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Effects of an Intervention to Reduce Hospitalizations From Nursing Homes

A Randomized Implementation Trial of the INTERACT Program

Robert L. Kane, MD; Peter Huckfeldt, PhD; Ruth Tappen, EdD, RN; Gabriella Engstrom, PhD, RN; Carolina Rojido, MD; David Newman, PhD; Zhiyou Yang, BS; Joseph G. Ouslander, MD

IMPORTANCE Medicare payment initiatives are spurring efforts to reduce potentially avoidable hospitalizations.

OBJECTIVE To determine whether training and support for implementation of a nursing home (NH) quality improvement program (Interventions to Reduce Acute Care Transfers [INTERACT]) reduced hospital admissions and emergency department (ED) visits.

DESIGN, SETTING, AND PARTICIPANTS This analysis compared changes in hospitalization and ED visit rates between the preintervention and postintervention periods for NHs randomly assigned to receive training and implementation support on INTERACT to changes in control NHs. The analysis focused on 85 NHs (36 717 NH residents) that reported no use of INTERACT during the preintervention period.

INTERVENTIONS The study team provided training and support for implementing INTERACT, which included tools that help NH staff identify and evaluate acute changes in NH resident condition and document communication between physicians; care paths to avoid hospitalization when safe and feasible; and advance care planning and quality improvement tools.

MAIN OUTCOMES AND MEASURES All-cause hospitalizations, hospitalizations considered potentially avoidable, 30-day hospital readmissions, and ED visits without admission. All-cause hospitalization rates were calculated for all resident-days, high-risk days (0-30 days after NH admission), and lower-risk days (≥31 days after NH admission).

RESULTS We found that of 85 NHs, those that received implementation training and support exhibited statistically nonsignificant reductions in hospitalization rates compared with control NHs (net difference, −0.13 per 1000 resident-days; $P = .25$), hospitalizations during the first 30 days after NH admission (net difference, −0.37 per 1000 resident-days; $P = .48$), hospitalizations during periods more than 30 days after NH admission (net difference, −0.09 per 1000 resident-days; $P = .39$), 30-day readmission rates (net change in rate among hospital discharges, −0.01; $P = .36$), and ED visits without admission (net difference, 0.02 per 1000 resident-days; $P = .83$). Intervention NHs exhibited a reduction in potentially avoidable hospitalizations overall (net difference, −0.18 per 1000 resident-days, $P = .01$); however, this effect was not robust to a Bonferroni correction for multiple comparisons.

CONCLUSIONS AND RELEVANCE Training and support for INTERACT implementation as carried out in this study had no effect on hospitalization or ED visit rates in the overall population of residents in participating NHs. The results have several important implications for implementing quality improvement initiatives in NHs.

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Author Affiliations: University of Minnesota School of Public Health, Minneapolis (Kane, Huckfeldt, Yang); Florida Atlantic University, Christine E. Lynn College of Nursing, Boca Raton (Tappen, Newman, Ouslander); Florida Atlantic University, Charles E. Schmidt College of Medicine, Boca Raton (Engstrom, Rojido, Ouslander).

Corresponding Author: Peter Huckfeldt, PhD, University of Minnesota School of Public Health, MMC 729, 420 Delaware St, SE, Minneapolis, MN 55455 (huckfeld@umn.edu).

Policy makers are increasingly focused on the high rate of hospitalizations and emergency department (ED) visits in the nursing home (NH) population.[1-3] Approximately 20% to 25% of NH admissions are readmitted to the hospital within 30 days.[4] A substantial percentage of these hospitalizations are rated as potentially avoidable.[5-7] On average, NH residents are sent to the ED close to twice per year, many with normal vital signs and no diagnostic test, suggesting that these visits were avoidable.[8] These patterns are particularly troubling given that NH residents are at high risk to develop complications during hospitalization and ED visits.[9,10]

The lack of focus on reducing readmissions has been attributed in part to Medicare payment policies that historically provided little financial incentive to coordinate care across health care settings.[1-4] New Medicare payment reforms, such as accountable care organizations and bundled payments, are intended to produce incentives to reduce potentially avoidable hospital admissions. In this context, NHs need effective approaches to better coordinate care and reduce hospitalizations.

The INTERACT program (Interventions to Reduce Acute Care Transfers) includes a set of tools that address the key factors leading to avoidable hospital admissions and ED visits among NH residents. INTERACT is based on 3 core tenets: (1) recognition and management of acute conditions before they become severe enough to require hospitalization; (2) providing communication, documentation, and decision support tools that allow for effective management in the NH without hospital admission when safe and feasible; and (3) emphasizing advance care planning, hospice, and palliative care to encourage goals of care discussions and reduce hospitalizations in people with end-stage illness among whom the risks and discomforts of hospital care often outweigh the benefits.[11] A nonrandomized pilot study of INTERACT involving 30 volunteer NHs found a 24% reduction in all-cause hospitalizations among NHs that actively participated, compared with only a 6% reduction in those that did not.[12] The NHs that actively participated in implementing INTERACT, however, may have systematically differed from those that did not (for example, in motivation to reduce hospitalizations).

