

Using Process Improvement Methodology to Address the Complex Issue of Falls in the Inpatient Setting

Deborah A. Christopher, MSN, RN, CPHQ;
Rebecca L. Trotta, PhD, RN; Margaret A. Yobo, MSN, RN;
Jocelyn Strong, MSN, RN, PCCN;
Phyllis Dubendorf, MSN, RN, CCNS, CNRN

Falls in the acute care hospital are a significant patient safety issue. The purpose of this article was to describe the use of process improvement methodology to address inpatient falls on 5 units. This initiative focused on a proactive approach to falls, identification of high-risk patients, and a complete assessment of patients at risk. During the project timeframe, the mean total fall rate decreased from 3.7 to 2.8 total falls per 1000 patient days. **Key words:** *fall prevention, fall rate, fall risk assessment, proactive rounding, process improvement, rounding*

FALLS in the acute care hospital setting are a significant patient safety issue. The Centers for Disease Control and Prevention reports falls as the leading cause of injury for adults 65 years or older.¹ Per the Centers for Disease Control and Prevention, 50% of adults 65 years or older who suffer a serious fall will die within 1 year of the event.

Author Affiliations: *Hospital of the University of Pennsylvania, Philadelphia (Ms Christopher, Yobo, and Dubendorf and Dr Trotta); and Clinical Solutions Group, Kronos Incorporated, Chelmsford, Massachusetts (Ms Strong).*

The authors declare no conflicts of interest.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.jncqjournal.com).

Correspondence: *Deborah A. Christopher, MSN, RN, CPHQ, Pennsylvania Hospital, 800 Spruce Street, Philadelphia, PA, 19107 (deborah.christopher@uphs.upenn.edu).*

Accepted for publication: January 1, 2014

Published ahead of print: February 4, 2014

DOI: 10.1097/NCQ.0000000000000053

204

The consequences of falling are substantial. Fractures and head trauma from a fall can lead to physical disability and negatively affect quality of life in terms of lost independence and confidence.² As the population ages, the number and cost of falls are expected to rise. In addition to the effects of falls on the patient, the annual total cost of fall-related injuries could increase to \$34.4 billion by the year 2020.³ This cost represents a significant and unnecessary burden for the US health care system. Concern for patient safety and high costs have led hospitals to prioritize the reduction of falls in the hospital setting, in particular falls with injury. Despite the critical nature of inpatient falls, hospitals are challenged to remediate this multifactorial issue.

BACKGROUND AND SIGNIFICANCE

Multiple external stakeholders influence hospitals to ensure that patient safety is a priority, especially with regard to falls. Since 2008, the Centers for Medicare & Medicaid Services no longer reimburses hospitals for

costs associated with preventable injuries due to falls.⁴ In addition, The Joint Commission has mandated that hospitals implement and evaluate a fall reduction program.⁵

The National Database of Nursing Quality Indicators (NDNQI) provides comparative nursing-related data from more than 1800 hospitals and includes falls on inpatient nursing units as a key nursing-sensitive indicator.⁶ As a nursing-sensitive indicator, falls are considered an outcome measure for the quality of nursing care. It is widely recognized that inpatient falls are multifactorial in nature and require interprofessional intervention.⁷ Acute care hospitals need to acknowledge stakeholder concerns and influences to assess fall prevention programs to further ensure patient safety.

The majority of the research on inpatient falls is conducted by nurses,⁸⁻¹⁰ and efforts to prevent falls in hospitals are often led by nurses. Nurses in inpatient settings typically use evidence-based fall risk screening instruments to determine a patient's relative potential to a fall during a hospital stay. On the basis of risk screen scores, nurses collaborate with various interprofessional team members, such as physical or occupational therapists, to ensure that appropriate interventions are in place to reduce the patient's risk of a fall. A plethora of literature exists around both risk screening and fall prevention interventions.^{11,12} Despite the wealth of knowledge available, nurses remain challenged in their efforts to systematically reduce inpatient falls.

The complexity of the acute care environment, coupled with the multifactorial nature of falls, undoubtedly intensify nurses' struggle with regard to fall prevention. Often attempts at process improvement are unable to produce a sustained reduction in falls. A potential opportunity is to use a novel process improvement methodology in the approach of this issue. In September 2011, the Hospital of the University of Pennsylvania (HUP) launched an initiative to assess the current fall prevention process and establish a sustainable and reliable fall prevention program. This ar-

ticle describes an interprofessional approach to process improvement. A team collaborated using DMAIC (Define, Measure, Analyze, Improve, and Control) methodology to create innovative, targeted solutions and influence change.¹³

Setting and description of problem

This project took place at the HUP, an 814-bed urban academic medical center located in Philadelphia, Pennsylvania. The HUP is part of the Penn Medicine system, which comprises 3 hospitals, several outpatient care centers, home care and hospice, and acute inpatient rehabilitation. Patients seeking care at the HUP include diverse and clinically complex populations, with a case-mix index of 2.3.¹⁴ The HUP has achieved Magnet designation in 2007 and redesignation in 2012. The organization is consistently among the top hospitals in *US News and World Report* annual Best Hospital rankings.¹⁵ As of 2013, more than 90% of the nurses at the HUP hold a minimum of a bachelor's degree in nursing. A clinical nurse specialist is employed on most inpatient units.

The HUP has a standard fall prevention program requiring all nurses to perform a risk screen on admission of a patient and thereafter daily and whenever there is a change in the patient's clinical condition. The fall risk screen is embedded within the electronic medical record. Other elements that are considered in the fall prevention program are associated with increased risk of falls, such as medications (antihypertensives, narcotics); symptoms (urgency, dizziness, and weakness); methods for toileting; impaired judgment; and risk of serious injury. There are mechanisms to alert medical staff of the patient's fall risk and interventions to prevent the occurrence of falls. Examples of the HUP's standard alert mechanisms include a fall risk sign to be placed outside the patient's room, orange patient identification band, orange nonslip socks for the patient to wear, and an orange band around the patient's chart. Interventions to prevent falls may include a combination of a bed and/or chair alarm, adaptive equipment such as a bedside commode or

walker, hourly rounding, and one-to-one monitoring by an ancillary staff member.

Despite the active presence of this fall prevention program, the HUP has not been able to achieve and maintain its target fall rate. Therefore, nursing leadership supported an initiative in which key stakeholders analyzed the problem and determined targeted interventions for sustained success. A nursing-led interprofessional team was assembled. The team assumed the title of the *HUP Falls Collaborative*, connoting that the initiative would be a collaborative effort related to discovery and process change. This project did not require approval from the institutional review board because it was a quality improvement initiative and therefore did not meet the criteria for human subject research.

DMAIC is a well-established methodology for process and quality improvement and is used in a variety of industries, including health care. Specifically, the application of DMAIC as a process improvement strategy aims to optimize quality outputs and decreases variation in processes. It is not typically used by nurses to address patient-centered problems. Therefore, this methodology represents a novel approach to addressing the complex issue of falls in the acute care inpatient setting. The initiative was led by the HUP's Director of Nursing Quality, a registered nurse who is trained in Six Sigma. The participants included selected inpatient units with consistently elevated fall rates. Nursing representatives as well as other interprofessional clinical and nonclinical stakeholders made up the team.

Description of the units and participants

The Supplemental Digital Content Table (available at: <http://links.lww.com/JNCQ/A65>) contains a brief description of each unit and the interprofessional participants in this process improvement project. The staff on the selected units, Step-down and Surgical, care for patients who have undergone surgery at the HUP. Each unit has a specific patient population within the surgical category. The project included participants from each of

these units who regularly engage with patients in fall prevention.

All participants were essential to evaluating and revising the process. Team members either volunteered or accepted their nomination to be part of the team. Nurses (clinical nurse specialists, clinical nurses, nurse managers, and certified nursing assistants) were identified as the primary stakeholders and leaders for each unit. Therapists offered their expertise, as it related to functional status and fall prevention. Unit-based pharmacists were essential in evaluating medication-related falls using the Beers Criteria.¹⁶ Early in the project, the Collaborative realized that education and communication would be essential strategies for improvement; therefore, they solicited expertise from a professional development specialist, a master's prepared nurse who specializes in continuing education for nurses. The research analyst, a PhD-prepared nurse who compiles evidence-based reviews for Penn Medicine's Center for Evidence-based Practice, worked with the Collaborative during the project to comprehensively review the literature available. From the start, all members of the Collaborative demonstrated a shared need to assess and understand the problem of falls and fall-related injuries in the hospital setting.

