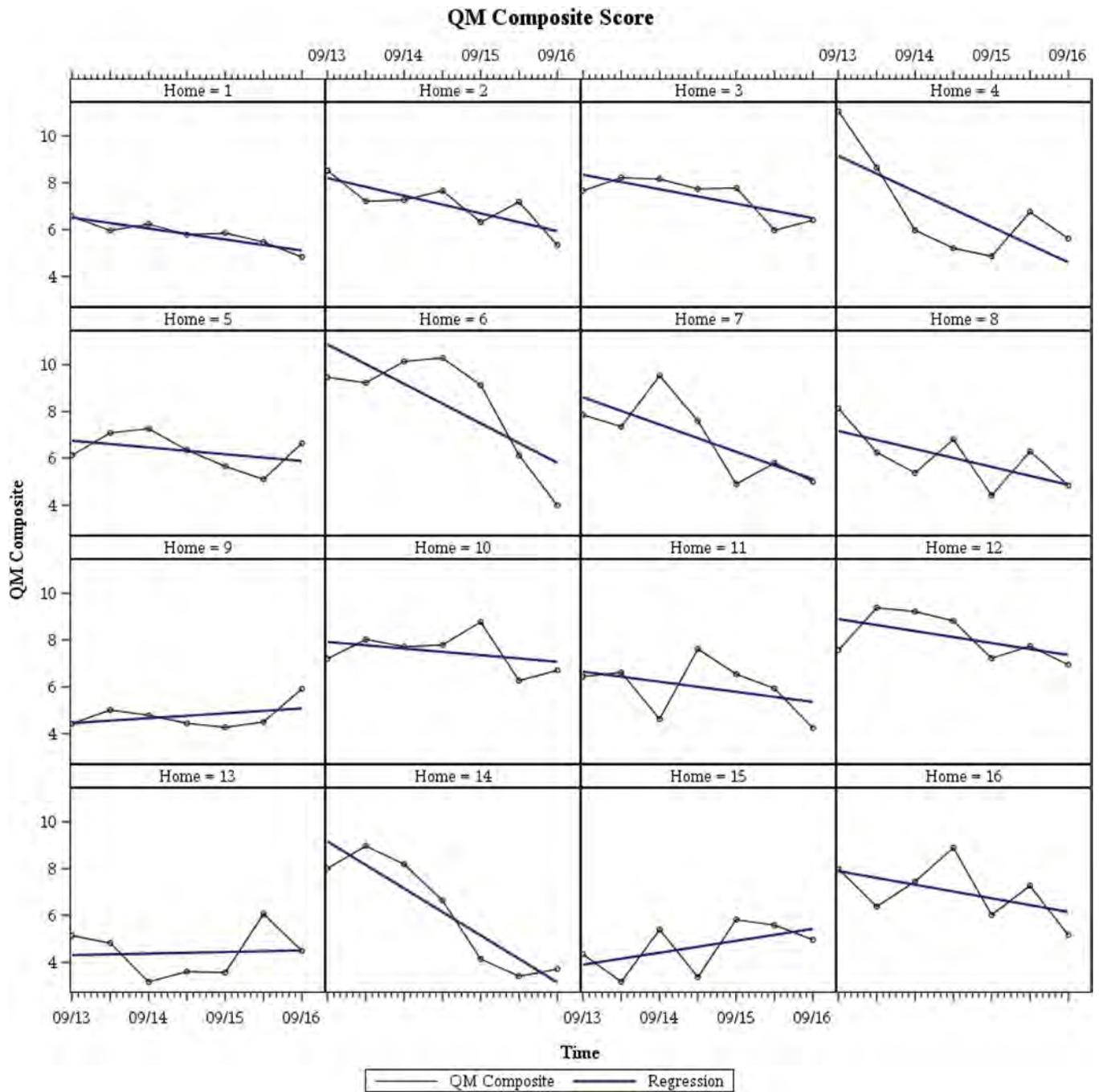


Fig. 10. Plots of QM composite scores and regression slopes for individual intervention facilities.

multifaceted focus that is needed for the success of the MOQI intervention.¹²

The experience of embedding APRNs in nursing homes providing care to long-term stay Medicare and Medicaid residents has been studied since before the passage of OBRA-87 and over the years of evolution of the use of MDS and QMs to measure quality of care in nursing homes. There have been consistent findings of the effectiveness of APRNs in nursing homes.^{2–4,14} With the overall improvement measured in the MOQI Initiative^{8,9} and the positive influence of APRNs on QMs reported in these analyses, there is increasing support for the wide-spread use of APRNs in nursing homes throughout the US.

For APRNs to work in nursing homes throughout the US, there are key changes in the Code of Federal Regulation (CFR 483.40) that are detailed

by Rantz et al.¹⁵ At this time, APRNs who are hired by nursing facilities cannot bill for required visits of Medicare beneficiaries (most residents of nursing facilities are Medicare beneficiaries); APRNs not hired by nursing facilities may bill for these required visits. With a straight-forward change, that in either case, billing could occur, nursing facilities could cover salary costs of APRNs, this 1 change would enable nationwide hiring of APRNs by nursing facilities to serve residents. There is precedent for this change, as currently, nursing facility-employed physicians are authorized to conduct and bill for required and necessary visits for skilled and long stay residents. Restricting visits by a nursing facility-employed APRN while allowing nursing facility-employed physicians is unnecessary regulation of an APRN's practice and inappropriately restricts nursing facility residents from access to APRN care. In addition, with the

advent of value based medicine there are sufficient cost and quality control measures to make source of employment mute.

Costs effectiveness and cost savings of the MOQI intervention was measured by an independent evaluation team of RTI. Medicare expenditures were significantly reduced in all categories for MOQI vs a comparison group that the evaluation team of RTI selected MOQI had significant reductions of the following: 10.4% in total Medicare expenditures by -\$2066 per resident $P = .034$; 33.6% reduction in spending on all-cause hospitalizations by -\$1369 per resident, $P < .001$; and 45.2% reduction in avoidable hospitalizations by -\$577 per resident, $P < .001$.¹⁶ With the results of the impact of APRNs on QMs, cost savings by improving quality of care should also be considered by nursing home leaders, as other research has found that improving quality improves costs of care.^{17–20}

Conclusions

Findings from the MOQI Initiative suggest that the presence of an embedded APRN in nursing homes has a positive effect on improving MDS QMs. Findings also suggest substantial cost savings in Medicare costs. Federal regulations in the US need minor adjustments to spread these findings nationwide. Medical Directors, APRNs, all nurses and direct care staff, interdisciplinary staff, leaders, and consumers of nursing home care are called to come together with regulators and legislators to make these changes happen. Quality of care has been a focus of much debate and wringing of hands for many years, the time for action to provide access to APRNs in nursing homes full-time to older adults is now. Evidence for this action continues to mount. This analysis measuring the effect of APRNs on QMs is another substantial piece of that evidence so that nursing homes could improve healthcare and financial outcomes of older adults in need of care.

Acknowledgments

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