To address this potential selection bias, we conducted a cluster-randomized clinical trial with the hypothesis that NHs provided with INTERACT training and implementation support would have a greater reduction in rates of hospitalization and ED visits than control NHs. The intent-to-treat analysis explored 2 potential paths by which effective INTERACT implementation could lead to reduced hospitalizations: (1) Resident medical conditions could be managed more effectively leading to fewer acute conditions that might require admission; we hypothesized that this path would result in fewer hospitalizations.[13] (2) Problems might be identified and managed earlier in the NH; this was assessed by examining the rate of ED visits that did not result in hospital admission.

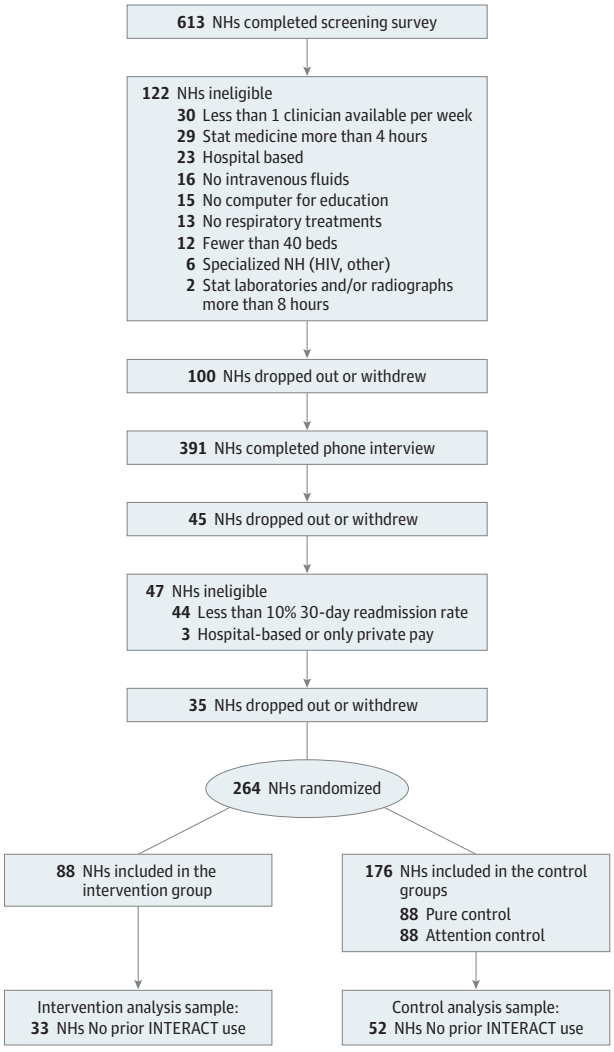
Key Points

Question Did training and support for implementation of a nursing home (NH) quality improvement program (Interventions to Reduce Acute Care Transfers [INTERACT]) reduce hospitalizations and emergency department (ED) visits?

Findings Among 85 NHs with no prior use of INTERACT, we compared preintervention and postintervention changes in hospitalization and ED visit rates for NHs randomly assigned to receive training and implementation support on INTERACT to changes in control NHs. We found no statistically significant effect on hospitalizations per 1000 NH residents.

Meaning Training and support for INTERACT implementation as carried out in this study had no effect on hospitalization or ED visit rates in participating NHs.

Figure 1. CONSORT Diagram



Nursing homes (NHs) included in the INTERACT study met the following inclusion criteria: (1) strong support from NH leadership, including signing a participation agreement; (2) the ability to safely manage acute changes in condition on-site (availability of on-site medical coverage and laboratory and pharmacy services); and (3) availability of technical support for training and data submission. Stat indicates urgent or rushed.