METHODOLOGICAL APPROACH

The Director of Nursing Quality introduced the Collaborative to the DMAIC methodology. This methodology serves as a guide for completing a full cycle of process improvement. DMAIC was used by the Collaborative in a systems approach to defining and measuring the problem of falls at the HUP. Next, the Collaborative analyzed and interpreted the data to further develop a solution to address the identified problem. The Table delineates the phased approach, tools used, and notable deliverables of each phase.

Define

The "Define" phase of the methodology clarified the purpose and scope of the project and encouraged an in-depth understanding of

Table. Summary of the DMAIC^a Phases

Phase	Tools	Deliverables
<i>Define</i>	Team charter High-level process map Stakeholder analysis Measurable customer requirement	Team development Clearly defined goals Process scope; start and end points Customer requirements: via patient interviews
<i>Measure</i>	Detail process map Development of audit tool(s) Audit current process (retrospective and prospective)	Sample size Engagement of team through medical record review Realization of actual problem through in-depth review of charts
<i>Analyze</i>	Chart/graph information for ease of understanding Identify contributing factors contributing to falls in high-risk populations	Information for brainstorming of solutions Focus on actual problems to solve Develop pilot to mitigate risk factors
<i>Improve and Control</i>	Best practice review Develop pilot Use Plan-Do-Study-Act to implement/adjust	Successful pilot to mitigate fall risk in high-risk population

^aDefine, Measure, Analyze, Improve, and Control

“the problem.” The problem in this project was defined as follows: the rate of adult patient falls in the acute care setting is variable and frequently above targeted goals. Activities toward framing the purpose and scope of this project included team-building exercises with idea formation and brainstorming. This phase allowed the team members to create their name, the “HUP Falls Collaborative,” and further define each person’s role as a part of the interprofessional team. The Collaborative participated in multiple rounds of brainstorming to define the scope and identify the issues across the professions and the continuum of care. A high-level process map was completed to define the project’s scope.

Next, stakeholders were identified to ensure that there was appropriate membership on the team as it related to the scope. These stakeholders included clinical nurses, a nursing assistant, clinical nurse specialists, a nurse manager, a pharmacist, a professional development specialist, a physical therapist, and

providers. The nurse manager and the clinical nurse specialist of each of the participating units were asked to identify 2 or 3 key stakeholders to participate in this project. Having unit leaders identify their own stakeholders was important to ensure ownership and accountability throughout the project. In addition, optimal team size for process improvement projects is no more than 8, hence the request for a limited number of participants from each unit.¹⁷

An innovative approach was enacted in the “Define” phase via a team-developed interview tool. Pairs of Collaborative members interviewed patients who had fallen in the past week. This tool allowed the team to gain a comprehensive understanding of customer requirements and establish measures for these requirements. The Collaborative used a “customer mapping tool” to identify customer need in terms of the patient, not clinician need. Through “Define,” the Collaborative worked to foster the shared need and

further to develop a vision and goals for the team.

Measure

Application of the “Measure” phase of the methodology facilitated measurement of the current state with regard to falls on the participating units. This measurement was both retrospective and prospective. A selected group of Collaborative members retrospectively reviewed all incidences of falls in a 6-month timeframe. In addition, they paired the incidence data with historical post-fall assessment data collected by clinical nurses at the unit level. The post-fall assessment data included patient history of fall(s), days since last fall, time of admission to the nursing unit, medication regimen, patient intent at the time of the fall, and fall prevention interventions, prior to the fall. Team members associated with each nursing unit prospectively assessed patients on their unit using a universal risk reduction protocol checklist. They compared the documented level of risk and associated interventions from the electronic medical record to real-time observation and assessment of each patient. This allowed for a complete evaluation of compliance with the hospital fall risk reduction policy and staff competency with regard to fall risk screening and assessment.

Analyze

The “Analyze” phase included a review of all data collected in the “Measure” phase. The objective of the phase was to identify components of the problem with the highest risk, occurrence, and potential to result in injury. The Collaborative evaluated discrete data and searched for opportunities to reduce total fall rate on participating units. The results of the analysis included discovery of circumstances most often associated with a patient fall. Thirty-eight percent of the falls reviewed from the retrospective analysis were related to toileting. There were 2 challenges to the aforementioned conclusion. One, the data from the retrospective review were limited in specificity. For instance, the clinical nurse assess-

ment of “toileting” on the post-fall assessment tool did not specify whether the fall was accidental (slip or trip) or whether the patient had a physiological problem while toileting. Next, the prospective data collection was variable due to a recently implemented electronic documentation system. Specifically, the system allowed for multiple variations in documentation related to screening, assessment, and interventions. Consequently, the Collaborative learned that the measurement and analysis of the data were essential to the methodological process; however, it did not result in a rigorous solution to pilot. Further review of the data, process, and recent literature led the Collaborative to pursue a proactive approach to fall screening and assessment of patients.

Improve

In the “Improve” phase, instead of formulating a pilot plan based on most frequent reasons for falls, the team was able to step back and develop a process that addressed variation in practice regarding specific risks for falls. It was this standardized process of assessment, named “Proactive Rounding,” that enabled the team to plan for the unique risks of each patient. The Collaborative developed and used a Proactive Rounding tool, which initially guides the interprofessional team to collect information about the patient’s fall risk and universal precautions in place. Next, the Proactive Rounding tool cues the team to assess for the patient’s unique fall risks. Finally, the Proactive Rounding tool prompts the team to identify and implement new interventions for this patient to promote an individualized plan of care.

For the pilot, an interprofessional team consisting of a nurse leader, a pharmacist, a therapist, and a provider rounded on patients and engaged staff in a Proactive Rounding assessment. Pilot patients were selected in several ways: those who were scored as at high risk for falls on the screening process, geriatric patients (at risk, older than 85 years), and patients deemed as at high risk by a physical or occupational therapist. Proactive Rounding was performed at least

twice a week on the 5 participating units from August to December 2012, for a total of 185 patient assessments. Patients were scored for fall risk using the Morse Fall Scale, and current fall precautions in place were identified.¹⁸ Proactive Rounding included a team approach to a focused assessment of the patient. Furthermore, the team assessed comprehension of fall education by the patient and his or her family, environmental risks factors, and therapy needs, and reviewed prescribed medications. In addition, the interprofessional team reinforced safety education with the patient and his or her family. During these rounds, patient-specific interventions were recommended and the individualized plan of care was updated. These rounding processes enabled the team to consider the unique patient, predict the risk for the individual, and develop a plan using standard interventions, but in combinations that addressed the specific needs of each patient at risk for falling and fall-related injury.

This process facilitated a focus on interprofessional assessment to identify the patient's individual fall risks. For example, if patients reported that they had fallen in the last 3 months, the team would request more information by simply stating, "Tell me more about the fall you experienced." If they reported dizziness as a factor in the fall, the pharmacist would review the current medications for this specific side effect. Conversely, if patients reported that they tripped on a garden hose, their unit environment was de-cluttered, and a plan for maintenance was developed. The team had insight into ineffective current practice: a "standardized fall prevention program" does not facilitate creation of an individualized assessment and plan to address patient-specific needs. Specifically, standardized interventions such as the band, slippers, and sign would not prevent a fall. The team concluded that a standardized fall prevention program is not an intervention to meet specific needs of patients. The team aimed to minimize the focus on risk screen and emphasize the nursing assessment and interprofessional plan of care. Although the DMAIC process, as

outlined in the Table, appears linear, our experience involved redefining and studying the problem after initial analysis of the data and interventions were proposed. The Supplemental Digital Content Figure (available at: <http://links.lww.com/JNCQ/A66>) illustrates the iterative process used by the Collaborative.

Control

The "Control" phase is ongoing as the Collaborative members continue to monitor falls on their respective units. A leader from each unit initiates Proactive Rounding with the interprofessional team for high-risk patients. These unit leaders have partnered with other inpatient units to develop an implementation plan for Proactive Rounding to support the diffusion of this initiative across the organization. The Collaborative reviews its total fall rate and fall-related injury rate data monthly. Quarterly comparisons are completed to gauge performance against the NDNQI benchmarks.

RESULTS

The original goal for the HUP fall prevention project was to reduce the total fall rate for each unit to 10% for fiscal year 2013. The standard formula for calculating *total fall rate* presented by NDNQI is the number of falls multiplied by 1000, divided by the number of patient-days. The long-term goal was to outperform the mean total fall rate in the NDNQI academic medical center peer group. From fiscal years 2012 to 2013, the combined participating units' total fall rate decreased by 27% (from 3.84 total falls per 1000 patient-days to 2.82 total falls per 1000 patient-days).

