



## Butler University Digital Commons @ Butler University

Scholarship and Professional Work - Business

College of Business

2014

# Communication and effectiveness in a US nursing home quality-improvement collaborative

Priscilla Arling

*Butler University*, [parling@butler.edu](mailto:parling@butler.edu)


Kathleen Abrahamson

Edward J. Miech

Thomas S. Inui

Greg Arling

Follow this and additional works at: [http://digitalcommons.butler.edu/cob\\_papers](http://digitalcommons.butler.edu/cob_papers)

 Part of the [Health Communication Commons](#), [Management Information Systems Commons](#), [Organizational Behavior and Theory Commons](#), and the [Organizational Communication Commons](#)

### Recommended Citation

Arling, Priscilla; Abrahamson, Kathleen; Miech, Edward J.; Inui, Thomas S.; and Arling, Greg, "Communication and effectiveness in a US nursing home quality-improvement collaborative" (2014). *Scholarship and Professional Work - Business*. Paper 216.  
[http://digitalcommons.butler.edu/cob\\_papers/216](http://digitalcommons.butler.edu/cob_papers/216)

This Article is brought to you for free and open access by the College of Business at Digital Commons @ Butler University. It has been accepted for inclusion in Scholarship and Professional Work - Business by an authorized administrator of Digital Commons @ Butler University. For more information, please contact [fgaede@butler.edu](mailto:fgaede@butler.edu).

# **Communication and effectiveness in a US nursing home quality-improvement collaborative**

**Priscilla A. Arling PhD<sup>1,\*</sup>,**

**Kathleen Abrahamson RN, PhD<sup>2</sup>,**

**Edward J. Miech EdD<sup>3</sup>,**

**Thomas S. Inui ScM, MD<sup>3</sup>**

**Greg Arling PhD<sup>3</sup>**

## **Abstract**

In this study, we explored the relationship between changes in resident health outcomes, practitioner communication patterns, and practitioner perceptions of group effectiveness within a quality-improvement collaborative of nursing home clinicians. Survey and interview data were collected from nursing home clinicians participating in a quality-improvement collaborative. Quality-improvement outcomes were evaluated using US Federal and State minimum dataset measures. Models were specified evaluating the relationships between resident outcomes, staff perceptions of communication patterns, and staff perceptions of collaborative effectiveness. Interview data provided deeper understanding of the quantitative findings. Reductions in fall rates were highest in facilities where respondents experienced the highest levels of communication with collaborative members outside of scheduled meetings, and where respondents perceived that the collaborative kept them informed and provided new ideas. Clinicians observed that participation in a quality-improvement collaborative positively influenced the ability to share innovative ideas and expand the quality-improvement program within their nursing home. For practitioners, a high level of communication, both inside and outside of meetings, was key to making measurable gains in resident health outcomes.

**Keywords:** collaborative; fall reduction; mixed-methods approach; nursing home; quality improvement

## **Introduction**

For several decades, collaborative groups of clinicians have come together to achieve mutually agreed-upon goals and address common organizational problems related to quality and safety issues in health care (Mittman, 2004). In quality-improvement (QI) collaboratives, members from multiple organizations work together to share information on effective interventions and ways to overcome barriers to QI implementation (Kilo, 1998; Cretin *et al.*, 2004). Many studies have reported the success of collaborative teams in improving specific processes in areas, such as colorectal, perinatal, and diabetes care. Yet no study has examined the influence of collaboratives on QI implementation in the nursing home setting, and only a few studies of clinical collaboratives have linked group communication patterns to resident health outcomes (Gould, 2010; Hicks *et al.*, 2010; Jackson *et al.*, 2010). In addition, while studies have reported the benefits of scheduled collaborative meetings (Ovretveit, 2002; Nembhard, 2009; Schouten *et al.*, 2013), little is known about whether and how communication outside of those meetings influences outcomes.

We used a mixed-methods approach to conduct an exploratory study of one nursing home QI collaborative, the Empira QI fall-reduction collaborative in Minnesota. The general aim of this study was to determine how participation and communication patterns in a nursing home QI collaborative influenced perceptions of collaborative effectiveness and resident health outcomes.

## **Literature review**

In QI collaboratives, members from multiple organizations work together to share information on effective interventions and ways to overcome barriers to implementations (Kilo, 1998; Cretin *et al.*, 2004). Research suggests that the interorganizational communication that occurs is a key differentiator in terms of whether or not collaborative participation benefits specific members and organizations (Nembhard, 2009). Communication among members in collaboratives takes place both during and outside of meetings. Collaboratives often seek to extend information exchange outside of scheduled meetings by offering a variety of ways for members to communicate with each other, including site visits, collaborative-specific websites, phone calls, and written reports (Kilo, 1998; Nembhard, 2009).

In order for any collaborative communication to affect change in an organization, each member must deem that communication to be useful and effective. One of the core benefits expected from collaborative participation is the introduction of new ideas. Participants are expected to exchange evidence and best practices, and to be able to learn from the testing of ideas conducted in other organizations (Schouten *et al.*, 2013). As a result, having peer members who are actively engaged in projects and provide information back to others is vital to benefiting from collaborative membership (Nembhard, 2009). Leaders are expected to encourage project participation from a variety of members. The leaders and organizers of the collaborative are also expected to keep members informed by presenting new research, identifying and linking members to experts, and teaching members about QI processes (Vos *et al.*, 2013; Versteeg *et al.*, 2013).

In this study, we explored the association between participation in a nursing home QI collaborative and resident outcomes in the form of changes in fall rates. In particular, we sought to understand whether and how communication outside of scheduled group meetings might be associated with

changes in fall rates, and also examined the extent to which changes in fall rates were related to members' perceptions of the collaborative's effectiveness in three key areas: introducing new ideas, encouraging member project participation, and keeping members informed.

## **Methods**

### **Study setting**

The Empira fall-reduction project ran from October 2008 to September 2011, with a goal of reducing the incidence rate of falls among nursing home residents in participating facilities. Members of the Empira QI collaborative include nursing and other leadership from participating facilities. The project received funding support from the Minnesota Nursing Home Performance-Based Incentive Payment Program (PIPP). The program is an innovative state-level initiative that funds grassroots QI projects that are provider initiated and evidence based.

Nursing facilities agreed to join the collaborative at the organizational level. In return for member fees provided by the participating nursing home organizations, Empira provided communication platforms, such as meetings and seminars, as well as technical assistance from QI experts employed through the Empira collaborative. The collaborative also offered networking opportunities for nursing home clinicians who were located in differing geographic regions, but who shared similar QI challenges.

QI leaders employed through the Empira organization assisted with the development and implementation of fall-prevention strategies through facility-based project coordinators. The project coordinators relied on fall-prevention teams or committees within their nursing facilities to adapt and implement falls prevention strategies in a manner that met their local organizational needs. Project coordinators met at least monthly as a group with Empira staff for project meetings or educational sessions, and communicated outside of scheduled meetings, both electronically and in person. The collaborative searched for information on evidence-based practices for falls prevention, held training sessions, consulted and problem solved with project coordinators individually or as a group, and reported project data on falls and other outcomes. Thus, although the fall-reduction project was centrally organized through the Empira collaborative, networking between project coordinators and adaptive implementation at the individual nursing home level was potentially a significant part of this collaborative falls reduction project.

### **Data collection and analysis**

In this study, we employed a sequential explanatory mixed-methods approach, which combines the strengths and minimizes the weaknesses of a solely quantitative or qualitative approach (Creswell & Plano Clark, 2011). First, an external source was used to determine facility fall-reduction percentages. Second, respondents at facilities were surveyed to measure communication levels and collaboration effectiveness. Finally, qualitative interview data were collected and analyzed in order to better understand and gain additional insights into the quantitative results. The Indiana University Institutional Review Board approved the data collection methods.

### **Fall-reduction percentage**

The primary outcome was each facility's percentage change in the incidence of resident falls. This quality indicator is part of the Minnesota Nursing Home Report Card. It is calculated quarterly from resident-level minimum dataset assessment data (Kane *et al.*, 2007; MDH, 2009). Using an interrupted time-series design, we examined trends in the fall rate for 15 Empira collaborative facilities compared to 357 other facilities in the state, with and without PIPP projects. We tracked facility-specific fall incidence rates for this universe of organizations over a baseline period prior to the beginning of the Empira fall-prevention project (2005–2007) and after the project was implemented (October 2008–2010). We assessed trends in fall rates with a mixed-effect growth model (Singer & Willett, 2003) using SAS software (SAS Institute, 2011). Each facility's fall rate per calendar quarter was modeled as a function of time (calendar quarter), being part of the Empira fall project (fixed effect), period before and after the fall-prevention project began (time-varying indicator variable), and interactions among time, membership in the Empira project, period before and after the project began, and a facility random effect.