Methods

Study Sample, Inclusion, and Exclusion Criteria

The study was approved by the Florida Atlantic University institutional review board as a quality improvement project. **Figure 1**

shows the derivation of the NH sample; NHs were recruited through collaboration with organizations and NH chains. Inclusion criteria included strong support from NH leadership including signing a participation agreement, the ability to safely manage acute changes in condition on-site (availability of on-site medical coverage, as well as laboratory and pharmacy services), and availability of technical support for training and data submission. Exclusion criteria included hospital-based facilities, participation in other projects aimed at reducing hospitalizations, or participation in major quality improvement efforts that could have impeded INTERACT implementation. Of the 613 NHs initially screened, 264 were enrolled and randomized to 1 of 3 groups: intervention, usual care control with no contact, and an attention control group (added in response to a suggestion from the study section for the original grant proposal) to account for possible Hawthorne effects of being assessed, which provided information on efforts to reduce hospitalizations quarterly via an online survey. The randomization was stratified by NHs' initial level of prior INTERACT use and baseline self-reported 30-day admission rates. Before the intervention was implemented, a majority of the enrolled NHs had already had some experience with INTERACT (as determined by telephone calls to facility leadership asking if any of 7 specific INTERACT tools were being used before the study was initiated). To provide the clearest test of the potential effect of INTERACT training and implementation, NHs with prior use of INTERACT tools were eliminated from the primary analyses. Because the results for the usual care and attention control groups were very similar, we combined them in the analysis as a single control group, resulting in a sample of 33 intervention and 52 control NHs. We also conducted sensitivity analyses using more inclusive samples of NHs.

Residents were identified using the Minimum Data Set (MDS) for each participating NH and linked with information on Medicare coverage, demographics, and mortality using the Medicare Master Beneficiary Summary File. The preintervention period was defined as January 2012 to February 2013 and the intervention period was March 2013 to February 2014. Hospitalizations and Medicare covered NH stays were identified using the Medicare Provider Analysis and Review file. Emergency department visits were identified using outpatient claims files. The evaluation data came from Medicare records for beneficiaries with fee-for-service coverage (ie, Parts A and B, because not all physicians are required to submit claims for Medicare Advantage enrollees[14]), leading to a sample size of 9050 and 8380 residents in intervention NHs in the preintervention and intervention periods, respectively, and 14 428 and 13 472 residents in control NHs in the preintervention and intervention periods, respectively.

Trial protocol is available in Supplement 1.

Intervention

INTERACT training and implementation support were based on experiences with multiple prior educational and quality improvement programs in NHs[15-18] using a strategy that could theoretically be emulated and disseminated by a NH chain, a coalition of NHs, or a health system and its affiliated NHs. Each intervention NH selected a project "champion" and "cochampion" who were responsible for facilitating INTERACT training and implementation, including periodic submission of facility-based data and participation in monthly phone calls and follow-up webinars. The INTERACT program and the training and implementation support strategies used are discussed further in eAppendix 1 in Supplement 2.

Measures

The primary outcome was the rate of hospitalizations per 1000 resident-days. In addition, we examined other outcomes that directly related to hypotheses that we prespecified on clinicaltrials.gov, including hospitalization rates during high-risk periods (within 30-day of NH admission) and low-risk periods (≥31 days after NH admission); avoidable hospitalizations rates (using federal definitions[6]); 30-day readmission rates (ie, among NH residents discharged from a hospital in each month, the percentage that were readmitted within 30 days, calculated similarly to that in the Medicare Hospital Readmissions Reduction Program[19]); and rates of ED visits that did not result in hospital admission. We investigated other outcomes (not reported) that do not directly relate to the prespecified hypotheses listed on clinicaltrials.gov.

The analyses controlled for baseline NH characteristics that could influence hospitalization rates including: rural location, number of Medicare certified beds; for-profit status; the number of certified nursing assistant, licensed practical nurse, and registered nurse hours per resident day reported at baseline (in 2012); occupancy rate; percent long-stay residents; and quality performance on Nursing Home Compare (top quartile of composite inspection score and a rating of 4 or 5 on a 5-point scale for overall, survey and quality ratings). Person-month level controls included indicators for age in 5-year increments, sex, race and ethnicity, Medicaid eligibility, hierarchical condition category score, any Part A stay and total Part A days, function reported on the MDS, including activities of daily living (ADLs) (indicator variables for 0-4, 5-8, 9-12, 13-16),[20] and the cognitive performance scale (indicator variables for 0-2, 3-4, 5-6).[21]

Statistical Analyses

The unit of analysis was a facility-month. For each outcome measure, we created adjusted rates (at the resident-month level) that adjusted for facility and resident characteristics and then aggregated them to the NH-month level for the 14 months prior to and the year of the intervention. For hospitalizations and ED visits per 1000 resident-days, we constructed NH-month aggregate rates that were weighted by the number of days residents spent in the NH each month. Our analytic framework used a difference-in-differences approach that computed relative changes in outcomes for intervention versus control NHs between the preintervention and intervention periods, including facility and month-year fixed effects. We weighted the analyses by the number of resident-days for each NH and month, except for readmission rates where the analysis was weighted by the number of index hospitalizations for each NH and month. Because we were also able to follow residents for an additional 10 months, we examined outcomes for the full 22-month postperiod as well. We estimated alternative specifications (eAppendix 2 in Supplement 2) (**Table 1**) that defined the unit of observation as a resident-month and estimated regressions that directly controlled for patient characteristics and included facility and month-year fixed effects.

Table 1. Baseline NH Characteristics by Intervention Status[a]

Characteristic	Intervention NHs (n = 33)	Control NHs (n = 52)
General characteristics		
Rural, No. (%)	9 (27)	9 (17)
For profit, No. (%)	19 (58)	32 (62)
Nonprofit, No. (%)	14 (42)	18 (35)
Government, No. (%)	0	2 (4)
Certified beds, mean (SD)	145 (69)	133 (66)
Occupancy rate, mean (SD)	0.90 (0.18)	0.91 (0.08)
Proportion of resident-days that are long-stay[b]	0.67 (0.09)	0.63 (0.18)
Staff hours per resident day, mean (SD)		
Certified nursing assistant	2.57 (0.63)	2.48 (0.54)
Licensed practical nurse	0.90 (0.27)	0.88 (0.38)
Registered nurse	0.67 (0.26)	0.77 (0.29)
Quality performance,[c] No. (%)		
Top quartile of weighted composite inspection score	6 (18)	10 (19)
Overall quality of 4 or 5	16 (48)	30 (58)
Survey rating of 4 or 5	7 (21)	22 (42)
Quality rating of 4 or 5	29 (88)	44 (85)
Staffing rating of 4 or 5	14 (42)	22 (42)
Registered staffing rating of 4 or 5	11 (33)	26 (50)

Abbreviation: NH, nursing home.

[a] The sample includes NHs randomized that reported no INTERACT use at baseline.

[b] Long-stay defined as the proportion of total 2012 resident-days that are more than 100 days into a stay.

[c] Quality performance measures come from 2012 Nursing Home COMPARE data.[22] The weighted inspection composite score is based on 3 most recent annual surveys of nursing homes, results from complaints investigations, and inspector repeat visits to facilities to verify compliance. In December 2011, the percentage of facilities receiving 4 or 5 stars was 43% for overall quality, 34% for survey, 47% for quality, 48% for staffing, and 40% for registered nurse staffing.

Our models needed to account for the correlation of errors within facilities over time, reflecting that the cluster randomization occurred at the facility level and outcomes for patients within the same facility may be correlated. We followed the literature and calculated cluster-robust standard errors at the facility level; the advantage of this approach is that the cluster-robust errors do not require a correct specification of within-cluster error correlation.[23,24] Performing an analysis of variance at the patient-level, we estimated a modest intracluster correlation of 0.028 for the probability of any hospitalization in 2012 among residents in our sample. It is important to note, however, that because of the large number of residents in each cluster (250 on average per NH in 2012), even modest correlation within facilities could lead to underestimated standard errors.[25]

Results

Of the 281 752 person-months identified through MDS assessments among residents in NHs with no reported baseline exposure to INTERACT, 45 648 (16%) were covered under Medicare Advantage and dropped from the analysis. The proportion was lower for the intervention relative to the control groups (12% vs 19%). An additional 4% (n = 8964) were dropped due to missing data, leading to an analysis sample of 227 140 person-months.

The characteristics of the intervention and control NHs were generally similar (Table 1). Intervention NHs were more often in rural areas and had a lower proportion of overall quality and survey scores rated as 4 or 5. Overall, residents in intervention and control NHs were similar in the preintervention and intervention periods (**Table 2**); except that during both periods, residents in intervention NHs were more likely to be black and non-Hispanic, less likely to be white and non-Hispanic, and more

Table 2. Resident Characteristics by Intervention Status and Study Period[a]