Statistical process control using *X-moving range charts* was generated for fall rate over a 24-month period for the 5 participating inpatient units. Furthermore, X-moving range charts were generated separately for the combined Step-down units and combined Surgical units. *C* statistics were calculated to identify significant trends in each time-series data.¹⁹ *C* statistics are independent of the autocorrelation in the data series and are

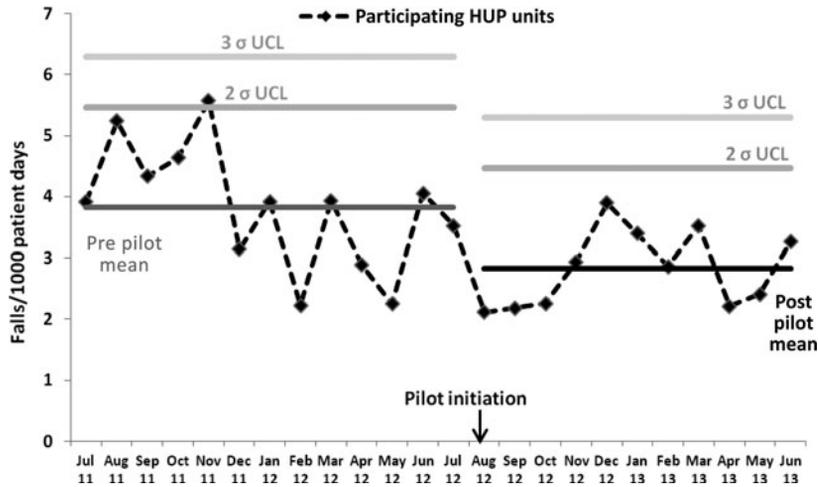


Figure 1. Total fall rate for participating HUP units. Control chart showing monthly “falls per 1000 patient-days,” mean “falls per 1000 patient-days,” and 2 and 3 standard errors (95% and 99.7%) UCL for combined 5 participating HUP units for 24 months. HUP indicates Hospital of the University of Pennsylvania; UCL, upper control limits.

appropriate when at least 8 measurement points are available. Figure 1 demonstrates the X-moving range chart for the fall rate for the 5 participating units combined. Figures 2 and 3 show the X-moving range charts for the

combined Step-down and combined Surgical units, respectively.

The charts highlight several key findings. As shown in Figure 1, for the 5 participating units combined, a statistically significant trend

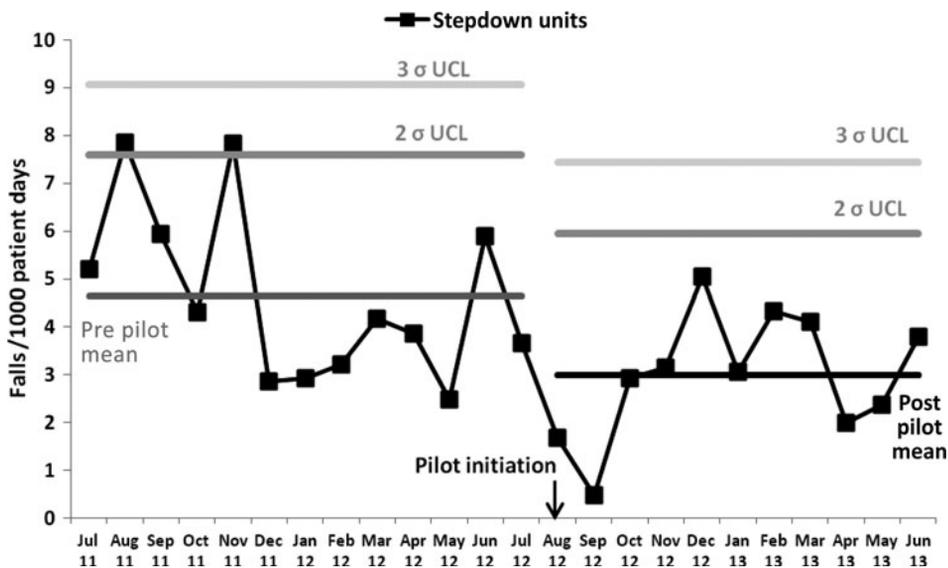


Figure 2. Total fall rate for Step-down units. Control chart showing monthly “falls per 1000 patient-days,” mean “falls per 1000 patient-days,” and 2 and 3 standard errors (95% and 99.7%) UCL for the Step-down units for 24 months. UCL indicates upper control limits.

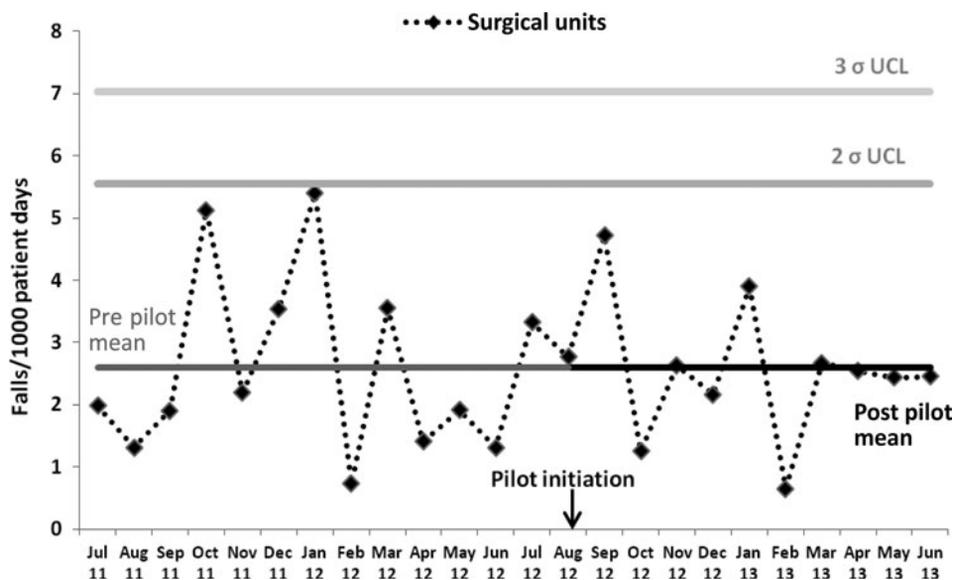


Figure 3. Total fall rate for Surgical units. Control chart showing monthly “falls per 1000 patient-days,” mean “falls per 1000 patient-days,” and 2 and 3 Standard Errors (95% and 99.7%) UCL for the Surgical units for 24 months. UCL indicates upper control limits.

($P < .05$) toward reduction in falls was noted following the implementation of the Proactive Rounding pilot. The trend in reduced fall rate was qualified by a reduction in mean falls from the pre- to post-pilot periods (from 3.84 total falls per 1000 patient-days to 2.82 total falls per 1000 patient-days). The fall rate from the combined Step-down units also mirrored the overall trend. During the pre-DMAIC period, the *C* statistic did not identify any particular trends in the time-series data for the combined Step-down units. However, when the post-pilot data were combined to the pre-pilot data, the findings revealed a statistically significant ($P < .05$) trend toward reduced falls. This trend was accompanied by an overall reduction in mean total fall rate from the pre- to post-pilot periods.

As evident from Figure 2, overall variability in the fall rate was reduced in the Step-down units following implementation of the pilot. At baseline, 2 instances were noted in which performance fell outside the 95% upper control limit. In contrast, in the post-pilot period, the total fall rate was at or below the pre-pilot mean in all but one instance. When

compared with the post-pilot mean fall rate, 7 of the 11 months performed at or better than the new mean. Unlike the Step-down units, however, Surgical units when considered separately did not demonstrate any significant trends in reduced fall rates. Their mean fall rate remained virtually unchanged from the pre- to post-pilot periods (Figure 3). These findings demonstrate clearly that Proactive Rounding was useful in reducing falls specifically at the Step-down units and contributed primarily to the reduction in fall rates across all the participating units.

