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Increasing Referrals to a Community Paramedicine Fall Prevention Program Through Implementation of a Daily Management System

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ABSTRACT

This quality improvement project was undertaken to improve trauma service referral compliance to an existing home-based elderly fall prevention program through the implementation of a daily management system (DMS). Operational excellence, a hospital-wide initiative, provided the foundation for improvement efforts. This initiative went through a series of 5 plan, do, study, and act (PDSA) cycles and demonstrated significant improvement in referrals from 0% to 100%. Compliance with referrals after the retirement of the key performance indicator remained high at 95.5%. Results from this project provided support for the framework set forth in DMS and PDSA improvement methodologies as a feasible option to implement quality and process improvement projects. Further study in this area is warranted.

Key Words

Community paramedic, Daily management system, Elderly fall prevention, Operational excellence, Quality improvement

Falls among community-dwelling older adults are a major public health concern in the United States (Alamgir, Muazzam, & Nasrullah, 2012) and are a leading cause of morbidity and mortality for older adults than 65 years (Centers for Disease Control and Prevention [CDC], 2012). One third of older adults than 65 years fall each year (Chen et al., 2008). In 2013, U.S. emergency departments (EDs) treated 2.5 million nonfatal elderly falls (CDC, 2015), resulting in 734,000 hospital admissions and nearly $30 billion in direct medical costs (CDC, 2015). Consequences of falls are significant, risking older adults' declining health status, social isolation, loss of confidence, and fear of falling again (Boele van Hensbroek et al., 2009). Falls are known risk factors for future falls and injury risk (Gillespie et al., 2012). Falls can be prevented by adopting evidence-based fall-prevention guidelines, as well as implementing home safety evaluations and community-based fall prevention interventions (Gates, Fisher, Cooke, Carter, & Lamb, 2008; Gillespie et al., 2012; Guse et al., 2015; Logan et al., 2010; McClure et al., 2005). Even with these strategies in place, implementation in clinical and community settings has been limited (Jones, Ghosh, Horn, Smith, & Vogt, 2011; Shubert, Smith, Prizer, & Ory, 2013). Older adults who have experienced a fall and have been injured were seen in the ED and were admitted to the hospital rarely received a formal fall risk assessment at the time of injury. Furthermore, even fewer are referred to fall prevention programs.

Although much has been written about prevention strategies, no clear consensus exists as to what exactly constitutes best practice. In-home assessment programs may help decrease fall-related injury, and professional groups such as community paramedics are available to help (Gates et al., 2008; Logan et al., 2010). In the state of Maine, lawmakers passed legislation in 2013, enabling the formation of the Community Paramedic Fall Prevention Pilot Program (CPFP^3). Maine Medical Center (MMC) and Northeast Ambulance developed a partnership that included development of a referral process aimed at identifying appropriate patients during their hospital stay and facilitated their referral to the CPFP^3 upon discharge. The purpose of the CPFP^3 is to provide care at home to patients within the community who may not qualify for home health care visits or who have been discharged from a hospital but still require help that may include vital sign checks, wound care or to monitor prescription use, or guidance on how to prevent injury within their own home. We believe that the referral process to the CPFP^3 directly from hospitals can be achieved by implementing lean methodologies that include a daily management system (DMS).

Implementing sustainable change in health care can be challenging; therefore, MMC has designed and applied an

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Operational Excellence (OpEx) program (Peck, Fredrick, Radloff, Nayak, & Leonard, 2015). This program utilizes a DMS that includes several strategies to achieve improvement such as daily huddles, daily management boards, standardized daily disciplines for leaders, and daily Gemba walks (Edelman, Hamaekers, Buhre, & van Merode, 2017; Wheeler, Tofani, & Morris, 2016). This has been implemented in order to support the sustainability of quality improvement (QI). This particular structured approach encourages staff to use methodologies with which they are comfortable to supplement an improvement initiative; thus, OpEx does not conflict with other common methods of structured QI. The philosophy of OpEx suggests that, over time, combined emphasis on engagement and empowerment leads to a culture of continuous QI and professional accountability. Daily management system is a major component of the OpEx process, which involves engaging and inspiring staff and leaders to collaborate on the work that supports setting daily expectations for leaders, managers, and staff (Donnelly, 2014). These expectations accompany standard work documents that allow participants to understand their role in the process. Daily management system provides a visual display that clearly indicates when expected tasks are incomplete, outstanding, or delayed (Donnelly, 2014).

While leaders collect and review data in a daily huddle, units or teams collect daily data on issues deemed to be high priority within their sphere of control. Issues that are recognized are then labeled as key performance indicators (KPIs). Each unit within the hospital has participated in a 3-day training workshop where they learn how to use the boards in order to facilitate data collection and pick measurable KPIs. The implemented KPI boards allow for daily tracking of KPIs by the staff, and once the staff has selected a KPI, they assign a category designation of safety, quality, experience, finance, or growth. Before this implementation of KPI boards, the KPIs were often internally focused, allowing units or teams to reflect on how they can improve their work in a meaningful way. With the OpEx program put into action, a senior hospital administrator leads a team of five to seven members on a daily Gemba walk along a predetermined route, visiting every department within the hospital. These walks keep leaders aware of important issues for frontline personnel, and they also create an opportunity for staff to engage and bring awareness of barriers that are beyond their control to leaders (Barve & Kruer, 2018). In addition, the Gemba walks include reviewing and discussing each unit's KPI boards. The implementation of the DMS, OpEx, and KPI boards has led to increased and improved QI.

Using the DMS, OpEx, and KPI structure in trauma service, we hypothesize that through implementation there will be an increase in trauma service referrals to the CPFP[3].

PURPOSE

The aim of this project was to introduce the DMS as a new framework to approach QI in order to increase referrals to an existing home-based fall-prevention program.

RESEARCH QUESTIONS

Following three questions guided the project:

1. Does implementation of a DMS lead to an increase in trauma service referrals to the CPFP[3]?
2. Does changing the referral process from patient-initiated visit scheduling to community paramedic-initiated visit scheduling increase home visits?
3. What is the perception of staff regarding the DMS?

METHODS

Context

Maine Medical Center undertook the project: a 637-bed tertiary care teaching hospital located in Portland, ME. The ED treats approximately 65,000 patients annually, admitting 2,200 patients to the trauma service. Of this group, approximately 40% have experienced a fall. Maine Medical Center is an American College of Surgeons verified Level 1 Trauma Center and is currently the state's only surgical residency. The trauma team comprises 34 members ranging from the medical director and other surgeons to advance practice professionals (nurse practitioners and physician assistants), residents, nurses, case managers, and other support personnel.

Interventions

In August 2015, the trauma program leadership joined the OpEx program and expanded the program to include all members of the team and not just to the nursing unit activities. The team decided that their first KPI would be that 100% of eligible patients discharged from the trauma service would receive a referral to the CPFP[3] upon discharge. The team implemented a series of plan, do, study, and act (PDSA) cycles, until a 90% success rate was achieved and sustained for at least 2 weeks. These thresholds were monitored using KPI boards for data collection and later analysis. Data from the boards, including run and Pareto charts, were compared to data from the trauma registry to verify compliance with the referral protocol. Automated reporting mechanisms were created by shared electronic health record analysts to identify discharged patients who had previously been admitted to the trauma service after having experienced a fall and thus were eligible for consideration in the CPFP[3].

Study of the Interventions

This QI project used a mixed methods approach. Throughout the duration of the 4-month project, values

TABLE 1 Clinical Roles of the Survey Respondents ($N = 34$)

Professional Roles	*n*	%
Attending surgeon	9	26.5
Resident physician	4	11.8
Advanced practice provider	9	26.5
Trauma program staff	4	11.8
Care manager/social worker	2	5.9
Clinical nurse leader	2	5.9
Administrator	4	11.8

accrued, correlating with eligibility data from the trauma registry. Data included patient demographics, the number of eligible patients, postdischarge contacts (patient initiated as well as staff initiated), scheduled visits, and visit refusals/cancellations, and progress were tracked through PDSA cycles. All trauma-related staff completed a survey to assess their experience with OpEx incorporation into the daily culture of the trauma service as a whole and for future QI initiatives (Table 1). Furthermore, the survey addressed their perceptions of DMS, OpEx, and KPIs in the trauma-related CPFP[3] referral process. Survey questions and responses were presented as both a Likert scale and as free text.

Data Collection and Analysis

Each patient discharged from the trauma service was evaluated in accordance with the inclusion criteria for the CPFP[3]. Clinicians were reminded of the pilot program daily in the form of KPI board preparation (filling out metrics, living Pareto chart, and run chart), and team members presenting results to senior leaders. The clinical team reviewed patient records and recorded cumulative tallies. The primary QI project leader validated the data weekly. Staff met regularly to discuss challenges, opportunities, and strategies to advance the project in accordance with the standards of PDSA cycle proceedings.

Data collected from the staff survey were entered into a Microsoft Excel (Microsoft Corp., Redmond, WA) spreadsheet and analyzed using IBM SPSS Statistics v. 22.0 (IBM Inc., Armonk, NY). Descriptive statistics and frequencies were used to summarize data and describe characteristics of study participants. Continuous variables were examined for normality using histograms and normal quantile–quantile plots. Significant skew did not emerge; therefore, data transformations were not required. Univariate correlation analyses revealed relationships between participant work experiences, experience using OpEx, comfort with OpEx tools and processes, and intent to use OpEx in the future. Ordinary least squares regression analysis was used to test whether experience, comfort, and years of posttraining significantly predicted participants' intention to continue the use of OpEx. Homoscedasticity, linearity, and independence assumptions were examined using residual analyses and assessment of influence diagnostics. Multicollinearity was appraised using variance inflation factors, which were below recommended cutoff points. Significance was set at $p < .05$.

Qualitative comments that were provided from the free-text option within the survey were assessed manually for common categories including unanticipated benefits of OpEx, barriers, and facilitators of OpEx implementation. Participant comments were organized using these main categories and then summarized.

Ethical Considerations

The institutional review boards of MMC and the University of Southern Maine approved this project. All data were maintained on a password-protected secure network. Paper copies were stored in a secure cabinet in a locked office without public access.

RESULTS

Over a 4-month period, the QI project employed four PDSA cycles; the fifth time period monitored was the post-DMS monitoring period. Figure 1 shows the summarized results.

Pre-PDSA Period

The pre-PDSA period included the time from CPFP[3] inception through the start of the QI project. During this period, the trauma team did not initiate any referrals to the CPFP[3]. The team identified 1,137 trauma registry patients as appropriate for referral; however, they excluded 935 patients because their postdischarge residencies were outside the program's geographic boundaries. No remaining 202 eligible patients were referred.

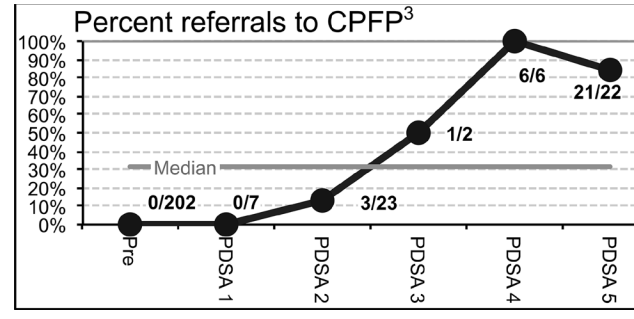

Figure 1. Summary of the PDSA cycle results and the percentage of referrals to the CPFP[3] during each individual cycle. CPFP[3] = Community Paramedic Fall Prevention Pilot Program; PDSA = plan, do, study, and act.

PDSA-1

During the first PDSA cycle, which lasted 3 weeks, the team convened a work group with participants representing all trauma service professional disciplines. This group established a consistent methodology to refer patients to the CPFP[3]. They mapped critical components of the referral process and decided to employ the OpEx process, specifically KPI boards, as part of the DMS, to highlight and reinforce daily compliance. The team also collaborated to identify patients eligible for referral and provide them a standardized set of after-visit instructions upon discharge by adding a SmartPhrase to the educational section of the after-visit summary (AVS).

SmartPhrase is a feature of the shared electronic medical record system that allows users to create a standardized documentation template that can be accessed easily during future episodes of care. SmartPhrases can be centrally edited and shared across provider groups, making them ideal for this type of initiative. The SmartPhrase provided patients all the necessary information for self-referral to the CPFP[3]. During this period, seven patients met the criteria for referral; however, despite all seven having had instructions for self-referral outlined clearly in their AVS, none contacted the dispatch center. Therefore, no referrals occurred during PDSA-1.

PDSA-2

During PDSA-2, which lasted 5 weeks, team members continued the work of the previous phase, including the use of KPI boards as part of the DMS, achieving a 13% referral rate. The team extensively debated a patient's ability to follow through on self-referral recommendations, noting that no patient had used the established self-referral process during the previous PDSA cycle and wondered if the lengthy nature of the AVS document was a barrier. Highlighting this information, alongside other provider-based referral information in the "Clinical Follow-Up" section, helped address this problem.

In addition, the team created a shared referral list, allowing clinical staff to place patients on a list (referred to as "the falls work queue") and to call them after discharge to remind them of their opportunity to schedule CPFP[3] appointments. A laminated, step-by-step instructional pocket card reminded staff of the referral criteria, the SmartPhrase to be employed, and the instructions for adding patients to the referral list. The project leader and champions from the nurse practitioner/physician assistant group offered just-in-time training during daily team huddles for anyone needing assistance with the amended processes. During this period, 23 patients were deemed eligible for referral and three were referred. Compliance in placing eligible patient in the falls work queue was less than 25%.

PDSA-3

During the 10 days of PDSA-3, the team discussed opportunities for further refinement. They decided to continue the work of the previous cycle and added an electronic "sticky note" to the medical record as a visual reminder to complete the referral process. Staff could electronically check a box on the note that all aspects of the referral were completed. During this period, the team continued to publicly report project progress each day. In this phase, two patients were eligible for referral with one referral occurring (50%).

PDSA-4

During the 4 days of PDSA-4, the team referred 100% of eligible patients ($n = 6$). This phase focused on optimizing an electronic solution to update the referral work queue. In consultation with information technology specialists, they learned that by documenting the patient mechanism of injury using the existing *International Classification of Diseases, Tenth Revision* coding available in the history-of-present-illness section of the medical record they could run and automatically e-mail a daily report identifying patients who fit the referral criteria to the team each morning. During this phase, the team also modified the trauma-admission-note template to include mechanism of injury as a required field.

PDSA-5

During the final cycle (post-DMS period), which lasted 2 months, the metric was retired from the KPI board and therefore no longer publicly reported on a daily basis; however, referral rates were sustained at 95.5%. The team continued the process implemented in PDSA-4, and the project leader monitored compliance. During this period, 22 patients met eligibility criteria and 21 were referred.

Patient Demographics

Table 2 depicts the general characteristics of patients encountered during this QI initiative. In general, the age distribution and gender identification characteristics were consistent across groups. The majority of patients encountered (98.9%) were White, and 63.1% of injured participants with a history of falls were admitted to trauma services. The other 36.9% of patients who fell were admitted to adult medicine, neurosurgery, critical care, and orthopedics.

Provider Survey

Of trauma team members, 34 (91.9%) responded to the provider survey. Table 1 provides a summary of respondents' roles. When asked how familiar they were with QI methodologies prior to OpEx initiation, 17 of 37 survey participants (50%) reported they were either moderately or extremely familiar. Participant comfort levels with the individual OpEx components varied. Table 3 depicts

TABLE 2 Summary of Patient Demographics

Characteristic	All Participants With a History of Falls (*n* = 1,349)		Eligible (*n* = 262)		Referred (*n* = 31)	
	n	%	*n*	%	*n*	%
Age						
Mean	79.9		78.9		83.0	
SD	8.6		8.9		9.4	
Range	65–104		65–98		66–97	
Age by decade						
65–69	205	15.2	52	19.8	4.0	12.9
70–79	427	31.7	82	31.3	7.0	22.6
80–89	513	38.0	94	35.9	12.0	38.7
90–99	199	14.8	34	13.0	8.0	25.8
100+	5.0	0.4	0	0.0	0.0	0.0
Gender						
Male	565	41.9	126	48.1	10.0	32.3
Female	784	58.1	136	51.9	2.0	67.7
Race						
White	1,334	98.9	256	97.7	31.0	100
Other	15.0	1.1	6.0	2.3	0.0	0.0
Admitted service						
Trauma	851	63.1	262	100	31.0	100
Other	498	36.9	0.0	0.0	0.0	0.0

respondents' comfort with critical aspects of KPI and DMS processes. Data were dichotomized, comparing those reporting discomfort versus comfort.

Of 34 survey participants, 33 (97.1%) reported believing that the OpEx program has been either "moderately" or "extremely important" in increasing referrals to the CPFP[3]. Additionally, 30 of 34 participants (88.2%) endorsed the DMS as "somewhat" or "very effective" at facilitating referrals to the CPFP[3]. