Final Progress Report

Producing Evidence: Coordination within a Multiteam System Makes Healthcare Safer

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1. Structured Abstract

Purpose: To analyze existing data collected using AHRQ tools to produce evidence that effective coordination within a multiteam system (MTS) makes healthcare safer.

Scope: Incentivizing outcomes by withholding payment for serious fall-related injuries has not significantly reduced the risk of this hospital-acquired condition. A reductionist focus on one element of a system is insufficient to mitigate a complex adverse outcome such as falls. Though it is established that interprofessional teams can reduce fall risk, little is known about the coordination of processes across healthcare MTSs that produce this outcome.

Methods: This study used a one-group pretest-posttest design embedded in a participatory research framework. Depending upon the level and correlated nature of the data, the project team used descriptive statistics, logistic regression, multilevel modeling, Poisson rate models, and nonparametric regression.

Results: The more reflexive a fall-risk-reduction coordinating team is, the lower the total and unassisted fall rates are within the hospital. The greater the extent of process coordination conducted by a fall-risk-reduction coordinating team, the lower the hospital's unassisted fall rate. The greater the extent of training conducted by the fall-risk-reduction team about the fall-risk-reduction program, the lower the hospital's injurious fall rate. The greater the extent of training about the fall-risk-reduction program and about safe/transfers and mobility, the more likely staff are to report all falls. Participating in post-fall huddles is associated with more positive perceptions of organizational safety culture and teamwork support for fall risk reduction and with decreased risk of repeat falls.

Key Words: Fall risk reduction, multiteam systems, evaluation methodology

2. Purpose

The purpose of the proposed project is to analyze existing data collected using AHRQ tools to produce evidence that effective coordination within a multiteam system (MTS) makes healthcare safer. The three project aims are:

Aim 1: Determine the structure of effective fall risk reduction coordinating teams.

Hypothesis 1: Coordinating team structure—member attributes, team development, and team project participation—is associated with the effectiveness of coordinating team processes.

Aim 2: Determine the relationship between coordinating team processes and organizational outcomes and perceptions of organizational context.

Hypothesis 2: Effectiveness of coordinating team processes is associated with organizational outcomes and individual staff perceptions of organizational context.

Aim 3: Determine the relationship between participation in contingency teams that conduct post-fall huddles and perceptions of organizational context and coordinating team effectiveness.

Hypothesis 3: Participation in post-fall huddles is associated with individual staff perceptions of organizational context and individual staff perceptions of coordinating team effectiveness.

3. Scope

Background

Approximately 3% of hospitalized patients fall annually.[1,2] Nearly one fourth of these falls result in injury,[3] with an average associated excess cost of $7,000 per injury.[4] Regardless of injury, falling can lead to fear that limits mobility and accelerates functional decline.[5] To incentivize safer care, serious fall-related injuries have been categorized as a preventable hospital-acquired condition (HAC) since 2008.[6] In 2017, there were 14 HACs for which the Centers for Medicare and Medicaid Services no longer reimburse hospitals that receive payment under the Prospective Payment System if the condition was not present on admission.[6] An evaluation of this 'pay-for-outcomes' program revealed that the incidence of serious fall-related injuries per 1,000 discharges decreased 15% from 2010 to 2015. In comparison, the incidence of central line-associated bloodstream infections and catheter-associated urinary tract infections decreased 91% and 33%, respectively, per 1,000 discharges during the same period.[7]

Reasons for limited progress in decreasing fall-related injuries include the complex etiology of falls and lack of rigorous research regarding the impact of system interventions,[8] including implementation strategies and adaptive management of risk.[9] The etiology of falls includes patient, environmental, and system risk factors. Patient factors include age greater than 80 years, muscle weakness, history of falls, gait and balance deficits, use of an assistive device, impaired cognition, urinary frequency/incontinence, and medication side effects.[1,10-12] Environmental factors include clutter/tripping hazards, room design, inadequate lighting, and inappropriate furniture heights.[1,13]

System factors include the attitude that falls are inevitable,[14] inadequate staffing,[15] and poor teamwork, which has been linked to missed nursing care such as assistance with transfers/mobility.[16] Additional system factors include not integrating evidence from multiple disciplines, not using standard fall-event

definitions, and not learning from fall-event data.[17] Standard fall-event definitions are needed to aggregate fall-event data for comparative benchmarking that reveals the scope of risk and supports resource prioritization.[18]

In 2000, the Institute of Medicine identified five principles to make healthcare safer. “Promote effective team functioning” was one of those five—for the simple reason that “people make fewer errors when they work in teams.”[19] A team is defined as two or more people with complementary skills and specific roles who interact to achieve a common goal.[20] The team has developed a solid theoretical foundation,[21] and empirical evidence that effective individual team function is associated with patient outcomes[22-29] and adoption of team skills improves perceptions of safety culture.[30]

This theory and evidence led to the development of AHRQ’s team training curriculum, Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS).[31] However, healthcare is a complex sociotechnical system—human beings work in social structures within complex technical environments to achieve a shared goal that requires coordinated action within and between teams.[32] Thus, an MTS is made up of two or more interdependent component teams that interact directly to achieve a shared organizational goal,[33] such as implementing evidence-based practice to improve performance and patient safety.

The TeamSTEPPS curriculum identifies six component teams, in addition to the patient/family, within a healthcare MTS: (1) coordinating teams that manage resources and coordinate processes; (2) core teams that provide direct patient care; (3) contingency teams made of members from various teams to address emergent issues; (4) ancillary team (laboratory, radiology); (5) support services (environmental services, laundry); and (6) management. TeamSTEPPS teaches that effective individual team function requires knowledge and skills in leadership, communication, situation monitoring, and mutual support.[31]

Falls and fall-related injuries are an outcome of the structure and process of a healthcare system. Outcomes are changes in individuals and populations due to healthcare. Structure refers to how care is financed and delivered. Structure determines a system’s capacity for work, and it may be the primary determinant of the quality of care a system can deliver. Process refers to actions taken; how structures are used to produce outcomes.[34] The structure-process-outcome framework is a system of interacting elements that is causal in nature—improving outcomes requires innovation in structure and process. A reductionist focus on one element of a system is insufficient to mitigate a complex adverse outcome such as a fall.[35]

Consequently, randomized controlled trials of individual processes, such as use of bed/chair pressure sensors,[36,37] low-low beds,[38] and patient education,[39] have not significantly decreased fall risk. Systematic reviews indicate that bundling multiple processes may decrease fall risk by 30%, but the ideal combination of processes[14] and the most effective implementation strategy remain unknown.[40] The project team does not believe that patient safety researchers have yet to been able to integrate the concepts of MTS structure and MTS coordination processes into studies designed to understand how nonpayment for hospital-acquired conditions can advance interprofessional practice and patient safety. This project synthesizes multilevel data about the structure, process, and outcome of the MTS approach to fall risk reduction.

Context

Participants, Setting, and Incidence: Healthcare professionals in a collaborative of 16 small, rural hospitals participated in this complex social intervention (CSI).[41] Table 1 summarizes the distribution of contextual factors and the pre- and post-implementation incidence of falls in the 16 hospitals.

Table 1. Hospital Contextual Factors and Fall Rate Outcomes by Three Levels of Fall-Risk-Reduction Program Coordination*

	Aggregate (n=16)	Low Coordination (n=5)	Moderate Coordination (n=6)	High Coordination (n=5)	P Value
Pre-Implementation Baseline Year (2012)					
Licensed beds, mean (SD or range)	26 (6)	24 (18-25)	24 (18-25)	29 (25-47)	NA
2010 county population, mean (SD)	12,087 (7792)	12,722(6495)	10,693(7145)	13,124(10814)	.82†
2010 proportion of county population 65+ years of age, mean (SD)	0.19 (0.04)	0.20 (0.03)	0.18 (0.04)	0.18 (.04)	.64†
Use Agency for Healthcare Research and Quality fall definition, No. (%)	3/16 (19%)	0/5 (0%)	1/6 (17%)	2/5 (40%)	.46‡
Integrate fall-risk-reduction evidence from multiple disciplines, No. (%)	7/16 (44%)	1/5 (20%)	4/6 (67%)	2/5 (40%)	.39‡
Interprofessional team accountable for fall-risk reduction, No. (%) Total	1/16 (6%)	0/5 (0%)	1/6 (17%)	0/5 (0%)	1.0‡
patient days, mean (SD)	2,972 (1893)	3,100(1556)	2,352(1280)	3,589 (2809)	.85†
Total fall rate, mean (SD)	5.1 (1.6)§	5.6 (0.8)	4.8 (1.5)	4.9 (2.3)	.70†
Injurious fall rate, mean (SD)	1.7 (1.0)§	2.4 (0.9)	1.0 (0.6)	1.8 (1.1)	.043†
Unassisted fall rate, mean (SD)	4.0 (1.8)§	4.5 (0.8)	2.7 (1.5)	4.4 (2.3)	.32†
Implementation Period (August 2012 – July 2014)					
Number of 31 activities in which hospital participated, mean (SD)	21 (6)	19 (7)	20 (5)	24 (7)	.24†
Post-fall huddle rate, mean (SD)	0.67 (.18)	0.64 (0.12)	0.65 (0.22)	0.73 (0.21)	.43†
Repeat fall rate, mean (SD)	1.12 (0.13)	1.13 (0.08)	1.11 (0.17)	1.13 (0.15)	.67†
Post-Implementation Period (January – July 2014)					
Fall-risk-reduction program coordination score out of 84, mean (SD)*	54.3 (8.5)	44.8 (3.4)	54.0 (2.6)	64.0 (4.3)	NA
Total patient days, mean (SD)	1,551 (992)	1,507 (7987)	1,257 (594)	1,947 (1512)	.77†
Total fall rate, mean (SD)	4.5 (1.9)§	5.8 (2.4)	4.7 (1.4)	3.1 (0.6)	.098†
Injurious fall rate, mean (SD)	2.0 (2.3)§	3.4 (3.5)	1.6 (1.4)	1.0 (1.0)	.22†
Unassisted fall rate, mean (SD)	3.7 (2.0)§	5.1 (2.5)	3.6 (1.7)	2.4 (0.8)	.033†
Reporting outcomes score out of 16, mean (SD)	14.4 (1.6)	14.6 (1.5)	14.2 (1.7)	14.6 (1.9)	.89†

*The three levels of fall-risk-reduction program coordination were based on the distribution of the fall-risk-reduction program coordination score, which was the coordinating team's rating of their effectiveness in implementing 21 processes (0=not performed, not effective to 4=very effective).
†Independent samples Kruskal-Wallis exact test for differences between levels of coordination
‡ Pearson chi-square exact test for differences between levels of coordination
§Paired samples t-test, no statistically significant differences between pre- and post-implementation assessments

4. Methods

The methodology used in the CAPTURE Falls project was a pretest-posttest design. The project team proposed three overarching hypotheses to achieve each of the three specific aims. The instruments; timing, either pre- or post-implementation, of data collection; and variables to test the hypotheses are summarized in Table 2.

Hypotheses and Analyses for Aim 1: Determine the structure of more effective fall-risk-reduction coordinating teams.

Hypothesis 1: Coordinating team structure—member attributes, team development, and team project participation—is associated with the effectiveness of coordinating team processes. The team hypothesized that there are differences between more effective and less effective coordinating teams in 1a. attributes (e.g., demographic characteristics, disciplinary composition, and member participation in the team); 1b. development/extent of reflexivity; 1c. development/extent of teamwork knowledge and skills; and 1d. extent of participation in project activities.

Analyses for Hypothesis 1: The project team operationalized coordinating team processes as two effectiveness scores, coordinating processes and training processes, from the CAPTURE Falls scorecard. Associations between these two scores and other variables were assessed using correlation (Pearson or Spearman, as appropriate) for continuous data and t-tests or one-way ANOVA for categorical variables.

To address the problem of the small hospital level sample size, the project team compared results from the correlation analyses to those obtained using the alternative extreme groups approach.[42] Specifically, the team divided the effectiveness scores into percentile groups (preliminary analyses suggest tertiles) to create three categories of coordinating teams: low effectiveness, moderate effectiveness, high effectiveness. The project team used chi-square tests or Fisher's exact test, as appropriate, to test for differences in categorical independent variables and one-way ANOVA to test for differences in independent continuous variables.

Hypotheses and Analyses for Aim 2: Determine the relationships between coordinating team processes and organizational outcomes and perceptions of organizational context.

Hypothesis 2: Effectiveness of coordinating team processes is associated with organizational outcomes and individual staff perceptions of organizational context. The project team hypothesized the effectiveness of coordinating team processes will be 2a. negatively associated with total and injurious fall rates and positively associated with 2b. the proportion of hospital falls that have a post-fall huddle; 2c. individual perceptions of how teamwork is used to support fall risk reduction; 2d. individual perceptions of organizational readiness to change; 2e. individual perceptions of safety culture; and 2f. individual ratings of coordinating team effectiveness.

Analyses for Hypothesis 2: Table 1 summarizes the instruments used to operationalize the independent and dependent variables. Associations between the coordinating team effectiveness scores and the dependent contextual variables in H2c-f were assessed using analyses appropriate for the level of data collected, taking into account the nesting of individual-level data by hospital and repeated measures of individuals over time using generalized linear mixed models and adjusting for baseline measures when appropriate. Similar to the methods used in our longitudinal evaluation of the impact of team training on safety culture,[30] the project team modeled the OR of a respondent reacting positively to an HSOPS or T-TPQ-F item after implementation compared with

before implementation; this was done for each 5% increase in the proportion of respondents who strongly agree/agree with the statement, “My hospital's fall-risk-reduction team effectively coordinates efforts to decrease fall risk.” The latter analysis will provide a dose-response relationship between perceived effectiveness of the coordinating team and impact on perceptions of safety culture and teamwork support for fall risk reduction.

Hypotheses and Analyses for Aim 3: Determine the relationship between participation in contingency teams that conduct post-fall huddles (PFHs) and perceptions of organizational context and coordinating team effectiveness.

Hypothesis 3: Participation in contingency teams that conduct the PFH coordination process is associated with individual staff perceptions of organizational context and individual staff perceptions of coordinating team effectiveness. These perceptions are nested by component team and hospital. The project team hypothesized that participation in PFHs is associated with better individual perceptions of 3a. teamwork support for fall risk reduction; 3b. organizational readiness to change; 3c. safety culture; and 3d. coordinating team effectiveness.

Analyses for Hypothesis 3: Table 1 summarizes the instruments used to operationalize the independent and dependent variables. Participation in PFHs will be operationalized as the answer to the question added to the T-TPQ-F: “In the past 2 years, approximately how many post-fall huddles have you participated in?” The independent variable of PFH participation can be dichotomized as “0” or “at least 1” or alternatively as ordered categories based on the distribution.

The project team used a mixed-effects linear model to account for nesting of individuals by hospital to test for differences in the dependent variables while adjusting for other factors as appropriate. The project team compared results for each component team, because contingency teams include members of all other component teams (e.g., management, coordinating, ancillary, and support services).

Table 2. Summary of Hypotheses, Instruments (see Appendix), and Relevant Variables in Analyses

Hypotheses	Instrument, Level of Analysis, Sample Size, Timing	Description	Relevant Variables
1 and 2	CAPTURE Falls scorecard completed by coordinating team, hospital level, n=16,* completed pre- and post-implementation	Gap analysis tool in CAPTURE Falls toolkit coordinating teams use to compare hospital fall-risk-reduction structures and processes to current evidence	Scale of effectiveness of 16 coordinating team processes Scale of effectiveness of five coordinating team education/ training processes Coordinating team job titles
1a, 1c, 2e, 3c	Hospital Survey on Patient Safety Culture (HSOPS), individual level, n=1,918, nested by hospital, completed pre- and post-implementation	AHRQ survey tool to assess patient safety culture; includes items we developed to assess TeamSTEPPS knowledge and adoption of team skills	Categorical measures of staff work area, position, tenure in hospital, and tenure in profession n=12 composites (42 items) assess safety culture n=4 dichotomous items assess knowledge of team skills n=5 items assess perceived adoption of team skills
1b	Coordinating Team Reflexivity Assessment, hospital level, n=17, completed pre- and post-implementation	Assessment of team reflexivity developed by West; added an item to assess extent of member participation in team	n=1 composite (6 items) assesses development/extent of coordinating team reflexivity n=1 item assesses extent of member participation in the coordinating team
1d	CAPTURE Falls Administrative Database, hospital level, n=17	Database to collect and organize project participants and activities	Count of activities that coordinating team participated in during project
2a, 2b	CAPTURE Falls Event Database, 360 fall events and 228 post-fall huddles nested by hospital	Database to collect and organize fall event and post-fall huddle reports submitted by hospitals	• Count of injurious and total falls • Count of patient days • Count of post-fall huddles • Post-fall huddle participants
2c, 2f, 3a, 3d	TeamSTEPPS Teamwork Perceptions Questionnaire modified for fall risk reduction (T-TPQ-F), individual level, n=928, nested by hospital, completed pre- and post-implementation	AHRQ survey tool adapted to assess perceptions of teamwork support for fall risk reduction; added an item to assess individual staff perceptions of coordinating team effectiveness; in CAPTURE Falls toolkit	n=5 composites (7 items each) assess teamwork support for fall risk reduction n=1 item assesses individual perceptions of coordinating team effectiveness

Table 2. Summary of Hypotheses, Instruments (see Appendix), and Relevant Variables in Analyses

Hypotheses	Instrument, Level of Analysis, Sample Size, Timing	Description	Relevant Variables
2d, 3b	Organizational Readiness to Change Assessment, individual level, n=928, nested by hospital, completed pre- and post-implementation	Adapted four composites from tool developed by Helfrich et al. to assess organizational readiness to change fall risk reduction program; integrated with T-TPQ-F; in CAPTURE Falls toolkit	n=1 composite (11 items) assess management support n=1 composite (4 items) assess staff support n=1 composite (4 items) assess informal opinion leaders support n=1 composite (4 items) assess resource availability
3	Post-Fall Huddle (PFH) Perceptions Questionnaire, individual level, n=247, completed post-implementation	Adapted three composite scales to assess PFH; integrated with T-TPQ-F at project end	Count measure of staff participation in PFHs n=1 composite (6 items) assess satisfaction with PFH n=1 composite (13 items) assess PFH attendee behavior n=1 composite (8 items) assess PFH leader behavior
Coordinating Team Focus Group, hospital level, n=17, completed post-implementation		Guiding questions reflected context, input, process, product evaluation model	Textual data describing perceptions of perceived progress, resources, processes, outcomes, lessons learned
Senior Leader Interview, hospital level, n=14, completed post-implementation		Guiding questions reflected the role of leadership support for the fall risk reduction team	Textual data describing perceptions of supporting actions taken, priority attached to the project, lessons learned, and plans for sustainment

*One hospital did not complete the CAPTURE Falls scorecard post-implementation, because it closed on July 1, 2014.

5. Results

The background, principal findings, and conclusions as of August 31, 2017, relevant to the three aims and a descriptive paper about the reported fall events are summarized below.

Aim 1, Hypothesis 1b. The development/extent of team reflexivity is associated with the effectiveness of coordinating team processes. Complete results are in the submitted manuscript: Reiter-Palmon R, Kennel V, Allen J, et al. Good Catch!: Using Interdisciplinary Teams and Team Reflexivity to Improve Patient Safety.

Background: Interdisciplinary teams play an important role implementing innovations that facilitate the quality and safety of patient care. Therefore, the project team examined the role of reflexivity in team innovation implementation and its association with an objective patient safety outcome, inpatient fall rates.

Results: The results suggest that coordinating teams benefited from participation in the CAPTURE Falls innovation, increasing reflexivity from the start of the project to the end. Increasing reflexivity was also positively related to innovation implementation and to decreases in fall rates.

Specifically, a dependent-samples t-test indicated that fall-risk-reduction teams' reflexivity significantly increased from the project start (M = 3.40, SD = .45) to the project end (M = 3.97, SD = .29), $t(14) = 5.47$, $p < .001$. A multiple regression analysis was conducted to test the relationship between team reflexivity at the end of the project while controlling for team reflexivity, as measured at the start of the project as a covariate, and team innovation implementation.

After controlling for fall-risk-reduction team reflexivity as measured at the start of the project (which was nonsignificant in both models), fall-risk-reduction team reflexivity at the project end was significantly and positively related to team innovation implementation ($\beta = .62$, $t = 2.28$, $p = .042$). Finally, team reflexivity at the end of the project was significantly related to lower total fall rates ($r = -.45$, $p = .041$) and lower unassisted fall rates ($r = -.41$, $p = .055$).

Conclusion: These findings indicate that, the greater the reflexivity of the fall-risk-reduction coordinating team, the better the team was able to fully implement their desired interventions and the lower were the total and unassisted fall rates.

Aim 2. Hypothesis 2a. Effectiveness of coordinating team processes is negatively associated with fall rates. Complete results are in the submitted manuscript: Jones KJ, Skinner AM, Venema DM, et al. Managing Complexity: Using Multiteam Systems to Decrease Inpatient Fall Risk.

Background: Incentivizing outcomes by withholding payment for serious fall-related injuries has not significantly reduced the risk of this hospital-acquired condition.

Results: During the final quarter of the study, each fall-risk-reduction coordinating team revised their fall-risk-reduction gap analysis to rate the extent of process implementation by each component team within their hospital. By aggregating ordinal scores from the items in the final gap analysis, the project team calculated process measure scores for the coordinating and core teams to assess extent of implementation.

There were six fall-risk-reduction coordinating team process measures. Specifically, there was one measure of fall-risk-reduction program coordination that was operationalized as the effectiveness of coordinating 21 processes. These coordination processes included planning actions, such as

integrating evidence from multiple disciplines, and standardizing actions, such as conducting audits to monitor core team adherence to fall-risk-reduction policy/procedure.

There were five measures of the extent of training: (1) purpose, interventions, and outcomes of the fall-risk-reduction program; (2) use of the fall-risk assessment tool by nursing; (3) safe transfers/mobility; (4) use of mechanical lifts; and (5) how to conduct post-fall huddles.

There were three core team process measures, which were operationalized as the reliability of implementing universal bedside (e.g., patient/family education; targeted bedside [e.g.] alarms, toileting schedule, and use of a gait belt); and universal organizational processes (e.g., communicate fall-risk status when patients are handed off across shifts).

The contingency team process measure was the post-fall huddle rate, which was the proportion of reported falls for which a post-fall huddle was conducted. Conducting post-fall huddles is synonymous with the third element of coordination—adjusting processes in real time.

Five fall-related outcomes measures were significantly or practically associated with one or more component team process scores (Table 3). The four fall-rate outcomes were *negatively* associated with component team processes, and reporting outcomes—the extent to which unassisted and assisted falls were reported regardless of injury—was positively and significantly associated with the extent of training about the fall-risk-reduction program and in performing safe transfers/mobility.

Table 3. Associations between Multiteam System Component Team Processes and Outcomes

	Total Fall Rate	Injurious Fall Rate	Unassisted Fall Rate	Repeat Fall Rate	Reporting Outcomes
Core Team Processes					
Targeted Bedside	-.205	-.309	-.344	-.414	.049
Universal Bedside	.167	-.039	-.064	-.541†	.173
Universal Organizational	-.275	-.224	-.397	-.251	-.094
Coordinating Team Processes*					
Fall-Risk-Reduction Program Coordination	-.443*	-.383	-.586†	-.129	.004
Training: Fall-Risk-Reduction Program	-.253	-.441*	-.418	-.235	.648‡
Training: Fall-Risk Assessment Tool	-.198	-.521†	-.384	-.075	.125
Training: Safe Transfers and Mobility	-.003	-.277	-.200	-.414	.602†
Training: Mechanical Lifts	.350	.176	.214	-.590†	.344
Training: Post-Fall Huddle	.317	-.174	-.009	-.586†	.330
Contingency Team Process†					
Post-Fall Huddle Rate	.097	-.392	-.109	-.465*	.391

P values calculated using Spearman exact test for correlations; *< .10; †< .05; ‡ < .01

The extent of process implementation predicted changes in outcomes (Table 4). Changes in coordinating team processes predicted changes in all five outcomes of interest. Specifically, for every 5-unit increase in the fall-risk-reduction program coordination score, there was a significant 0.86 decrease in a hospital's unassisted fall rate and practically significant 0.82 and 0.89 decreases in the injurious and total fall rates, respectively.

For every 1-unit increase in the score quantifying the extent of training provided by the coordinating team about the fall-risk-reduction program, there was a significant 0.80 decrease in the injurious

fall rate. A practically significant decrease also occurred in the injurious fall rate in response to a 1-unit increase in the score quantifying the extent of training to use the fall-risk assessment tool. Finally, the perception that all falls were reported regardless of assistance or injury improved significantly due to increases in the scores quantifying the extent of training about the fall-risk-reduction program and the extent of training in safe transfers/mobility.

Conclusion: The MTS structure and coordination processes improve the capacity of hospitals to manage the complexity of the multiple factors that cause falls. Thus, MTS processes predict fall-related outcomes.

Table 4. Predicted Changes in Outcomes by Multiteam System Component Team Process

	Outcome Multipliers (95% CI)*			Slopes†	
	Total Fall Rate (95% CI)	Injurious Fall Rate (95% CI)	Unassisted Fall Rate (95% CI)	Repeat Fall Rate	Reporting Fall Events
Core Team Processes					
Targeted Bedside Interventions	0.98 (0.95, 1.02)	0.98 (0.93, 1.03)	0.98 (0.94, 1.01)	0.00	0.00
Universal Bedside Interventions	0.99 (0.95, 1.03)	0.97 (0.90, 1.04)	0.98 (0.93, 1.03)	-0.01‡	0.07
Universal Organizational Interventions	0.97 (0.92, 1.02)	0.94 (0.87, 1.02)	0.96 (0.90, 1.01)	-0.01	0.00
Coordinating Team Processes					
Fall-Risk-Reduction Program Coordination‖	0.89 (0.79, 1.00)‡	0.82 (0.68, 1.00)‡	0.86 (0.75, 0.99)§	0.00	0.00
Training: Fall-Risk-Reduction Program	0.94 (0.83, 1.06)	0.80 (0.65, 0.98)§	0.90 (0.78, 1.03)	-0.02	0.60§
Training: Fall-Risk Assessment Tool	0.98 (0.91, 1.06)	0.87 (0.75, 1.01)‡	0.97 (0.89, 1.07)	0.00	0.00
Training: Safe Transfers and Mobility	0.98 (0.94, 1.03)	0.95 (0.89, 1.02)	0.98 (0.93, 1.02)	-0.01‡	0.17§
Training: Mechanical Lifts	1.01 (0.97, 1.06)	0.98 (0.90, 1.06)	1.00 (0.95, 1.05)	-0.02‡	0.09
Training: Post-Fall Huddle	1.02 (0.95, 1.09)	0.93 (0.83, 1.05)	0.99 (0.92, 1.08)	-0.02‡	0.17
Contingency Team Process					
Post-Fall Huddle Rate	1.03 (0.92, 1.17)	0.93 (0.77, 1.11)	1.01 (0.88, 1.15)	-0.53‡	3.21

*P values calculated using a Poisson rate model

†P values calculated using nonparametric regression method

‡$P < .10$; §$P < .05$

‖Outcome multipliers for fall-risk-reduction program coordination are calculated for every 5-unit increase in this process; outcome multipliers for all other processes are calculated for every 1-unit increase in that process.

Aim 3 Hypotheses 3a and 3c. Participation in contingency teams that conduct post-fall huddles is associated with individual staff perceptions of safety culture and teamwork support for fall risk reduction. Complete results are in the submitted manuscript: Jones KJ, Crowe J, Allen J, et al. The post-fall huddle: A practical tool to adaptively manage risk and improve safety culture.

Background: Falls among hospital patients are a complex, "wicked" problem, which is persistent, is context dependent, and lacks definitive solutions. The purpose of this paper is to determine associations between conducting post-fall huddles and repeat fall rates and between participating in post-fall huddles and perceptions of teamwork and safety culture.

Results: The repeat fall rate within a hospital was negatively associated with the proportion of falls that were followed by a post-fall huddle (Spearman's rho = - .47, p = .07, Figure 1). Compared with hospital staff who did not participate in huddles, those who participated in at least one huddle had significantly more positive perceptions of how aspects of team structure, team leadership, and situation monitoring supported fall-risk reduction (Table 5). They also had more positive perceptions of aspects of organizational learning, nonpunitive response to error, teamwork across hospital departments, and hospital handoffs and transitions (Table 6).

Conclusion: Effective post-fall huddles are structured sensemaking conversations that reduce the risk of repeat falls. Participation in post-fall huddles improves perceptions of specific aspects of teamwork and safety culture.

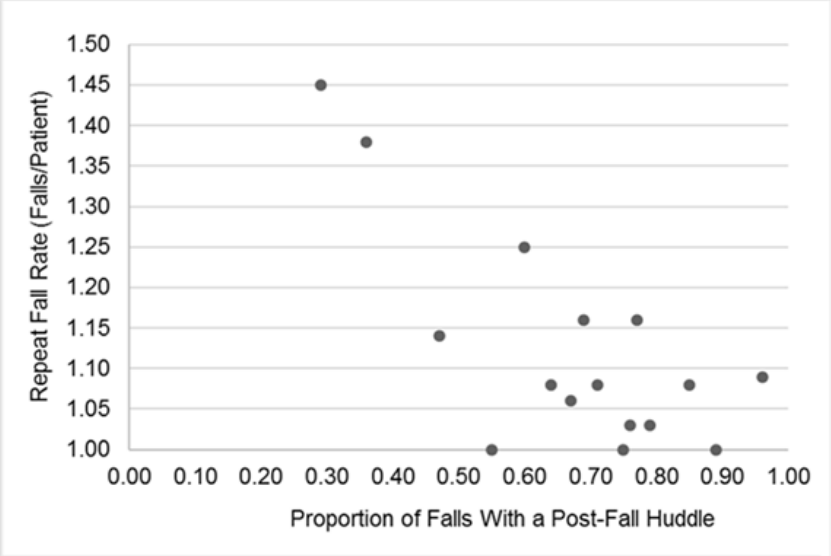

Figure 1. Association between post-fall huddles and repeat fall rate

Table 5. TeamSTEPPS® *Teamwork Perceptions Questionnaire Percent Positive Scores by Post-Fall Huddle Participation (reported if p ≤ .10 at the item level)*

Dimensions and Items	Post-Fall Huddle Participation		
	Yes (n varies 256 to 266)*	No (n varies 440 to 472)*	P value
Team Structure (α = .92)	92	90	.63
Staff within my unit/department share information that enables timely decision making about fall-risk reduction by the direct patient care team.	95	89	**.009**
My unit/department has clearly articulated goals for fall-risk reduction.	93	86	**.003**
Leadership (α = .96)	91	82	**.001**
My supervisor/manager considers staff input when making decisions about fall-risk reduction.	93	86	**.01**
My supervisor/manager provides opportunities to discuss the unit/department's performance after a patient fall.	91	78	**.001**
My supervisor/manager takes time to meet with staff to discuss the fall-risk-reduction program.	88	74	**.001**
My supervisor/manager ensures that adequate resources (e.g., staff, supplies, equipment, information) are available to support the fall-risk-reduction program.	92	88	**.09**
My supervisor/manager successfully resolves conflicts involving the fall-risk-reduction program.	87	81	**.04**
My supervisor/manager models appropriate team behavior in support of the fall-risk-reduction program.	92	87	**.06**
My supervisor/manager ensures that staff are aware of any situations or changes that may affect the fall-risk-reduction program.	91	83	**.004**
Situation Monitoring (α = .89)	90	87	.26
Staff effectively anticipate each other's needs when implementing fall-risk-reduction interventions.	92	88	**.08**
Staff exchange relevant information to decrease the risk of falls as it becomes available.	94	91	**.08**
Staff continuously scan the environment for important information to decrease the risk of falls.	93	90	**.02**
Staff share information regarding potential complications that may increase a patient's risk of falls (e.g., change in status, previous fall).	95	91	**.07**
Staff meet to re-evaluate a patient's fall-risk-reduction plan of care when aspects of the situation have changed.	88	82	**.049**
Mutual Support (α = .92)	89	87	.42
Staff resolve their conflicts about fall-risk reduction, even when the conflicts have become personal.	82	76	**.07**
Communication (α = .94)	92	90	.24
Information about fall-risk reduction is explained to patients and their families in lay terms.	95	91	**.06**

Bold p values indicate differences between groups that are statistically significant at $p < .05$ or of interest with $p \leq .10$.

*Number of respondents varies for each dimension due to the requirement to complete at least five items to calculate the dimension percent positive score.

Table 6. Hospital Survey on Patient Safety Culture Percent Positive Scores by Post-Fall Huddle Participation (reported if p ≤ .10 at the item level)

	Post-Fall Huddle Participation		
Dimensions and Items	**Yes (n varies 218 to 221)***	**No (n varies 357 to 368)***	**P Value**
Overall Perception of Safety (α = .92)	76	76	.83
Frequency of Events Reported (α = .97)	70	66	.48
When a mistake is made, but has no potential to harm the patient, how often is this reported?	70	63	**.09**
Supervisor/Manager Expectations & Actions Promoting Patient Safety (α = .92)	83	80	.88
Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts.†	88	83	**.10**
Organizational Learning—Continuous Improvement (α = .86)	85	79	**.10**
We are actively doing things to improve patient safety.	96	91	**.03**
Mistakes have led to positive changes here.	77	71	**.08**
After we make changes to improve patient safety, we evaluate their effectiveness.	83	74	**.01**
Teamwork Within Departments (α = .92)	87	85	.63
People support one another in this department.	91	92	.80
Communication Openness (α = .90)	64	63	.88
Feedback and Communication About Error (α = .84)	69	68	.71
Nonpunitive Response to Error (α = .87)	64	56	**.05**
Staff feel like their mistakes are held against them.†	70	63	**.07**
When an event is reported, it feels like the person is being written up, not the problem.†	69	56	**<.001**
Staffing (α = .96)	73	69	.31
Hospital Management Support for Patient Safety (α = .92)	83	80	**.10**
Teamwork Across Hospital Departments (α = .88)	75	66	**.011**
There is good cooperation among hospital departments that need to work together.	76	67	**.02**
Hospital departments work well together to provide the best care for patients.	86	76	**.003**
Hospital departments do not coordinate well with each other.†	62	52	**.02**
It is often unpleasant to work with staff from other hospital departments.†	77	67	**.01**
Hospital Handoffs and Transitions (α = .96)	61	52	**.07**
Things "fall between the cracks" when transferring patients from one department to another.†	59	50	**.04**
Important patient care information is often lost during shift changes.†	63	50	**.003**
Problems often occur in the exchange of information across hospital departments.†	60	50	**.03**

Bold p values indicate differences between groups that are statistically significant at p < .05 or of interest with p ≤ .10.

*Number of respondents varies for each dimension due to the requirement to complete at least three items to calculate the dimension percent positive score.