DISCUSSION

Use of DMAIC in a clinical health care setting

Traditionally, DMAIC methodology has been implemented in a business setting where reasons for variation are predictable. The overarching goal of DMAIC methodology is to standardize a process and eliminate the defects caused by variation. The DMAIC methodology facilitated the Collaborative’s learning

about the defects or inefficiencies of the HUP's current program for fall prevention. The Collaborative concluded that while a patient's relative risk of falling could be systematically predicted with confidence, timing and actual occurrence of the event were less predictable. Hence, one patient identified as at high risk for falling could make it through a hospitalization without falling whereas a patient who had been identified as at low risk for falling could sustain a fall. Similarly, Kim and colleagues⁸ rigorously examined the validity of 3 widely used fall risk assessment tools and found that while sensitivity and specificity are strong, the predictive value of the tools was poor. Kim et al. attribute this to the low number of patients who fell in the cohort of patients identified as "at risk." Patient characteristics and environmental hazards need to be evaluated on a case-by-case basis, a concept typically not consonant with process improvement methodologies. Using DMAIC methodology to standardize the process of fall prevention could be effective only if a *standardized intervention* had the latitude to capture the individual patient's unique characteristics with regard to fall risk. Proactive Rounding, a standardized process that allows for situational variance, was the intervention in this project.

Benefits of using the DMAIC process

Current literature identifies the need for multiple process improvement strategies to address the complex issue of fall prevention in the acute care setting.^{9,20} For this project, it was necessary to adapt the DMAIC methodology for use with a complex patient-centered problem. The DMAIC methodology facilitated development of Proactive Rounding as the pilot intervention. Although there was a marked decrease in fall rates on Step-down units with this intervention, the reductions likely also stemmed from the ancillary benefits of this quality improvement process, such as teamwork, awareness, and engagement. The incidence of these ancillary effects is not routinely addressed in process improvement methodology, given the goal of complete standard-

ization in dynamic environments. The acute care units that were part of this project are rarely static. New care processes and initiatives, personnel changes, and patient concerns are ever-changing. Accounting for and collecting data on all the potential changes over the course of the project would have been extremely challenging and were also beyond the scope of the project. Yet, in addressing a complex patient-centered problem such as falls in the acute care setting, the Collaborative acknowledged these effects within the confines of DMAIC.

Throughout this process, our Collaborative of experts worked through team-building exercises as we used the DMAIC tools to develop a greater understanding of the fall prevention process. Through collaboration, we recognized the need to move from a primary focus on *screening* for a patient's fall risk to a comprehensive interprofessional *assessment* of the patients who were at a high risk for falls and their surrounding environments. Feil and Gardner²¹ have explicated the importance of screening followed by comprehensive assessment, noting that one or the other will fall short in effectively preventing falls. The HUP Falls Collaborative found that moving from a standardized universal fall risk reduction protocol to a standardized process of assessment that could focus on the individual risks of each patient was most successful in prevention of inpatient falls.^{22,23} Our journey through the DMAIC process also created a heightened awareness of falls that allowed leaders on each pilot unit to engage clinical nurses in the process. This unit-level engagement allowed the clinical nurses to embrace the Proactive Rounding process as an ongoing critical thinking process of assessment and reassessment, instead of "just another risk screening task" to complete during their shift.²⁴

Challenges/limitations of using the DMAIC process

While using the DMAIC methodology provided an in-depth learning experience, there

were challenges along the way. Initially, we had to identify appropriate executive-level sponsorship and resources for our team. With the Director of Nursing Quality leading our team, we were challenged to pinpoint pertinent stakeholders outside of nursing to gather the most effective interprofessional team membership, which included partnering with providers, physical therapy, pharmacy, ancillary staff, nursing management, clinical nurse specialists, and clinical nurses.

Heightened awareness and engagement are key to success for a fall prevention program. However, it is difficult to maintain longevity of these strategies. The team remains challenged to identify a sustainable process to prevent falls. The Collaborative created a communication plan that will be carried out biannually to support continued awareness of the fall

prevention program at the unit and system levels.

CONCLUSION

The risk of falling for an individual patient over the course of acute inpatient hospitalization is not directly comparable with typical process improvement efforts, such as a widget assembly in a manufacturing plant. This project demonstrated that with some adaptation, the DMAIC process improvement strategy could be successfully applied to a complex patient-centered problem. Additional studies using process improvement methodology and alternative approaches to such complex problems are needed to further understand the multifactorial challenges faced in the acute care setting and across the continuum.

REFERENCES

- Centers for Disease Control and Prevention. Fall among older adults: an overview. CDC.gov Web site. <http://www.cdc.gov/homeandrecreationalafety/falls/adultfalls.html>. Accessed November 17, 2013.
- Rosedale M. Catching falls: a synthesis of recent research. *Caring*. 2001;20(1):14-19.
- Bonuel N, Manjosa A, Lockett L, Gray-Becknell T. Best practice fall prevention strategies. *CATCH! Crit Care Nurs Q*. 2011;34(2):154-158.
- Centers for Medicare & Medicaid Services. Hospital acquired conditions (present on admission indicator). CMS.gov Web site. <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Hospital-Acquired-Conditions.html>. Accessed May 14, 2013.
- The Joint Commission. Helping patients stand tall: a primer on fall prevention in health care. *Jt Comm Perspect*. 2009;9(9):1-5.
- National Database of Nursing Quality Indicators. Main page. NDNQI Web site. <http://www.nursingquality.org>. Accessed March 25, 2013.
- Oliver D, Healey F, Haines TP. Preventing falls and fall-related injuries in hospitals. *Clin Geriatr Med*. 2010;26(4):645-692.
- Kim EAN, Mordiffi SZ, Bee WH, Devi K, Evans D. Evaluation of three fall-risk assessment tools in the acute care setting. *J Adv Nurs*. 2007;60(4):427-435.
- Kalisch BJ, Tschannen D, Lee KH. Missed nursing care, staffing, and patient falls. *J Nurs Care Qual*. 2012;27(1):6-12.
- Schwendimann R, Buhler HM, DeGeest S, Milisen K. Falls and consequent injuries in hospitalized patients: effects of an interdisciplinary falls prevention program. *BMC Health Serv Res*. 2006;6:69.
- Oliver D, Hopper A, Seed P. Do hospital fall prevention programs work? A systematic review. *J Am Geriatr Soc*. 2000;48(12):1679-1689.
- 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.
- Pande PS, Neuman RP, Cavanagh RR. *The Six Sigma Way Team Fieldbook: An Implementation Guide for Process Improvement Teams*. New York, NY: McGraw-Hill; 2005.
- Centers for Medicare & Medicaid Services. Acute inpatient PPS. CMS.gov Web site. <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Acute-Inpatient-Files-for-Download-Items/CMS1247873.html>. Accessed March 25, 2013.
- US News and World Report. Best Hospitals 2013-14. Overview and Honor Roll. US News and World Report Web site. <http://health.usnews.com/health-news/best-hospitals/articles/2013/07/16/best-hospitals-2013-14-overview-and-honor-roll>. Accessed November 17, 2013.
- American Geriatrics Society 2012 Beers Criteria Update Expert Panel. American Geriatrics Society updated Beers Criteria for potentially inappropriate

- medication use in older adults. *J Am Geriatr Soc*. 2012;60(4):616-631.
17. Kurnick R. Process improvement teams Power Six Sigma success. iSix Sigma Web site. <http://www.isixsigma.com/implementation/teams/process-improvement-teams-power-six-sigma-success>. Accessed November 17, 2013.
 18. Morse JM. *Preventing Patient Falls: Establishing a Fall Intervention Program*. 2nd ed. New York, NY: Springer Publishing Co; 2009.
 19. Portney LG, Watkins MP. *Foundations of Clinical Research: Applications to Practice*. Upper Saddle River, NJ: Pearson Education Inc; 2009.
 20. Ang E, Mordiffi SZ, Wong WB. Evaluating the use of a targeted multiple intervention strategy in reducing patient falls in an acute care hospital: a randomized controlled trial. *J Adv Nurs*. 2011;67(9):1984-1992.
 21. Feil M, Gardner LA. Fall risk assessment: a foundational element of falls prevention programs. *Pa Patient Saf Advis*. 2012;9(3):73-81.
 22. Miake-Lye IM, Hempel S, Ganz DA, Shekelle PG. Inpatient fall prevention programs as a patient safety strategy: a systematic review. *Ann Intern Med*. 2013;158(5, pt 2):390-396.
 23. Dykes PC, Carroll DL, Hurley A, et al. Fall prevention in acute care hospitals: a randomized trial. *JAMA*. 2010;304(17):1912-1918.
 24. Odell E. Teaching quality improvement to the next generation of nurses: what nurse managers can do to help. *J Nurs Adm*. 2011;41(12):553-557.