Characteristics	Preintervention (January 2012-February 2013)		During Intervention (March 2013-February 2014)	
	Intervention (33 Unique NHs; 9050 Unique Residents)	Control (52 Unique NHs; 14 428 Unique Residents)	Intervention (33 Unique NHs; 8380 Unique Residents)	Control (52 Unique NHs; 13 472 Unique Residents)
Age, mean (SD), y	81.0 (10.9)	81.7 (10.3)	80.1 (10.9)	80.4 (10.5)
Female, No. (%)	5989 (66)	9581 (66)	5583 (67)	8994 (67)
Black non-Hispanic, No. (%)	1609 (18)	1803 (12)	1542 (18)	1759 (13)
White non-Hispanic, No. (%)	7256 (80)	12 393 (86)	6675 (80)	11 477 (85)
Hispanic, No. (%)	95 (1)	80 (1)	90 (1)	72 (1)
Asian/other, No. (%)	90 (1)	152 (1)	73 (1)	164 (1)
Mean (SD) Hierarchical Condition Category Score[b]	1.46 (1.20)	1.39 (1.16)	1.40 (1.12)	1.35 (1.13)
Dual Medicare/Medicaid status, No. (%)	2846 (31)	3930 (27)	2693 (32)	3722 (28)
Any Part A days, No. (%)	6167 (68)	10 429 (72)	5274 (63)	9118 (68)
Total Part A days (in period), mean (SD)	25.8 (30.8)	23.8 (27.8)	23.0 (28.9)	21.4 (26.0)
Late loss ADL score, mean (SD) [range, 0-16]	8.2 (4.5)	7.9 (4.5)	8.2 (4.5)	8.0 (4.5)
Complete dependence, any late loss ADL (ever in period), No. (%)	2610 (29)	2873 (20)	2323 (28)	2317 (17)
Terminal diagnosis (ever in period), No. (%)	360 (4)	665 (5)	265 (3)	550 (4)
Severe cognitive disability, No. (%)	947 (10)	1254 (9)	767 (9)	1058 (8)

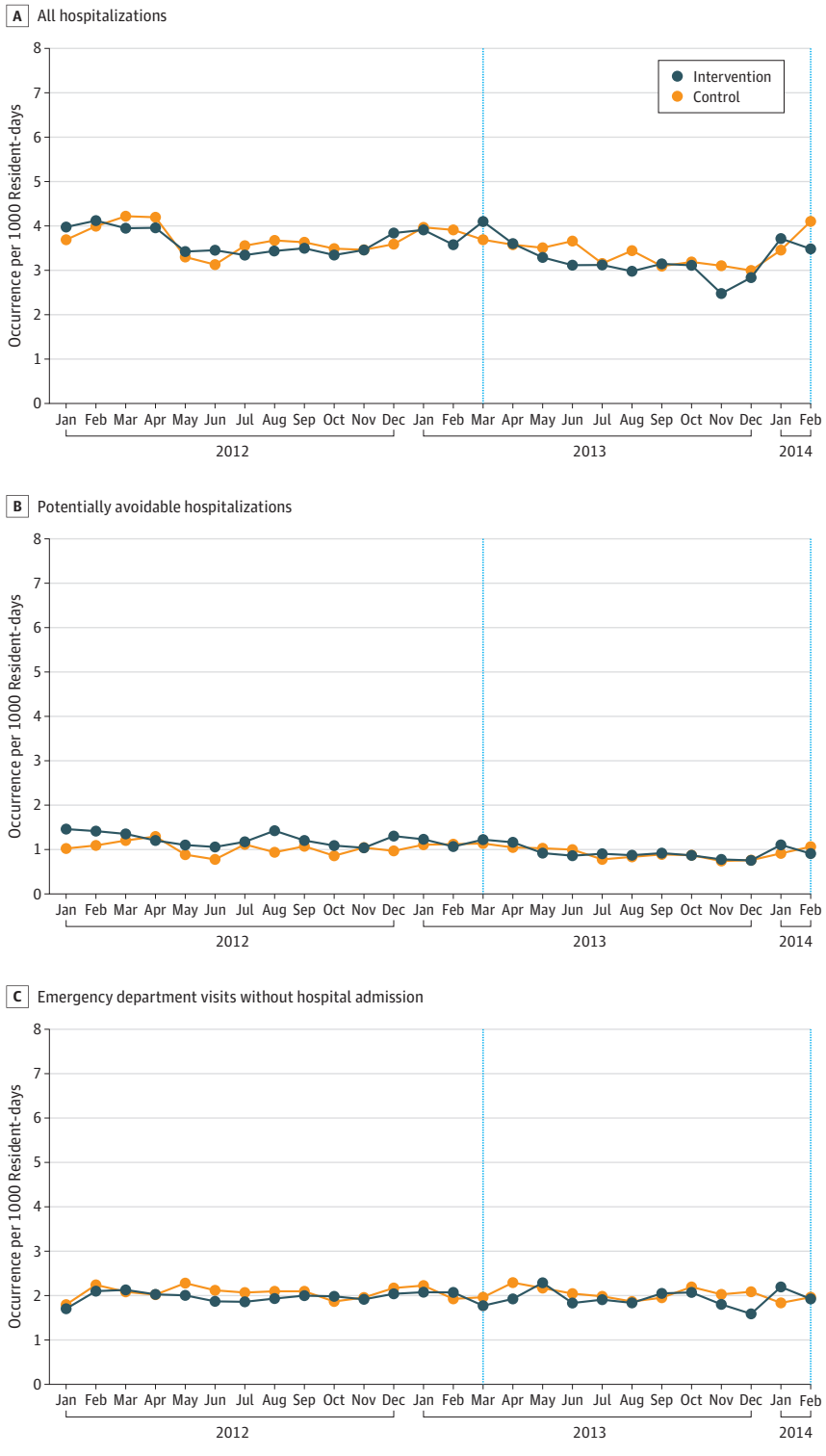
Abbreviations: ADL, activity of daily living; NH, nursing home.