### **Collaborative communication and effectiveness surveys**

A second source of data was a structured, quantitative survey. The survey, administered in person during a 2011 meeting of Empira collaborative members, measured type and frequency of communication between members and perceived effectiveness of the collaborative process. The survey addressed the number of formal collaborative meetings attended, the frequency of communication with collaborative members outside of scheduled meetings, and perceived effectiveness of the collaborative. Demographic data were also collected.

Communication outside of scheduled meetings was characterized by asking how often each respondent communicated about falls with other collaborative members outside of the scheduled meetings. Respondents were asked to choose from the following frequencies, with the weighted value of each in parentheses: every day (5), several times a week (4), once or twice a week (3), at least monthly (2), less than once a month (1), or do not contact (0).

The effectiveness of the collaborative was measured via three separate questions, based on prior work on QI initiatives and collaboratives (Lindenauer, 2008; Nembhard, 2009; Schouten *et al.*, 2013). Each question used a four point Likert scale, from “0” (not effective/no success) to “4” (very high). Respondents were asked to assess the effectiveness of the collaborative in: (i) introducing new ideas that are applicable to participating clinicians; (ii) informing membership of changes; and (iii) encouraging project participation among fellow collaborative members. Thirty four survey responses were received from collaborative members, representing 15 participating facilities. The number of respondents per facility ranged from one to three. Because fall-reduction percentages are reported by facility, results were aggregated to the facility level by averaging survey item responses across all respondents within a facility. Due to the exploratory nature of the study and the small sample size, the analysis of the survey data was limited to observed bivariate correlations, which were run using IBM SPSS Statistics for Windows (IBM Corp, 2011). We used Spearman correlations, because the survey responses were ordinal rather than interval.

## **Collaborative group interviews**

The third method of data collection was group interviews conducted during two collaborative meetings in March and August 2011. The March interview was an appreciative inquiry (Cooperrider & Srivastva, 1987) designed to elicit success stories from the projects and collaborative. The August interview followed an interview guide that touched on the same topics as the survey. Three of the authors separately reviewed the data extracted from these interviews, searching for themes and key data points, such as influencing factors and outcomes. Specifically, we looked for themes related to communication and the effectiveness areas identified in the survey. Output from each analysis was grouped into logical categories and cross-validated by the researchers. The results were compared to the correlations from the quantitative analysis in order to better understand how collaborative membership aided in the reduction of fall rates.

## **Results**

### **Impact of the collaborative on fall rates**

The results from the trend analysis based on the linear growth model are shown in Figure 1. There was a significant three way interaction linking time (calendar quarter), a facility being part of the Empira fall project, and period before or after the project began. Although the Empira facilities were slightly different from other facilities in fall-reduction percentages prior to project implementation (2008), they showed a significant downward trend in their resident fall rates after project implementation. Fall-reduction rates for non-Empira facilities displayed no significant change during the same periods. The percentage improvement in the fall-reduction rates of Empira facilities between 2007 and 2010 is shown in Figure 2. The rate of new falls declined on average 31% across the facilities in the project. Facilities varied from -10% (10% increase in the incidence rate of falls) to 55% (55% decline in the rate of falls), with 13 of 15 facilities improving.

### **Survey and interview results**

The characteristics of the 29 individuals who completed the survey and participated in the interviews are shown in Table 1.

The number of collaborative meetings attended by respondents was not significantly related to facility fall rates. Improvement in the fall reduction was significantly and positively correlated to communication with other collaborative members outside the meetings ( $r = 0.524$ ,  $P < 0.05$ ), perception that the collaborative kept their membership informed ( $r = 0.523$ ,  $P < 0.05$ ), and perception that the collaborative was effective in promoting new ideas ( $r = 0.548$ ,  $P < 0.05$ ). The number of meetings attended was unrelated to communication outside of meetings, perception that the collaborative kept members informed, and perception that the collaborative promoted new ideas and participation from members. In contrast, the frequency of communication outside the meetings was strongly correlated to the perceived effectiveness of the collaborative in keeping the membership informed ( $r = 0.750$ ,  $P < 0.01$ ). In turn, keeping members informed was positively correlated to the perceived effectiveness in exposing respondents to new ideas ( $r = 0.632$ ,  $P < 0.05$ ).

Finally, findings from the interview data were compared with the quantitative results in order to provide additional understanding of the impact of collaborative participation. From our group interviews, we identified three ways respondents indicated how collaborative participation ultimately influenced resident outcomes: (i) by enabling idea sharing; (ii) by boosting the value of shared ideas through the sharing of successful intervention trials; and (iii) by promoting the concept of “buy-in” of ideas as a process and a journey rather than a discrete event.

### **Sharing of ideas with peers and educators**

The critical role of communication and sharing information with both peers and educators was echoed throughout the interviews. While published evidence was frequently presented at meetings, evidence and learning from peers was just as valuable and constituted one way that collaborative participation led to changes in resident outcomes. Participants reported in interviews that new ideas emerged during the collaborative meetings. One respondent remarked:

I think the best thing about this is being able to ... share what you're learning ... obstacles that you have to overcome and then getting support from each other because you're on your own for the most part. You run out of ideas, so I think the biggest thing for me is being able to share the experience, but also be able to learn from your peers.

Another respondent noted how the collaborative environment aided in the sharing of ideas:

People bring suggestions so there was a lot of communication and you felt comfortable... . I've been in nursing for a long time, but you felt very open and you're eager to learn and felt very accepted.

### **Boosting the effectiveness of shared ideas through sharing of trials**

While ideas were presented at collaborative meetings, they often required adaptation in order to be implemented within the context of individual facilities. A second way collaborative participation affected fall rates is that subgroups of the collaborative would trial ideas, figure out how to modify them to be effective in their facility's context, and then pass on this learning to other collaborative members. Respondents noted how, through the sharing of one nursing home's trial of a QI tool, the tool began to be used by the group, but in a modified form:

I think we did it for a year.

We had a separate meeting every quarter with (collaborative facilitator).

We really found that it didn't have the outcome that was intended ... our results were not to par with that researcher's result.

What we did though, we enjoyed the tools and so other facilities are continuing and using the tools ... but with a less rigid research base ... so it's still being implemented but ... an alternative program.

One member noted how important it was to get feedback from a facility where the QI tool had been tested and that facility's own evidence had been gathered:

She came back on her own and gave us very relevant statistical data... It was assuring that they're not using more staff time (when using the QI tool). That's the kind of examples we would get ... would come back with solidifying (evidence) ... even though it's research based, it solidified, and then the other coordinators were very much on board because they wanted their own testing.

### **“Buy-in” as a journey**

Finally, a third way collaborative participation culminated in positive changes in resident outcomes was through modeling how to establish a receptive context for implementation and getting staff at the facilities to “buy into” and implement new ideas. While staff buy-in could occur quickly for some individuals and for some ideas during the collaborative meetings, in general, the process of achieving staff buy-in emerged over time. Collaborative leaders brought fall-reduction evidence to the attention of members, and then allowed members to discuss the evidence as presented and arrive at their own conclusions. This permitted the buy-in decision to evolve on a personal level, rather than being dictated in a top-down manner, which was a model of adult learning and professional development that could eventually be applied at the individual facility level as well. One respondent noted:

The question would be presented or the background would be presented and ... the discussion would just take off and (the group) would arrive at some conclusion, so there was time for both (presentation of an idea and discussion), which was very valuable.

In the interviews, several respondents cited the experience of facilities going alarm free as an example of practitioner support for new fall-related practices not being manifested immediately, but rather growing over time:

Some fall coordinators embraced it. Some didn't at first. Some tried it and came back and went, Wow, it's had an incredible effect!

Yeah. It just started as one little sharing of some evidence of facilities of who reduces falls and handing it to this group, and then some trying it and embracing it. Some DONs (Directors of Nursing) who did and some who didn't. It just rippled. The effect was huge.

### **Discussion**

The study findings suggested that communication, both inside and outside of formal meetings, was associated with changes in resident outcomes. Respondents who most perceived that the collaborative kept them informed and felt the collaborative was highly effective at communicating new ideas were based in the facilities with the highest fall-reduction percentages. Communicating outside of scheduled meetings was also related to successful QI outcomes. This suggested that one of the advantages of participating in a collaborative was networking and obtaining the support and knowledge of peers beyond scheduled meetings. It also highlighted the importance of informal communication within QI collaboratives. Organizational theory suggests that it is through informal outlets for idea sharing that individuals are able to insert the individual and local context into the sometimes rigid structure of healthcare organizations (Katz & Kahn, 1978). Formal systems of communication either inadvertently or purposefully promote predictability, coordination, and the



maintenance of existing hierarchies. Informal communication outside of established meetings might have encouraged the type of innovation that allowed member facilities to excel in meeting QI outcomes. Member mutual learning and alignment required informal interaction and social processing to take place in addition to the formal presentation of centrally-managed content during the formal meetings.

These findings are consistent with prior research and have implications for QI in the wider healthcare system. Studies in multiple healthcare areas have found that interorganizational communication and collaboration is a key factor in improving the quality of care in today's multiprofessional healthcare arena. Chan *et al.* (2005) studied a healthcare delivery network that included acute care, rehabilitation, emergency medical system, and primary care providers, among others. They found that innovations spread more quickly and effectively when the innovation was generated within the network members, rather than outside the network, and when members facilitated the flow of information across boundaries through formal and informal exchanges. Shah *et al.* (2008) found that even in the absence of financial or contractual obligations to coordinate and collaborate, members of disparate organizations could work to reduce the amount of time it took to give appropriate care to heart attack patients. The authors attributed the coordination and success of the interorganizational communication to shared goals, shared knowledge, and mutual respect for the work. These studies, as well as our own, further strengthen the need to foster interorganizational communication networks and mechanisms, such as QI collaboratives, that facilitate coordination and collaboration in a wide variety of healthcare settings.

One factor not considered directly in this study was the role played by the Minnesota PIPP (Cooke *et al.*, 2010). Funding through this program supported facilitation activities by the collaborative, as well as project implementation in participating facilities. Through the program, the collaborative designed its own project, submitted a proposal for competitive review by the state, and obtained three years of project funding. This approach to QI differs from traditional pay-for-performance models, in which financial incentives are tied to general performance measures and incentives are received only after performance targets have been met. Although there is little evidence for the effectiveness of traditional incentive approaches (Werner *et al.*, forthcoming), the Minnesota program has shown significant increases in care quality among participating facilities (Abrahamson *et al.*, 2013; Arling *et al.*, 2013).

### **Implications for practitioners**

QI efforts within nursing home environments present unique challenges. Unlike acute care organizations, nursing homes must address both quality-of-care and quality-of-life issues in order to provide exceptional care. Frequently, communication with staff members occurs at mandatory meetings or through newsletters. Formal communication in group settings is a practical, time-efficient approach. Time constraints might prevent opportunities for frequent informal conversations that go beyond the immediate moment and focus on larger QI issues. However, the findings of this study highlight the importance of communication that occurs outside of formal meetings. The respondents noted that, when given the opportunity from leadership to engage in communication outside of set meetings, the results were positive. Therefore, management

interventions intended to provide time and opportunities for informal communication are likely to benefit QI initiatives.

### **Limitations**

This exploratory study had several limitations. It was a study of a single collaborative. The quantitative survey findings were based on correlations, and the causal direction of influence between the fall-reduction percentage and the survey variables could not be established. Respondents might have known their facility's fall-reduction percentage when they took the survey and were interviewed. That knowledge could have influenced their answers regarding the effectiveness of the collaborative. Communication might also have been influenced by knowledge of the fall-reduction percentage. It is possible that as the facility's fall-reduction percentage improved, respondents increased their communication with others in order to share success stories or provide advice. In addition, the communication measure was subject to possible response bias, as external validation of the measure would not have allowed the surveys to be completed anonymously. Finally, the small sample size limited analysis of the survey results.

### **Conclusion**

This study contributes to understanding the association between communication and effectiveness in the context of a QI collaborative. Encouraging collaborative participants to make use of collaborative-related contacts to the greatest extent possible, both inside and outside of formal meetings, is a communication strategy that appeared to help sites in this QI collaborative reach their fullest potential. This research is part of a larger study of the Minnesota PIPP where evidence was found of the program having positive effects on clinical outcomes for residents in participating nursing homes, and in promoting better care practices and QI strategies (Abrahamson *et al.*, 2013; Arling *et al.*, 2013). Further research will study care processes and outcomes of PIPP projects carried out by collaboratives compared to individual facilities, and will also compare collaboratives with similar project objectives, but different approaches to collaboration.

### **Acknowledgments**

This project was supported by a grant from the Agency for Healthcare Research and Quality (grant no. R18HS018464). The content is solely the responsibility of the authors and does not necessarily represent the official views of the Agency for Healthcare Research and Quality.

### **Contributions**

Study Design: PA, KA, GA.

Data Collection and Analysis: PA, KA, EM, TI, GA.

Manuscript Writing: PA, KA, EM, TI, GA.

## References

- Abrahamson KA, Arling PA, Arling GW. A state-sponsored approach to quality improvement in nursing homes: insights from providers. *Ann. Long-Term Care* 2013; 21: 2–6.
- Arling GW, Cooke V, Lewis T, Perkins A, Grabowski D, Abrahamson KA. Minnesota's provider-initiated approach yields care quality gains at participating nursing homes. *Health Aff.* 2013; 32: 1631–1638.
- Chan YE, Dekker AR, Ramsden DJ. Information systems and health care III: diffusing healthcare knowledge: a case study of the care delivery network. *Commun. Assoc. Inform. Syst.* 2005; 15: 225–241.
- Cooke V, Arling GW, Lewis T, Abrahamson KA, Mueller C, Edstrom L. Minnesota's nursing facility performance-based incentive payment program: an innovative model for promoting care quality. *Gerontologist* 2010; 50: 556–563.
- Cooperrider DL, Srivastva S. Appreciative inquiry in organizational life. *Res. Organ. Change Dev.* 1987; 1: 129–169.
- Creswell JW, Plano Clark VL. *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: Sage Publications, 2011.
- Cretin S, Shortell SM, Keeler EB. An evaluation of collaborative interventions to improve chronic illness care. *Eval. Rev.* 2004; 28: 28–51.
- Gould J. The role of regional collaboratives: the California Perinatal Quality Care Collaborative model. *Clin. Perinatol.* 2010; 37: 71–86.
- Hicks L, O'malley A, Lieu T et al. Impact of health disparities collaboratives on racial/ethnic and insurance disparities in US community health centers. *Arch. Intern. Med.* 2010; 170: 279–286.
- Ibm Corp. *IBM SPSS Statistics for Windows (20.0 edn)*. Armonk, NY: IBM Corp, 2011.
- Jackson G, Powell A, Ordin D et al. Developing and sustaining quality improvement partnerships in the VA. *J. Gen. Intern. Med.* 2010; 25: 38–43.
- Kane RL, Arling G, Mueller C, Held R, Cooke V. A quality-based payment strategy for nursing home care in Minnesota. *Gerontologist* 2007; 47: 108–115.
- Katz D, Kahn RL. *The Social Psychology of Organizations*. New York: Wiley, 1978.
- Kilo CM. A framework for collaborative improvement: lessons from the institute for healthcare improvements breakthrough series. *Qual. Manag. Health Care* 1998; 6: 1–13.
- Lindenauer PK. Effects of quality improvement collaboratives. *Brit. Med. J.* 2008; 336: 1448–1449.
- Mdh. 2009. Minnesota NH Report Card Technical User Guide [Online]. [Cited 9 Sep 2013.] Available from URL: <http://nhreportcard.dhs.mn.gov/technicaluserguide.pdf>
- Mittman B. Creating the evidence base for quality improvement collaboratives. *Ann. Intern. Med.* 2004; 140: 897–901.
- Nembhard IM. Learning and improving in quality improvement collaboratives: which collaborative features do participants value most? *Health Serv. Res.* 2009; 44: 358–378.
- Ovretveit J. How to run an effective improvement collaborative. *Int. J. Health Care Qual. Assur.* 2002; 15: 192–196.
- Sas Institute. *SAS (9.3 edn)*. Cary, NC: SAS Institute, 2011.

Schouten LMT, Hulscher MEJL, Van Everdingen JJE, Huijsman R, Niessen LW, Grol RPTM. Short- and long-term effects of a quality improvement collaborative on diabetes management. *Implement. Sci. (Serial online)*. [Cited 1 Sept 2013.] Available from URL: <http://www.implementationscience.com/content/5/1/94/abstract>

Shah R, Goldstein SM, Unger BT, Henry TD. Explaining anomalous high performance in a health care supply chain. *Decis. Sci.* 2008; 39: 759–789.

Singer JD, Willett JB. *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. New York: Oxford University Press, 2003.

Versteeg MH, Laurant MG, Franx GC, Jacobs AJ, Wensing MJ. Factors associated with the impact of quality improvement collaboratives in mental healthcare: an exploratory study. *Implement. Sci. (Serial online)*. [Cited 9 Sept 2013.] Available from URL: <http://www.implementationscience.com/content/7/1/1>

Vos L, Dückers ML, Wagner C, Van Merode GG. Applying the quality improvement collaborative method to process redesign: a multiple case study. *Implement. Sci. (Serial online)*. [Cited 1 Sept 2013]. Available from URL: <http://www.implementationscience.com/content/5/1/19>

Werner RM, Konetzka RT, Polsky D. The effect of pay-for-performance in nursing homes: evidence from state Medicaid programs. *Health Serv. Res.* 2013; 48: 1393–1414

## Figures

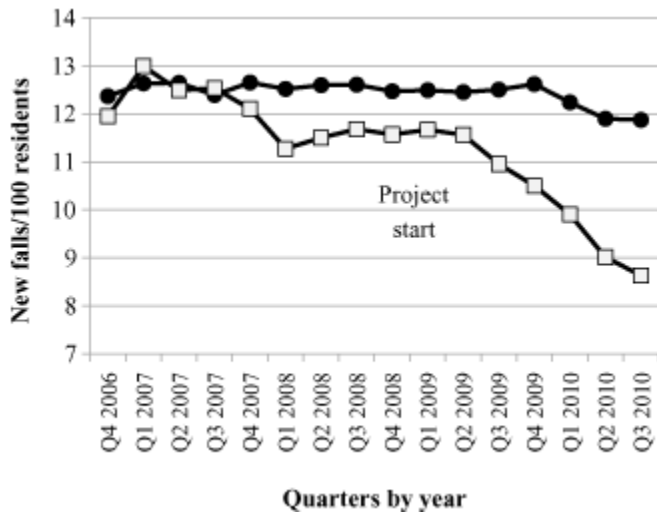


Figure 1. Mean facility rate of new falls for the Empira project (n = 15) and other nursing facilities (357). image, Other Minnesota facilities; image, Empira.

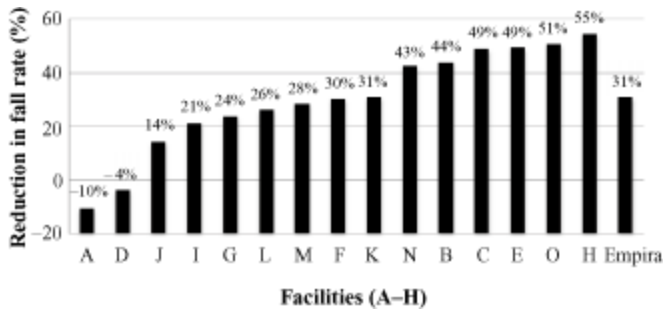


Figure 2. Empira facilities: percentage reduction in rate of new falls (2007–2010).

**Table 1. Survey and interview respondent characteristics**

<b>Characteristic</b>	<b>N</b>	<b>Frequency (%)</b>
Sex		
Male	5	17
Female	24	83
Age range (years)		
18–25	1	3
26–44	8	28
45–64	20	69
Education		
Some college	9	31
Bachelor's degree or equivalent	19	66
Master's degree or higher	1	3
Licenses and certificates		
Registered nurse	12	41
Recreational therapist	3	10
Other, including nursing home administrator, activity director, and social worker	14	48
Average years in current position	8.42	
Average years in facility	10.17	
Average years in long-term care	20.92	
Average years participating in collaborative	2.77	
Average no. collaborative meetings attended	9.22	