† Reverse-worded item

What are the associated risk factors for unassisted and injurious falls in small rural hospitals? Complete results are in the submitted manuscript: Venema DM, Skinner AM, Jones KJ, et al. Lessons learned from defining and categorizing falls among adults in small rural hospitals.

Background: The purpose of this study is to describe inpatient fall events and associated risk factors for unassisted and injurious falls in 17 small rural hospitals, 16 of which are Critical Access Hospitals (CAHs) licensed for 25 beds or fewer. CAHs are less likely to report or benchmark falls to external organizations[17] despite the value that reporting and benchmarking may provide for quality improvement.[43] CAHs are also less likely than larger hospitals to use a standard definition of a fall.[17] For these reasons, less is known about the risk of falls and fall-related injury in rural hospitals, such as CAHs. Because there is potential for injury with every fall, preventing all falls is a goal that hospitals seek to achieve regardless of hospital size or reimbursement structure.

However, an organizational goal of preventing all falls may incentivize underreporting of noninjurious and assisted falls and discourage mobilization of patients.[44-46] A more appropriate goal than reducing the total number of falls may be to specifically reduce unassisted falls,[45] because unassisted falls are more likely to result in injury compared with assisted falls.[45,47] Despite the large volume of literature identifying risk factors for falls in general (without assistance differentiated) and the risk of injury due to unassisted falls, the project team knows of only one other research group that has published studies identifying risk factors associated with falling unassisted versus assisted.[45,48,49]

Results: Three hundred fifty-three falls were reported over a 2-year period; 32% of the falls were injurious, and 75% of the falls were unassisted.

The project team used the Pearson chi-square test or exact Pearson chi-square test to determine the bivariate association between patient and system factors and fall type and fall outcome. Statistical significance was set at $\alpha \leq .05$. The team used univariate logistic regression to determine significant patient or system predictors of fall type and outcome. All falls were considered as independent system events not nested by patient because of the relatively small numbers of patients with two or more falls and the different situations in which repeated falls occurred.

The project team used multivariate logistic regression to determine which patient or system factors best predicted fall type and outcome. The team entered any variable that had a p value < .15 in the univariate analyses into the multivariate analyses on an exploratory basis to adjust the outcome for the presence of these variables in the model. With all other factors being equal, the odds of falling unassisted were 2.55 times greater for a patient aged ≥ 65 versus < 65, 3.70 times greater for a patient with cognitive impairment than without, and 6.97 times greater if a gait belt was not identified as an intervention for a patient versus if it was identified as an intervention (Table 7). With all other factors being equal, the odds of an injurious fall were 2.55 times greater for a patient aged ≥ 65 versus < 65, 2.48 times greater if a fall occurred in the bathroom versus other locations, and 3.65 times greater if the fall occurred when hands-on assistance was provided without a gait belt versus hands-on assistance with a gait belt (Table 8).

Conclusion: Many factors that increased the odds of a fall being unassisted or injurious in rural hospitals were consistent with research conducted in larger facilities. A key finding of the project team's work is the impact of gait belt usage. Identifying a gait belt as an intervention decreases the odds patients falling unassisted. Using a gait belt during an assisted fall decreases the odds of injury.

Table 7. Odds Ratios for Patient and System Factors Associated with Increased Odds of Falling Unassisted

Patient or System Factor	Crude Odds Ratio[a] (95% CI)	Adjusted Odds Ratio[b] (95% CI)
Age ≥ 65 years[c]	1.89 (1.11-3.21)	2.55 (1.30-5.03)
Cognitively Impaired[d]	3.21 (1.95-5.28)	3.70 (2.06-6.63)
Gait Belt NOT Identified as an Intervention[e]	5.35 (3.15-9.08)	6.97 (3.75-12.94)

CI, Confidence Interval

[a]Calculated using univariate logistic regression with all falls considered independent events

[b]Calculated using multivariate logistic regression and adjusted for the influence of other variables in the model

[c]Reference category = 19 to 64 years

[d]Cognitively impaired includes the three contributing patient factors of "cognitive impairment," "impulsive behavior," or "overestimated ability." Reference category = not cognitively impaired

[e]Gait Belt NOT Identified as an Intervention" means the hospital did not identify a gait belt as an intervention to prevent a reported fall. Reference category = gait belt was identified as an intervention to prevent a reported fall

Table 8. Odds Ratios for Patient and System Factors Associated with Increased Odds of Fall-Related Injury

Patient or System Factor	Crude Odds Ratio[a] (95% CI)	Adjusted Odds Ratio[b] (95% CI)
Age ≥ 65 years[c]	2.20 (1.22-3.96)	2.55 (1.32-4.94)
Fall in Bathroom[d]	2.23 (1.32-3.77)	2.48 (1.41-4.36)
NO Alarms in Use[e]	1.58 (1.00-2.49)	1.46 (0.89-2.41)
Unassisted[f]	2.28 (1.28-4.04)	1.48 (0.69-3.14)
Hands on Assist WITHOUT Gait Belt[f]	4.76 (1.99-14.15)	3.65 (1.34-9.97)

CI, Confidence Interval

[a] Calculated using univariate logistic regression with all falls considered independent events

[b] Calculated using multivariate logistic regression and adjusted for influence of other variables

[c] Reference category = 19 to 64 years

[d] Reference category = fall occurred in location other than the bathroom

[e" NO Alarms in Use" means the hospital did not report that either bed or chair alarms were in use as interventions to prevent a reported fall. Reference category = either bed or chair alarms were in use as interventions in use to prevent a reported fall

[f" Unassisted" and "Hands on Assist WITHOUT Gait Belt" indicate whether or not hands on assist was provided at the time of the fall and whether or not a gait belt was used to provide that assistance. Reference category = Hands on Assist WITH Gait Belt

6. List of Publications and Products

Published Works

1. Jones K. Sentinel Event Alert brings falls back into the spotlight. Patient Safety Monitor Journal 2015 Oct.
2. Kennel, V, Jones, KJ, & Reiter-Palmon, R. (2017). Team innovation in healthcare. In R. Reiter-Palmon (Ed.), Team Creativity and Innovation. New York, NY: Oxford University Press.

Manuscripts Submitted

1. Reiter-Palmon R, Kennel V, Allen J, et al. Good Catch!: Using Interdisciplinary Teams and Team Reflexivity to Improve Patient Safety.
2. Jones KJ, Skinner AM, Venema DM, et al. Managing Complexity: Using Multiteam Systems to Decrease Inpatient Fall Risk.
3. Jones KJ, Crowe J, Allen J, et al. The post-fall huddle: A practical tool to adaptively manage risk and improve safety culture.
4. Venema DM, Skinner AM, Nailon R, et al. Patient and System Factors Associated with Unassisted and Injurious Falls in Rural Hospitals.
5. Kennel V, Yoerger M, Skinner AM, et al. Guided Post-Fall Huddles: A Sensemaking Tool to Learn from and Take Action to Reduce Patient Fall Risk
6. Allen JA, Reiter-Palmon R, Kennel V, et al. Group and Organizational Safety Norms Set the Stage for Good Post-Fall Huddles.

Manuscripts in Preparation

1. Schantz C, Conley D, Jones KJ. Patient and Caregiver Perceptions of Being Safe from Falling in the Hospital.
2. Topliff K, Venema DM, Jones KJ. Rehabilitation Therapists in Inpatient Fall Risk Reduction: Playing a More Valuable Role.

Selected Presented Works

1. Kennel V, Allen J, Reiter-Palmon R, & Jones K. Ideal safety norms precipitate good leader behaviors in post-fall huddles. Society for Industrial Organizational Psychology 2016 Conference; 2016 Apr 14-16; Anaheim, CA.
2. Kennel V, Reiter-Palmon K. Leadership support for organizational change implementation: Reducing patient fall risk. Society for Industrial Organizational Psychology 2016 Conference; 2016 Apr 14-16; Anaheim, CA.
3. Jones K. Collaboration and proactive teamwork used to reduce (CAPTURE) falls. Science of Team Science Conference; 2016 May 18; Phoenix, AZ.
4. Jones K, Kennel V. Collaboration and proactive teamwork used to reduce (CAPTURE) falls. Meeting: Hospital Engagement Network (HEN) Leadership, Improvement Advisors, and Hospitals Pacing Event Meeting; 2016 Jun 2; World Wide Web.
5. Venema D, Jones K, Nelson E. “Teaming Up for Inpatient Falls-Risk Reduction.” APTA NEXT 2016 Conference and Exposition; 2016 Jun 10; Nashville, TN.
6. Jones K, Venema D, Skinner A, et al. Association between safe transfer/mobility techniques and fall-related injury in the acute care setting: Implications for physical therapists. Center on Health Services Training and Research; 2016 Jun 28; Boston, MA.

7. Venema D, Jones K, Nelson E. Moving beyond direct patient care: An expanded role for physical therapy in inpatient fall risk reduction. Nebraska Critical Access Hospitals Conference on Quality; 2016 Oct 27; Kearney, NE.
8. Jones K. Coordination within Multiteam Systems Makes Healthcare Safer. Iowa Hospital Association Annual Meeting; 2016 Oct 20; Des Moines, IA.
9. Venema D. HRET HIIN falls webinar: Teaming up to jump the gap in falls. Health Research & Educational Trust. 2016 Dec 1; World Wide Web.
10. Jones K. Managing the Complexity of Patient Safety Problems using Multiteam Systems. Nebraska Coalition for Patient Safety CIMRO Quality Forum; May 18, 2017; Lincoln, NE.
11. Jones K, Kennel V. CAPTURE Falls Part 1: A systems approach to a complex patient safety problem. COMPASS Hospital Improvement Innovation Network; June 20, 2017.
12. Jones K. Innovating to Manage Complexity: Using Multiteam Systems to Decrease Inpatient Fall Risk. AcademyHealth Annual Research Meeting; June 26, 2017; New Orleans, LA.
13. Skinner AM. CAPTURE Falls Part 2: Know Falls: An Online Organizational Tool for Fall Risk Reduction; July 18, 2017.
14. Venema D. CAPTURE Falls Part 3: Moving Beyond Direct Patient Care: An Expanded Role for Physical Therapy in Inpatient Fall Risk Reduction. COMPASS Hospital Improvement Innovation Network; August 15, 2017.

Use of CAPTURE Falls Website

Listed below are the project report analytic results from four key pages of the project website for the period January 1, 2016 – November 8, 2017.

Title of Webpage	Description of Webpage	Web Address	Total Page Views[a]	Unique Page Views[b]	Entrances[c]
CAPTURE Falls	This is the homepage for the project. Visitors can access all other pages from this page.	https://www.unmc.edu/patient-safety/capturefalls/	1,987	1,602	1,479
Tool Inventory	This page includes links to documents that fall risk reduction coordinating teams can use to support their efforts.	https://www.unmc.edu/patient-safety/capturefalls/tool-inventory.html	3,707	2,847	1,593
Learning Modules	This page includes recordings for 11 different webinars that provide education on a variety of fall-related topics.	https://www.unmc.edu/patient-safety/capturefalls/learningmodules/index.html	1,374	1,012	189
Fall-Event Reporting	This page includes forms for fall-event reporting. Versions exist for hospitals that work directly with us as well as for hospitals who use the form independently.	https://www.unmc.edu/patient-safety/capturefalls/reporting.html	1,079	794	158

A The total number of visits to that page; includes first-time and repeat visitors

B The number of first-time visits to that page

C The number of visits when the viewer came directly to that page

7. References

1. Oliver D, Healey F, Haines TP. Preventing falls and fall-related injuries in hospitals. *Clin Geriatr Med*. 2010;26(4):645-692.
2. Weiss AJ, Elixhauser A, eds. *Overview of hospital stays in the united states, 2012.* http://www.hcup-us.ahrq.gov/reports/statbriefs/sb180-Hospitalizations-United-States-2012.pdf ed. Rockville, MD: Agency for Healthcare Research and Quality; October 2014
HCUP Statistical Brief; No. 180.
3. Bouldin EL, Andresen EM, Dunton NE, et al. Falls among adult patients hospitalized in the united states: Prevalence and trends. *J Patient Saf*. 2013;9(1):13-17.
4. Agency for Healthcare Research and Quality. Interim update on 2013 annual hospital-acquired condition rate and estimates of cost savings and deaths averted from 2010 to 2013. http://www.ahrq.gov/professionals/quality-patient-safety/pfp/interimhacrate2013.pdf. Accessed November 15, 2017.
5. Tinetti ME, Mendes de Leon CF, Doucette JT, et al. Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. *J Gerontol*. 1994;49(3):M140-7.
6. Centers for Medicare and Medicaid Services (CMS). Hospital-acquired conditions. CMS.gov Website. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Hospital-Acquired_Conditions.html. Updated 2015. Accessed September 28, 2017.
7. Agency for Healthcare Research and Quality. AHRQ national scorecard on rates of hospital-acquired conditions. U.S. Department of Health & Human Services, Agency for Healthcare Research and Quality Website. https://www.ahrq.gov/professionals/quality-patient-safety/pfp/index.html. Published December 2016. Updated 2016. Accessed November 12, 2017.
8. Barker AL, Morello RT, Wolfe R, et al. 6-PACK programme to decrease fall injuries in acute hospitals: Cluster randomised controlled trial. *BMJ*. 2016;352:h6781.
9. Healey F. Preventing falls in hospitals. *BMJ*. 2016;532:i251.
10. American Geriatrics Society, British Geriatrics Society, American Academy of Orthopaedic Surgeons Panel on Falls Prevention. Guideline for the prevention of falls in older persons. American Geriatrics Society, British Geriatrics Society, and American Academy of Orthopaedic Surgeons Panel On Falls Prevention. *J Am Geriatr Soc*. 2001;49(5):664-672.
11. Evans D, Hodgkinson B, Lambert L, et al. Fall risk factors in the hospital setting: A systematic review. *IJNP*. 2001;7:38-45.
12. Oliver D, Daly F, Martin FC, et al. Risk factors and risk assessment tools for falls in hospital in-patients: A systematic review. *Age Ageing*. 2004;33(2):122-130.
13. Tzeng HM, Yin CY. The extrinsic risk factors for inpatient falls in hospital patient rooms. *J Nurs Care Qual*. 2008;23(3):233-241.
14. Miake-Lye IM, Hempel S, Ganz DA, et al. Inpatient fall prevention programs as a patient safety strategy: A systematic review. *Ann Intern Med*. 2013;158(5 Pt 2):390-396.
15. Aydin C, Donaldson N, Aronow HU, et al. Improving hospital patient falls: Leveraging staffing characteristics and processes of care. *J Nurs Adm*. 2015;45(5):254-262.
16. Kalisch BJ, Lee KH. The impact of teamwork on missed nursing care. *Nurs Outlook*. 2010;58(5):233-241.
17. Jones KJ, Venema DM, Nailon R, et al. Shifting the paradigm: An assessment of the quality of fall risk reduction in Nebraska hospitals. *J Rural Health*. 2015;31:135-145.
18. Brown DS, Donaldson N, Burnes Bolton L, et al. Nursing-sensitive benchmarks for hospitals to gauge high-reliability performance. *J Healthc Qual*. 2010;32(6):9-17.
19. Institute of Medicine (IOM). Kohn,L., Corrigan J, Donaldson M, eds. *To err is human: Building a safer health system.* Washington, DC: National Academy Press; 2000.
20. Salas E, Dickinson TL, Converse SA. Toward an understanding of team performance and training. In: Swezey RW, Salas E, eds. *Teams: Their training and performance.* Norwood, NJ: Ablex; 1992:3-29.
21. Salas E, Sims DE, Burke CS. Is there a big five in teamwork. *Small Group Research*. 2005;36(5):555-599.
22. Young MP, Gooder VJ, Oltermann MH, et al. The impact of a multidisciplinary approach on caring for ventilator-dependent patients. Int J Qual Health Care. 1998;10(1):15-26.

23. Mukamel DB, Temkin-Greener H, Delavan R, et al. Team performance and risk-adjusted health outcomes in the program of all-inclusive care for the elderly (PACE). *Gerontologist*. 2006;46(2):227-237.
24. Strasser DC, Falconer JA, Stevens AB, et al. Team training and stroke rehabilitation outcomes: A cluster randomized trial. *Arch Phys Med Rehabil*. 2008;89(1):10-15.
25. Percarpio KB, Harris FS, Hatfield BA, et al. Code debriefing from the Department Of Veterans Affairs (VA) Medical Team Training program improves the cardiopulmonary resuscitation code process. *Jt Comm J Qual Patient Saf*. 2010;36(9):424-9, 385.
26. Neily J, Mills PD, Young-Xu Y, et al. Association between implementation of a medical team training program and surgical mortality. *JAMA*. 2010;304(15):1693-1700.
27. Mayer CM, Cluff L, Lin WT, et al. Evaluating efforts to optimize TeamSTEPPS implementation in surgical and pediatric intensive care units. *Jt Comm J Qual Patient Saf*. 2011;37(8):365-374.
28. Deering S, Rosen MA, Ludi V, et al. On the front lines of patient safety: Implementation and evaluation of team training in iraq. *Jt Comm J Qual Patient Saf*. 2011;37(8):350-356.
29. Havyer RD, Wingo MT, Comfere NI, et al. Teamwork assessment in internal medicine: A systematic review of validity evidence and outcomes. *J Gen Intern Med*. 2014;29(6):894-910.
30. Jones KJ, Skinner AM, High R, et al. A theory-driven, longitudinal evaluation of the impact of team training on safety culture in 24 hospitals. *BMJ Qual Saf*. 2013;22(5):394-404.
31. Agency for Healthcare Research and Quality. TeamSTEPPS fundamentals course: Module 2. Team structure. http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/fundamentals/module2/igteamstruct.html. Accessed June 7, 2015.
32. DeChurch LA, Zaccaro SJ. Perspective: Teams won't solve this problem. *Hum Factors*. 2010;52(2):329-334.
33. Marks MA, DeChurch LA, Mathieu JE, et al. Teamwork in multiteam systems. *Journal of Applied Psychology*. 2005;90:964-971.
34. Donabedian A. *An introduction to quality assurance in health care.* New York: Oxford University Press; 2003.
35. Umscheid CA, Brennan PJ. Incentivizing "structures" over "outcomes" to bridge the knowing-doing gap. *JAMA Intern Med*. 2015;175(3):354-355.
36. Shorr RI, Chandler AM, Mion LC, et al. Effects of an intervention to increase bed alarm use to prevent falls in hospitalized patients: A cluster randomized trial. *Ann Intern Med*. 2012;157(10):692-699.
37. Sahota O, Drummond A, Kendrick D, et al. REFINE (REducing Falls in In-patieNt Elderly) using bed and bedside chair pressure sensors linked to radio-pagers in acute hospital care: A randomised controlled trial. *Age Ageing*. 2014;43(2):247-253.
38. Haines TP, Bell RA, Varghese PN. Pragmatic, cluster randomized trial of a policy to introduce low-low beds to hospital wards for the prevention of falls and fall injuries. *J Am Geriatr Soc*. 2010;58(3):435-441.
39. Haines TP, Hill AM, Hill KD, et al. Patient education to prevent falls among older hospital inpatients: A randomized controlled trial. *Arch Intern Med*. 2011;171(6):516-524.
40. Hempel S, Newberry S, Wang Z, et al. Hospital fall prevention: A systematic review of implementation, components, adherence, and effectiveness. *J Am Geriatr Soc*. 2013;61(4):483-494.
41. Ovretveit J. Evaluating complex social interventions. In: *Evaluating improvement and implementation for health.* Maidenhead, England: Open University Press; 2014:158-175.
42. Preacher KJ, Rucker DD, MacCallum RC, et al. Use of the extreme groups approach: A critical reexamination and new recommendations. *Psychological Methods*. 2005;10:178-192.
43. Moscovice IS, Casey M. Quality of care in critical access hospitals. *JAMA:the journal of the American Medical Association*. 2011;306:1653.
44. Staggs VS, Davidson J, Dunton N, et al. Challenges in defining and categorizing falls on diverse unit types: Lessons from expansion of the NDNQI falls indicator. *J Nurs Care Qual*. 2015;30(2):106-112.
45. Staggs VS, Mion LC, Shorr RI. Assisted and unassisted falls: Different events, different outcomes, different implications for quality of hospital care. *Jt Comm J Qual Patient Saf*. 2014;40(8):358-364.
46. Growdon ME, Shorr RI, Inouye SK. The tension between promoting mobility and preventing falls in the hospital. *JAMA Intern Med*. 2017;177(6):759-760.
47. Krauss MJ, Nguyen SL, Dunagan WC, et al. Circumstances of patient falls and injuries in 9 hospitals in a Midwestern healthcare system. *Infect Control Hosp Epidemiol*. 2007;28(5):544-550.

48. Staggs VS, Knight JE, Dunton N. Understanding unassisted falls: Effects of nurse staffing level and nursing staff characteristics. *J Nurs Care Qual*. 2012;27(3):194-199.
49. Staggs VS, Dunton N. Associations between rates of unassisted inpatient falls and levels of registered and non-registered nurse staffing. *Int J Qual Health Care*. 2014;26(1):87-92.