[a] The sample includes residents of NHs randomized and who reported no INTERACT use at baseline (33 intervention and 52 control NHs). Table displays unweighted averages across NH residents.

[b] Hierarchical Condition Category score ranges from 0.164 to 12.052; 1st percentile, median, and 99th percentile are 0.37, 1.00, and 5.55 respectively.

[c] Severe cognitive disability is defined as patients with a cognitive performance scale score of 5 or 6.

Figure 2. Trends in Hospitalizations and Emergency Department Visits for 33 Intervention NHs and 52 Control NHs



Trends in (A) all hospitalizations, (B) potentially avoidable hospitalizations, and (C) emergency department visits without hospital admissions for NHs randomized who reported no INTERACT use at baseline. Sample includes 33 intervention NHs and 52 control NHs. All outcomes are displayed per 1000 resident-days and are adjusted based on multiple covariates. Vertical bars indicate the initiation of INTERACT (March 2013) and the end of the 1-year intervention period (February 2014). NH indicates nursing home.

likely to have complete dependence in a late loss ADL (ie, bed mobility, transfers, eating, and/or toilet use).

Both intervention and control NHs exhibited between 3 and 4 hospitalizations per 1000 resident-days in most months of the sample period (**Figure 2**A). For a facility with a census of 100, this rate translates to 3 or 4 residents being admitted to the hospital every 10 days. This rate is comparable to that exhibited by facilities in the pilot study of INTERACT.[12] Trends in adjusted rates of all hospitalizations per 1000 resident-days were very similar between the intervention and control groups. The intervention

Table 3. Intent-to-Treat Analysis for NHs With No Baseline Use of INTERACT

Hospitalization and ED Visit Outcomes	Preintervention (January 2012-February 2013)		During Intervention (March 2013-February 2014)		Change in Intervention NHs Minus Change in Control NHs[a] (95% CI)	*P* Value
	Intervention (33 Unique NHs; 9050 Unique Residents)	Control (52 Unique NHs; 14 428 Unique Residents)	Intervention (33 Unique NHs; 8380 Unique Residents)	Control (52 Unique NHs; 13 472 Unique Residents)		
	Mean (SD)[b]	Mean (SD)[b]	Mean (SD)[b]	Mean (SD)[b]		
Hospitalizations						
All-cause admissions	3.66 (1.40)	3.70 (1.60)	3.25 (1.26)	3.42 (1.44)	−0.13 (−0.36 to 0.10)	.25
All-cause admissions within 30 d of NH admission	9.99 (5.46)	9.93 (5.44)	8.59 (4.90)	8.93 (4.58)	−0.37 (−1.40 to 0.67)	.48
All admissions, >31 d after NH admission	2.04 (1.04)	2.10 (1.24)	1.88 (0.98)	2.02 (1.27)	−0.09 (−0.28 to 0.11)	.39
Potentially avoidable hospitalizations	1.22 (0.75)	1.03 (0.80)	0.94 (0.67)	0.92 (0.74)	−0.18 (−0.31 to −0.04)	.01
30-d readmission rate	0.21 (0.16)	0.21 (0.16)	0.19 (0.16)	0.21 (0.18)	−0.01 (−0.04 to 0.01)	.36
ED visits						
Visits that did not result in hospital admission	1.97 (1.01)	2.07 (1.23)	1.93 (1.02)	2.02 (1.12)	0.02 (−0.17 to 0.22)	.83

Abbreviations: ED, emergency department; NH, nursing home.

[a] Controlling for NH fixed effects and month-year fixed effects.

[b] Units are hospitalization or ED visits per 1000 resident-days (except for the readmission rate, which is a proportion of index hospitalizations that were associated with a hospital readmission within 30 d), adjusted for resident and facility characteristics. For example, rates of 3.0 to 4.0 for all-cause admissions in a typical NH with a census of 100 would represent 3 to 4 hospital admissions every 10 days.

NHs exhibited a slightly higher rate of potentially avoidable hospitalizations in the preintervention period and converged with control NHs during the intervention period (Figure 2B). Trends for ED visits without admission were also very similar between the intervention and control groups (Figure 2C).

Intervention NHs exhibited no significant reduction in overall hospital admissions relative to control NHs (−0.13 hospitalizations per 1000 resident-days; 95% CI, −0.36 to 0.10; *P* = .25) (**Table 3**). The standard error for the estimated effect on overall hospital admissions (0.12) implies that we were able to detect effect sizes larger than 0.24 hospitalizations per 1000 resident-days, which is a 6.5% reduction in hospitalizations for the intervention group relative to the preperiod (3.66 hospitalizations per 1000 resident-days). Similarly, there was no significant reduction in hospitalizations within 30 days of NH admission or 31 or more days after NH admission. We did find a reduction in potentially avoidable hospitalizations (−0.18 hospitalizations per 1000 resident-days; 95% CI, −0.31 to −0.04; *P* = .01); this represents a nearly 15% reduction in hospitalizations relative to the preintervention rate among intervention facilities. This estimate was not robust to adjusting for multiple comparisons with a Bonferroni correction; with 6 outcomes, the *P* value threshold for statistical significance was .008. Results for readmission rates and ED visits without hospital admission showed no significant differences between the intervention and control groups (Table 3). We found no significant effects for outcomes that were not prespecified (hospitalizations via the ED, all ED visits, ED visits without admission that were deemed primary care treatable,[26] mortality, and a composite outcome including NH deaths, hospitalizations, and observations stays). Focusing on just severely impaired residents (based on the presence of advanced disability, severe cognitive impairment, and/or short life expectancy in the MDS), we found a similar pattern of results as for the main sample; all effects were insignificant except for potentially avoidable hospitalizations.

In a series of sensitivity analyses, we estimated the main regression specifications for the full sample of 264 nursing homes that were initially randomized and found no significant effects of INTERACT training and implementation. However, when we focused on severely impaired resident-months within the full sample of NHs, we found significant reductions in ED visits for INTERACT relative to control NHs that were larger in magnitude than in the sample of NHs with no baseline INTERACT use. When we estimated the main analysis at the resident-month level, including facility fixed effects, year-month fixed effects, and resident characteristics and clustering standard errors at the facility level, we found similar results to the results from the facility-month level (eAppendix 2 in Supplement 2) (Table 1). Finally, we used a 22-month postperiod (extending to the end of 2014) and found similar results.

Discussion

The INTERACT program seeks to improve quality of care and reduce hospital readmissions through improved identification, evaluation, and management of acute changes in condition; use of care paths and decision support by NH staff; increasing advanced care planning activities; and facilitating quality improvement activities. This study evaluated training and implementation support for the INTERACT program across 85 NHs that reported no use of INTERACT before the trial was initiated. Overall, the training and implementation support model did not reduce hospitalizations or ED visits, with statistically insignificant findings for 5 of 6 of the prespecified study outcomes. The reduction in potentially avoidable hospitalizations in intervention facilities implies some evidence for overall better management of acute changes in condition. While this estimate was not statistically significant after applying a Bonferroni correction for multiple comparisons, the magnitude implied a nearly 15% reduction in potentially avoidable hospitalizations relative to the preintervention rate for intervention NHs. This compares to a 17% relative reduction in all-cause hospitalizations observed in our pilot study.[12] In recently published results from a Centers for Medicare and

Medicaid Services (CMS) study[27] designed to reduce hospitalizations among long-stay residents, the multifaceted intervention programs involving 143 facilities in seven states resulted in 2.2 to 9.3 percentage point reductions in the probability of all-cause hospitalizations across states and 1.4 to 7.2 percentage point reductions in the probability of potentially avoidable hospitalizations and substantial reductions in Medicare expenditures.

The lack of effects of the training and implementation support for INTERACT in this study may be related to several factors, including the specific nature of the training and implementation support provided, the quality of the NH staff and medical care, concerns over legal and regulatory liability of attempts to manage sicker patients in the NH, and varying degrees of motivation to reduce hospitalizations, ED visits, and hospital readmissions based on the local penetration of value-based care initiatives such as Medicare-managed care, bundled payments, and accountable care organizations. Evidence for the importance of motivation can be seen in 2 studies[28,29] of hospitals that showed that the intensity of hospital efforts to reduce readmissions was more important than the techniques used. Moreover, a recent qualitative study of NHs found that a key difference between NHs with high and low hospitalization rates was staff attitudes towards hospital transfers.[30]

The results of this cluster randomized trial differ from an earlier evaluation of INTERACT[12] and data reported on a CMS program.[27] The pilot study and the CMS program focused on voluntary adopters of INTERACT, and thus may have been subject to selection bias—in particular, the adopters may have been more motivated to reduce hospitalizations that contributed to the reduction in hospitalizations. In contrast, INTERACT training and implementation support was randomly assigned across participating NHs in this study, and thus intervention status was independent of motivation and other differences across NHs in the sample. Moreover, the policy climate has changed since the pilot study. Shortly before the current study was initiated, Medicare implemented the Hospital Readmissions Reduction Program, a policy penalizing 30-day readmissions.[19] Possibly in response to this, we found some evidence that NHs in the control groups had adopted aspects of INTERACT before and during the intervention period (albeit without training from the study) that may have diluted the effect. Among the intervention NHs, the extent of training and support may have been insufficient. Nursing homes participating in the pilot study received more hands-on training, while the cluster randomized trial relied on online training and telephonic support. Many of the intervention NHs that received tools, training, and implementation support did not take full advantage of the training or adhere to requirements for data submission in their signed participation agreements. For example, although champions in each intervention NH were expected to complete all training modules, they only attended 67% of online webinars and completed 52% of online course modules; intervention NHs submitted 63% of root cause transfers requested; and on average NHs participated in 52% of monthly support/or feedback calls. This incomplete participation was unexpected because the NHs randomized to the immediate intervention group all received free INTERACT program materials and training, and participation agreements outlining their responsibilities were signed by administrators, directors of nursing, and medical directors.

The monthly calls with NH champions and administrators revealed barriers and facilitators to INTERACT implementation. Data from these calls were analyzed using standard qualitative techniques and categorized. Commonly cited barriers included scarce resources, staff resistance, competing demands, and instability of NH leadership; commonly cited facilitators included organization-wide involvement, persistence and oversight, adequate training, and leadership support.[31] These findings are not unique to the INTERACT program and have important implications for design and implementation of future quality improvement initiatives in NHs in the new federally required Quality Assurance and Performance Improvement program.[32] For example, implementing a major quality initiative may be more effective using a local approach in smaller groups of NHs with in-person training and support rather than distance learning and remote implementation support in a large group simultaneously, as was done in this study. While the implementation model we used may be more feasible and less costly than in-person implementation strategies, the lack of the in-person connection may not result in as effective implementation. The use of videoconferencing, Skype (Microsoft Inc), and telehealth may be better alternatives to the implementation model we used. In addition to in-person training, more rigorous follow up and certification of implementation champions, with oversight by a senior leader of the NH or the NH chain, may result in better outcomes. Also, incorporating quality improvement programs and related decision support and documentation tools into electronic health records and other forms of health information technology could help overcome several of the barriers cited.

Limitations

Some limitations in our analysis must be noted. The original sample included a substantial number of NHs that reported prior use of INTERACT. In at least 1 of the sensitivity analyses we performed, including all NHs yielded a positive result not seen in the more restricted sample. Excluding them lowered the power; however, the standard errors on our estimate of the intervention effect allowed us to detect reductions in overall hospitalization rates of 6.5% or greater. Thus, we do not think that the overall negative findings are driven by a lack of statistical power. Information on the use of INTERACT by an NH during the baseline period and during the study was self-reported and may have been subject to inaccurate or biased reporting. Further analyses are being conducted to explore the relative effects of implementation fidelity, motivation to reduce hospitalizations, and the degree of participation in the training and implementation support on the outcomes measured in this trial.

Conclusions

Training and support for INTERACT implementation as carried out in this study had no effect on hospitalization or ED visit rates in the overall population of residents in the participating NHs. The results have several important implications for implementing quality improvement initiatives in NHs.

ARTICLE INFORMATION

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Study concept and design: Kane, Huckfeldt, Tappen, Newman, Ouslander.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Kane, Huckfeldt, Newman, Yang, Ouslander.
Critical revision of the manuscript for important intellectual content: All authors.
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Administrative, technical, or material support: Kane, Tappen, Engstrom, Rojido.
Study supervision: Kane, Huckfeldt, Tappen, Ouslander.

Conflict of Interest Disclosures: Dr Ouslander is a full-time employee of Florida Atlantic University (FAU) and has received support through FAU for research on INTERACT from the National Institutes of Health, the Centers for Medicare & Medicaid Services, The Commonwealth Fund, the Retirement Research Foundation, the Florida Medical Malpractice Joint Underwriting Association, PointClickCare, Medline Industries, and Think Research; he and his wife had ownership interest in INTERACT Training, Education, and Management (I TEAM) Strategies, LLC, which had a license agreement with FAU for use of INTERACT materials and trademark for training during the time of the study, and they receive royalties from Pathway Health, which currently holds the license. Dr Ouslander also serves as a paid advisor to Pathway Health, Think Research, and Curavi. Work on funded INTERACT research is subject to the terms of conflict of interest management plans developed and approved by the FAU financial conflict of interest committee.

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