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CONNECT for Better Fall Prevention in Nursing Homes: Results from a Pilot Intervention Study

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Abstract

Background—We hypothesized that an intervention which improves nursing home (NH) staff connections, communication, and problem solving (CONNECT) would improve implementation of a falls reduction education program (FALLS).

Design—Cluster randomized trial.

Setting—Community (n=4) and VA NHs (n=4)

Participants—Staff in any role with resident contact (n=497).

Intervention—NHs received FALLS alone (control) or CONNECT followed by FALLS (intervention), each delivered over 3-months. CONNECT used story-telling, relationship mapping, mentoring, self-monitoring and feedback to help staff identify communication gaps and practice interaction strategies. FALLS included group training, modules, teleconferences, academic detailing, and audit/feedback.

Measurements—NH staff completed surveys about interactions at baseline, 3 months (immediately following CONNECT or control period), and 6 months (immediately following FALLS). A random sample of resident charts was abstracted for fall risk reduction documentation (n=651). Change in facility fall rates was an exploratory outcome. Focus groups were conducted to explore changes in organizational learning.

Results—Significant improvements in staff perceptions of communication quality, participation in decision making, safety climate, care giving quality, and use of local interaction strategies were observed in intervention community NHs (treatment by time effect $p=.01$), but not in VA NHs where a ceiling effect was observed. Fall risk reduction documentation did not change significantly, and the direction of change in individual facilities did not relate to observed direction of change in fall rates. Fall rates did not change in control facilities (2.61 and 2.64 falls/bed/yr), but decreased by 12% in intervention facilities (2.34 to 2.06 falls/bed/yr); the effect of treatment on rate of change was 0.81 (0.55, 1.20).

Conclusion—CONNECT has the potential to improve care delivery in NHs, but the trend toward improving fall rates requires confirmation in a larger ongoing study.

Keywords

nursing homes; accidental falls; staff education

Introduction

Improving care for frail older adults residing in nursing homes (NHs) remains a national priority. Because many adverse health outcomes in older adults result from the interaction of multiple risk factors rather than from a single underlying problem, it is rare that interventions focused on a single problem result in substantial improvements. Rather,

multifactorial risk reduction interventions have been proposed to be more appropriate for many of the “geriatric syndromes” that affect NH residents.¹ Multifactorial interventions have been developed for NH falls, incontinence, pressure ulcer prevention, behavioral disturbance, and insomnia.^{2–8}

Randomized controlled studies suggest that such multifactorial interventions are effective in improving outcomes when study staff implement their components; however, studies which have attempted to train *existing* NH staff to implement multifactorial risk reduction have generally not been as successful.⁹ Fall prevention exemplifies this problem. A recent systematic review and meta-analysis found a trend that multifactorial fall risk reduction interventions reduced fall rates by 22%, but the result was not statistically significant.¹⁰ When one examines the individual studies that were included in this calculation, those which used external study staff to complete risk reduction activities demonstrated substantial reductions in fall rates^{2,11–13}, while those which trained nurses or nurse aides (NAs) to perform fall risk reduction did not^{6,14,15}. Indeed, the study by Kerse et al. which contributed substantially to the negative finding in the meta-analysis, showed an increase in fall rates when nurses and nurse aides are trained in fall prevention, perhaps due to increased staff awareness and therefore reporting of falls.¹⁴

Our prior research suggests several reasons why multifactorial interventions are not successful when taught to existing NH staff. Implementing such interventions requires accurate information about resident behaviors, health status, medications and other risk factors to be available to multiple members of the team so that tailored risk reduction plans can be developed. In addition, they require ongoing coordination among direct care and interdisciplinary staff to implement the components of the risk reduction plan. Our prior in-depth case study of NH staff behaviors¹⁶ revealed that staff often lack the connections needed to obtain and share pertinent resident information.^{17–20} Common local interaction strategies used by busy staff to avoid additional work or risk of punishment include “being aloof”, keeping information to yourself, working alone without asking for or offering assistance, and a “not my job” attitude.^{21–23} These practices result in thin connections, little information flow, and limited use of diverse perspectives and frameworks (cognitive diversity)²⁴ to make sense of a resident’s fall risk factors (sensemaking)²⁵. Teaching staff to perform multifactorial risk factor reduction is unlikely to be effective unless these parameters are first strengthened.

Therefore, we conducted a randomized controlled pilot test of the CONNECT intervention, which is designed to improve NH staff connections, information exchange, use of cognitive diversity and sense-making. We hypothesized that NHs which received CONNECT prior to a gold-standard falls reduction training program would have larger changes in measures of staff communication and fall reduction documentation compared to NHs which received the fall reduction program training program alone. The change in facility fall rates was measured as an exploratory outcome to estimate an effect size for a subsequent larger trial testing the impact on resident outcomes.

Methods

Design and Setting

This was a cluster-randomized controlled trial testing the impact of CONNECT and FALLS, compared to FALLS alone, on measures of staff communication, fall risk reduction documentation, and (as an exploratory measure) facility fall rates. Four community nursing homes and four Veterans Affairs (VA) Community Living Centers in North Carolina and Virginia were included (NHs). Study NHs provided post-acute skilled nursing/rehabilitation services and long-term care, and had at least 90 beds. Each NH was matched to a similar

facility based on VA or community status, academic affiliation and chain ownership; NHs were randomized within each pair to receive either CONNECT followed by FALLS or FALLS alone. A study team member blinded to NH identity assigned treatment groups using a random number generator.

All study procedures were approved by the institutional review boards at Duke University and the four participating VA Medical Centers. Directors of Nursing and NH Administrators in each facility signed written informed consent.

Participants

All NH employees aged 18 years or over who had direct resident contact were eligible for participation. Temporary agency staff and staff working only as needed were excluded. Participants' departments included nursing, rehabilitation, social work, dietary services, environmental services, activities, medical services, and administration. All eligible participants were invited to participate in educational sessions designated as quality improvement where no consent was required [CONNECT classroom sessions (intervention facilities only); FALLS team training, teleconferences, online modules, and academic detailing sessions, described below]. Participants who provided informed consent were asked to complete staff surveys, and to attend additional CONNECT study activities [(intervention NHs only) group mapping, individual mapping, unit-based mentoring]. (CONSORT diagram, Figure 1)

Residents who were aged 50 years and over, experienced 1 or more falls during the study period, and remained in the NH at least 72 hours after the fall were eligible for chart abstraction, described below. Falls were defined as per the Resident Assessment Inventory as "an unintentional change in position coming to rest on the ground, floor or onto the next lower surface"²⁶ and included witnessed and reported falls. A list of potentially eligible residents who fell was obtained by reviewing both facility incident report logs and Minimum Data Set records. In VA facilities all residents with 1 or more fall had their electronic medical records reviewed for fall risk reduction documentation (see below); in community facilities a random subset of 35 eligible residents per facility had their records abstracted. A waiver of informed consent and HIPAA authorization was obtained for chart abstraction.

Interventions

Details of the CONNECT and FALLS interventions have been described previously²⁷, and components are listed in Appendix A.²⁸ CONNECT was developed based on case study research^{17,22,29-31}, complexity science and social constructivist learning theoretical models. By participating in intervention activities, staff were encouraged to: 1) critically evaluate their relationships with co-workers and set goals for improvement; 2) share resident information within and between disciplines and using multiple perspectives to make sense of it; and 3) practice interaction strategies which facilitate connection, information flow, and use of cognitive diversity in sense-making. Delivery methods included group story-telling and role play, individual and group-level relationship mapping, individual mentoring on the nursing unit, and self-monitoring of communication patterns and use of interaction strategies.

FALLS was a staff education and quality improvement program based on AHRQ's falls management program³², and included both didactic and interactive learning activities. Each facility was asked to form a Falls Team. The Falls Team members received a half-day training session followed by 11 weekly teleconferences which covered fall multifactorial risk reduction strategies and basic quality improvement processes. Case-based self-study modules were developed for nursing assistants, licensed nursing staff, and medical/

pharmacy staff; modules were available over the Internet or in paper form. Academic detailing sessions for small groups of direct care staff were conducted twice at each nursing unit; these were facilitated discussions about real resident fallers that modeled risk factor identification and modification. Finally, audit and feedback of the facility's fall risk reduction documentation in comparison with other study NHs was provided to the Falls Team.

CONNECT and FALLS were delivered by separately trained research interventionists over 12 weeks each. Intervention dose and fidelity were monitored by other research team members on 10% of intervention components.

Data Collection

Staff measures of communication—Staff who had provided informed consent were asked to complete surveys at baseline, 3 months (following CONNECT or control period) and 6 months (following FALLS). Measures included demographic information and scales of communication openness³³, accuracy³³ and timeliness³⁴; participation in decision making instrument³⁵; psychological safety³⁶; safety organizing scale³⁷ (a measure of safety culture), a quality of caregiving scale, and a local interaction strategies scale which were developed for this study. Most of these scales have been previously validated in the NH setting, and all were written on a 6th grade reading level; additional detail about the scale domains, response range, and most relevant setting of validation is found in Appendix B. Focus groups with direct care and management staff were also conducted (n=2 in each facility) to obtain a richer understanding of the interventions' impact on the work environment; the methods and results from these have been reported previously.³⁸

Fall risk reduction measures. We chose to evaluate the NH's fall risk reduction documentation in a sample of residents who had experienced a fall and for whom fall prevention was clearly warranted. Although facilities may have differed in the quality of their fall reduction efforts among residents at risk for falls but who had not yet fallen, it was not feasible to review all records in the facility, nor was there a validated fall risk measure consistently documented for all residents across all facilities. Resident fallers' medical records were abstracted for demographic information, time remaining in the NH after their fall (if less than the 30 days after their fall), and co-morbidities associated with falls risk. Documentation of interventions targeting fall risk factors within 30 days of the first fall were recorded including measurement and treatment of orthostatic hypotension, psychoactive medication reduction, calcium and vitamin D supplements, gait or assistive device intervention (e.g., physical or occupational therapy assessment), vision assessment or intervention, environmental modification, footwear modification, and toileting program. In community NHs, charts were abstracted by trained RNs who were blinded to intervention status; in VA NHs, study staffing limitations precluded blinding. In all facilities, inter-rater reliability measured by simple agreement was maintained at >90% on a random 5% sample of charts.

Facility fall rates—Facility fall rates were calculated as an exploratory measure. The total number of falls in the 6 month period before the intervention period and 6 months following the intervention period were divided by the NHs' occupied bed days of care to determine the falls/bed/year. Falls were ascertained from facility fall logs, incident reports, and the Minimum Data Set; occupied bed days were calculated from daily census data provided by each facility. The proportion of falls resulting in an injury (defined as requiring urgent medical assessment or imaging, pain lasting at least 24 hours, new skin tear or bruise) and the proportion of fallers who fell more than once were also calculated.

Analysis

An intention to treat analysis strategy was used. Hierarchical linear modeling with SAS PROC Glimmix was used to account for clustering; this procedure is useful when there are multi-level, nested sources of variability such as patients and staff clustering within nursing homes. The Glimmix procedure analyzes both individual and group level trajectories of change over time, and can be used to estimate models where persons within clusters are changing over time.

Descriptive, baseline, and follow-up statistics were obtained for all dependent variables; initial analyses tested each dependent variable for violations of distributional assumptions (normality, skew, etc.) and employed logarithmic or other transformation where necessary. The study aims sought to describe the impact of CONNECT plus FALLS, compared to FALLS alone, on staff measures of communication, fall risk reduction documentation, and facility fall rates (exploratory) over time. For each aim, models were first estimated for the dependent variable assuming that the effect of time did not vary with treatment. We then tested for a time by treatment interaction by adding a product term to the model. To control on between-person differences prior to the intervention, we included a baseline measure of each dependent variable as a control in each analysis. We also controlled on facility and individual-level potential confounders when they were related to the independent variable of interest. The confounders considered included: age, gender, race, history of stroke, peripheral neuropathy, Parkinson's disease, visual impairment, cognitive impairment, assistive device use, fall in the previous 6 months, ambulatory status, facility bed-size and staffing levels. Because this was a pilot study, no adjustments were made for multiple comparisons. Because the analysis examined trajectories in staff perception of communication over time, only data from staff completing a baseline and at least 1 follow-up survey were included. There were no missing data for the fall rate or fall risk reduction documentation outcomes. Because of substantive differences between VA and community nursing homes and because the funding sources for these sites were distinct, we planned a-priori sub-analyses in which VA and community nursing homes were examined separately.

The power analysis algorithms used to determine cluster size take clustering at the individual level into account. The study was powered to detect a change of 0.20 in staff measures (considered a "moderate" change)³⁹, and a change of 0.55 in fall risk reduction documentation.

Results

Overall, 471 staff members provided informed consent and completed at least 1 survey. Demographic characteristics of staff participants were well balanced (Table 1) except that there was more Caucasian staff in intervention NHs. Approximately half of eligible NH staff participated in one or more of the intervention components, similar in intervention and control NHs (Figure 1). Sixty two percent of staff who participated in at least 1 component of CONNECT or FALLS also completed at least 1 survey; surveys were completed by 71% of consented participants at baseline, 47% of participants at 3 months, and 42% at 6 months. Medical records were abstracted on 651 unique residents with falls; characteristics were similarly balanced except for a higher proportion of residents with vision impairment in the intervention NHs.

To answer the questions of whether the interventions influenced the staff communication variables, we tested for treatment by time interactions at 3 and 6 months, controlling for baseline scores (Table 2). Both individual and site level clustering were taken into account in significance testing. Significant improvements over time in communication openness and safety culture were observed for the sample as a whole (openness mean score 3.51 to 3.64

[3.7%], $p=0.02$; safety culture 4.45 to 4.69 [3.6%], $p<0.01$). In addition, the intervention group had a significant increase in communication timeliness (3.33 to 3.45 [3.6%], $p=0.03$). When the mean score of all items were combined, control group means decreased slightly over time indicating an overall decline in communication quality (-0.74) while intervention group means improved (0.116), with a trend to a positive treatment by time effect ($p=0.06$) (Figure 2). This magnitude of change is considered “moderate” in the psychometrics literature,³⁸ and likely represents a meaningful clinical change. When VA and community NHs were examined separately, a ceiling effect was noted on staff communication measures in the VA, that is, the baseline means were near the top range of the scale, thus leaving little room for improvement to be observed; further, the baseline VA means were also significantly higher than those in community NHs. When the analysis was limited to community nursing homes only, we found significant improvements in staff perceptions of communication quality, NA participation in decision making, safety climate, care giving quality, and use of local interaction strategies ($p=.01$). Using a subset of staff items including communication openness, accuracy and timeliness; local interactions, safety climate, and caregiving quality, a significant treatment by time effect was noted for the full sample with a mean score difference between intervention and control facilities of 0.086 ($p<0.01$). This subset was only calculated in community NHs, because 1 of the scales was not completed by VA staff due to IRB approval delays.

To answer the question of whether the intervention influenced the use of fall risk reduction documentation, we calculated a score for each resident who fell using the number of risk reduction measures documented within 1 month of their first fall divided by the number of potential interventions. We calculated the average facility score, indicating the proportion of potential fall risk reduction measures documented for their fallers, comparing scores for the 6 months preceding study initiation and the 6 months following FALLS. Based on initial tests, the dependent variable was treated as normally distributed in our regression models. A re-analysis using poisson regression gave similar results. Baseline scores improved from 24% to 36% for all facilities combined ($p=0.30$), with no significant difference between intervention and control facilities. In a model adjusted for time at risk and covariates significantly related to fall risk reduction documentation, the treatment by time effect was not significant ($p=0.51$).

The question of whether facility fall rates responded to the intervention was exploratory, given the limited facility sample size. Negative binomial regression was used to take overdispersion into account. Fall rates increased by 1% in the control group (Rate Ratio 1.1, 95% CI 0.62, 1.65) and decreased by 12% in the intervention group (0.88, 95% CI 0.56, 1.37), from 2.34 to 2.06 falls per bed per year (Figure 3). Being in the intervention group multiplied the rate of decline by 0.81 (0.55, 1.20) but the effect was not statistically significant. Adding time at risk to the models did not change the results. No statistically significant treatment effect was observed in the proportion of fallers who suffered additional falls (45% in control facilities, 48% in intervention facilities), nor in the risk of injurious falls.

Discussion

With already constrained resources and potential cuts to NH reimbursement looming, adding additional staff to implement risk reduction programs for complex geriatric syndromes such as falls is not feasible. Therefore, identifying ways to increase the existing staff's capacity to adopt evidence-based practices is an essential part of improving outcomes for frail NH residents.

This pilot study suggests that the CONNECT intervention has the potential to improve resident outcomes through its impact on staff connections, information exchange, use of cognitive diversity and sense-making. Complexity science theory suggests that these form the necessary foundation which allows staff to “self-organize”, creatively problem solve about individual resident issues, and implement an optimal plan to address them.²¹ CONNECT was developed based on case-study observations of NH staff behaviors, and therefore has substantial construct and face validity. We used social constructivist learning approaches to foster the acquisition of these important processes.

Supporting an impact on staff connections, we found significant improvements in measures of NH staff communication, despite an apparent ceiling effect in VA NHs. Baseline staff communication measures scores were substantially lower in intervention than control sites; this likely reflects chance imbalance in facility work culture or other characteristics despite randomization. Results from the larger trial will be important to ensure that the observed improvement in intervention facilities does not represent a regression to the mean phenomenon. There are important differences between VA and community facilities that may account for the VA ceiling effect including a greater proportion of RN level nurses, higher staffing levels, and lower staff turnover rates; subsequent studies in VA NHs might consider limiting the scale ranges to five and including two negative and three positive response anchors which is recommended to minimize ceiling effects.⁴⁰ Of our communication measures, only the local interaction scale fully met these criteria. Nevertheless, focus group participants in both VA and community NHs who had received CONNECT reported wider and richer interactions with co-workers within and between disciplines, resulting in more effective fall care plans, compared to focus groups in NHs which had received FALLS only.³⁸ Using mixed method approaches such as this has been suggested as a method for overcoming ceiling effects in quantitative measures.⁴¹ This improvement, while it endured over at least 6 months, is potentially vulnerable to high rates of staff turnover, a common issue in NH practice. Strategies we used to promote long-term change in the face of expected high turnover include providing training materials that can be used in new staff orientation, and identifying CONNECT “champions”; these are staff at all levels who are specifically trained to continue individual mentoring on the use of effective local interaction strategies after the study is complete.

It is notable that we did not observe a significant change in fall risk reduction documentation in either study arm. While the FALLS intervention offered a standardized template for fall risk reduction activity documentation, the facilities could choose to adopt it or not at their discretion; in practice most facilities chose to modify existing note templates. Furthermore, the direction of change in fall risk reduction scores did not relate to observed changes in fall rates in individual facilities. Chart abstraction was completed by skilled personnel and inter-rater reliability remained >90%, suggesting that data collection issues were not at fault. Rather, we hypothesize that the documentation of fall risk reduction activities may not reflect the care that is actually delivered at the bedside; for example, an order for prompted voiding may be documented on the chart, but not implemented by nurse aides, or conversely, environmental modifications may be made but not recorded. The use of boilerplate language in care plans or check boxes on post-fall assessment forms further limits the utility of chart abstraction in measuring true changes in risk reduction activities; this phenomenon has been observed in quality improvement programs for other geriatric syndromes in the nursing home such as pressure ulcer prevention.⁴² Alternative ways of measuring changes in care delivery resulting from quality improvement interventions are needed. For example, staff responses to clinical vignettes have been reported to be superior to chart abstraction in outpatient settings, when standardized patient encounters are used as a gold standard.⁴³

Ultimately, the most important measure of intervention effectiveness is the impact on resident outcomes. While our study was not powered to detect a difference in facility-level fall rates, the direction of change was encouraging and the magnitude of the effect was clinically important. An ongoing randomized controlled trial of CONNECT will ultimately include 24 facilities; if the magnitude of the effect size is similar to that observed in the pilot study it would be statistically significant. If shown to be effective with falls as an indicator condition, CONNECT could be tested as a companion intervention for programs targeting other geriatric syndromes, since it does not target a specific resident issue but rather the underlying staff connections, information exchange, and cognitive diversity required to develop tailored intervention programs, a hallmark of high quality long-term care.

In summary, pilot testing suggests that CONNECT is feasible and acceptable in community and VA NHs. Measures of staff communication improved in community NHs that received CONNECT while declining slightly in control facilities. Decreases in facility-level fall rates were observed in the intervention but not control facilities. Chart abstraction measures of fall risk reduction documentation were insensitive to change and do not appear to relate to changes in fall rates.

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Appendix A. Components of the CONNECT and FALLS Interventions**

Intervention Components	Rationale/Outcome	Participants	Duration
CONNECT			
CONNECT In-Class Protocols CONNECT Basics (Session 1). Introduces local interaction strategies using storytelling. Participants practice using role-play.	Interdisciplinary learning facilitates skill acquisition, creation of new horizontal and	All staff	two sessions, 30 min each

Intervention Components	Rationale/Outcome	Participants	Duration
CONNECT Advanced (Session 2). Brief review followed by focus on the more advanced strategies of cognitive diversity. Uses storytelling, role-playing, and discussion of participants' experiences in applying concepts.	vertical connections among staff, and learning through cognitive diversity.		occurring 2 weeks apart (1.0 hrs total)
Group-to-group maps <u>Session 1.</u> Researcher assists staff to describe actual interactions between work groups (e.g., NAs, LPNs, SW, Dietary, etc.). <u>Session 2.</u> Researcher assists staff to depict new interaction patterns and develop guidelines for improved group-to-group interaction patterns.	Assists staff to make interaction patterns explicit (develop a group-to-group relationship map), and agree on guidelines for improved interactions.	Mid-level managers and selected LPNs, NAs.	two classes, 1-hr each; 1 week apart (2 hrs total)
Individual-to-individual maps Researcher assists staff to draw an individual "relationship map" that defines his/her ideal interactions with selected co-workers in all work groups; reviews strategies for improving interactions. Participants learn to self-monitor and record interactions using relationship maps and recording sheets.	Assists staff to evaluate relationships. Self-monitoring reinforces and sustains newly acquired behaviors and provides a measure of adherence and behavior change.	All staff	one session, 30 min (30 min total)
Structured Mentoring During the 2 weeks following each in-class session, the researcher engages each participant in a 10-minute session to discuss and reflect on his/her experiences applying CONNECT concepts. The researcher uses a semi-structured guide to elicit concerns about using the strategies.	Facilitates authentic learning, which occurs only when learners can directly and independently apply concepts.	All staff	2, 10 min sessions (20 min total)
FALLS			
Falls Team Training Session Researcher reviews: 1) role of FALLS Coordinator and Team members; 2) Falls Management Program rationale and main components; 4) toolkit materials; 5) team goals.	Falls Team members champion fall prevention, identify area to improve, monitor changes.	FALLS Coordinator, Falls Team, DON	one session, 4 hours duration
Weekly Teleconference Researcher contacts FALLS team weekly for problem-solving/discussion, and highlights a topic from the Fall Management Program in more depth. Topics include 1) staff fall prevention education; 2) medications and falls 3) patient and family fall education; 4) orthostatic hypotension; 5) vision assessment and intervention; 6) gait and balance assessment and intervention 7) environmental assessment and intervention; 8) challenging behavior management; 9) establishing a culture of safety; 10) audit and feedback; and 11) Wrap-up and re-setting goals	Reinforces key concepts of multi-factorial risk reduction, supports FALLS Coordinator and maintains enthusiasm.	FALLS Team, others as invited by team	11 sessions, 45 min each weekly (8.25 hrs total)
Case-Based Modules Separate modules tailored for nurses, medical providers/pharmacists, and nurse aides. Using case scenarios, describes impact of falls and multifactorial risk reduction strategies pertinent for each group. Online or in paper form.	Uses case-based learning to impart knowledge and change attitudes about multi-factorial fall risk reduction.	RNs, LPNs, NAs, MDs, NPs, PAs, Consultant Pharmacists and others	30–60 min
Academic Detailing NH frontline staff is invited to participate in consultations with the researcher and FALLS Coordinator regarding their most challenging residents with falls, modeling risk factor assessment and multifactorial interventions. Sessions occur at each nursing station during the day and evening shifts.	Reinforces key concepts and promotes behavior change and interdisciplinary discussions.	Nurses, NAs, other interested staff	two sessions, 20 min each (40 min total)
Audit and Feedback Report Report uses visual (bar graph) and written depictions of the NH's current practice on fall-related process and outcome measures, and how this compares with peer NHs.	Identifies areas for improvement, promotes behavior change.	FALLS team, others as desired by Falls Coordinator	30 min

Intervention Components	Rationale/Outcome	Participants	Duration
Toolbox Data collection instruments, worksheets, posters, patient/family handouts, checklists, fax communication forms	Provides modifiable tools to assist with communication, implementation, and documentation of multi-factorial risk reduction.	FALLS team determines dissemination	Voluntary

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Appendix B. Staff communication measures, domains, scale, and prior validity studies in nursing home (NH)

Author Reference	Domains Measured	Number of Items	Response Range	Validation Setting
Roberts and O'Reilly ³³	Communication openness; Communication accuracy	5 5	1-5 1-5	NH
Shortell ³⁴	Communication timeliness	4	1-5	NH
Anderson ³⁵	LPN participation in decision-making	4	1-10	NH
Anderson ³⁵	Nurse Aide participation in decision-making	4	1-10	NH
Edmonson, Tucker ³⁶	Psychological Safety	3	1-7	Healthcare
Vogus and Sutcliff ³⁷	Safety organizing	9	1-7	Intensive Care Unit
Anderson	Local interaction quality: supervisor, co-worker	30	1-5	NH, in process
Colón-Emeric	Quality of care planning, shift change, personal care, feeding, medical care	25	1-5	NH, In process

Figure 1.

CONSORT diagram of study enrollment and follow-up. Participation in study activity for FALLS includes completing one or more of the following: falls team training, case-based modules, teleconference, academic detailing, audit and feedback. Participation in study activity for CONNECT includes one or more of the following: classroom sessions, mapping sessions, unit based mentoring, self-monitoring.

Figure 2.

Composite staff survey responses at baseline, immediately following intervention, and 3 months after intervention. Treatment by time interaction for all staff items $p = 0.06$, for complexity science subset items $p < 0.01$. Subset items include communication openness, accuracy and timeliness; local interactions; safety climate, and caregiving quality. Individual survey response ranges were 1–5, 1–7 or 1–10 (appendix B).

Figure 3. Facility level fall rate (falls/bed/year) in intervention and control NHs in the 6 month baseline and post-intervention periods, and change in fall rates after intervention.

Table 1

Demographic characteristics of participating nursing homes, staff, and resident fallers.

	FALLS only (control group)	CONNECT and FALLS (intervention group)
Nursing Home	n=4	n=4
Bed size (mean)	114.3	131.3
Facility Type		
VA, academic	1	1
VA, non-academic	1	1
Community non-profit	1	1
Community for-profit	1	1
Staff Participants	n=254*	n=243*
Age (%)		
18–35 years	22%	23%
36–55 years	57%	54%
56 years and over	21%	23%
Female (%)	85%	87%
Race (%)		
Caucasian	45%	59%
Black	50%	37%
Other	5%	4%
Role (%)		
Nursing assistants	32%	32%
Direct care nurse	33%	29%
Administrator	4%	4%
Dietary	4%	1%
Housekeeping	1%	6%
Medical staff	1%	2%
Rehabilitation	6%	4%
Other	19%	22%
Residents who Fell	n= 293	n=358
Mean age (years)	77.4(12.5)	79.0(11.4)
Female (%)	30%	31%
Race (%)		
Caucasian	75%	78%
Black	19%	17%
Other	6%	5%

	FALLS only (control group)	CONNECT and FALLS (intervention group)
Prior Falls	53%	56%
Cognitive Impairment	62%	64%
Parkinsonism	5%	10%
Neuropathy	18%	12%
Vision Impairment	30%	42%
Ambulatory Status		
Fully Independent	43%	45%
Transfer Independent	45%	41%
Fully Dependent	12%	15%
Stroke	31%	31%

* Only consented study staff participants who also completed demographic surveys are included on table; demographics were not available for staff who participated in study educational activities that did not require informed consent.

Staff survey responses (n=292) at baseline, immediately after the intervention, and 6 months after the intervention for intervention and control groups.

Table 2

Scale Domain (possible response range)	Intervention mean (SD)			Control mean (SD)		
	Baseline (n=185)	3 mo. (n=119)	6 mo. (n=100)	Baseline (n=188)	3 mo. (n=129)	6 mo. (n=118)
Communication accuracy (1–5)	2.97 (0.77)	2.85 (0.49)	2.88 (0.57)	3.05 (0.80)	3.01 (0.58)	3.00 (0.55)
Communication timeliness (1–5)	3.33 (0.72)	3.45 (0.70)*	3.44 (0.70)*	3.68 (0.71)	3.69 (0.71)	3.67 (0.68)
Communication openness (1–5)	3.37 (0.76)	3.51 (0.80)	3.43 (0.81)	3.65 (0.82)	3.75 (0.81)	3.73 (0.79)
Nurse Aide participation in decision making (1–10)	4.65 (2.05)	5.08 (2.10)	5.00 (2.02)	5.41 (2.23)	5.33 (2.38)	5.32 (2.34)
LPN participation in decision making (1–10)	6.12 (2.11)	6.52 (2.20)	6.33 (2.04)	6.01 (2.18)	6.11 (2.31)	6.06 (2.37)
Safety culture (1–7)	4.26 (1.31)	4.48 (1.22)*	4.40 (1.37)*	4.62 (1.33)	4.69 (1.25)*	4.93 (1.33)*
Psychological safety (1–7)	4.74 (1.29)	4.85 (1.16)	4.76 (1.29)	5.10 (1.23)	5.13 (1.22)	5.16 (1.19)
Overall mean	4.03 (0.80)	4.10 (0.73)	4.11 (0.71)	4.83 (0.84)	4.74 (0.84)	4.69 (0.82)
Complexity science subset mean**	3.62 (0.78)	3.74 (0.75)*	3.79 (0.68)*	4.51 (0.84)	4.42 (0.79)	4.37 (0.78)

* Change over time significant at $p < 0.05$

** Community nursing homes only, includes communication openness, accuracy and timeliness; local interactions; safety climate; and caregiving quality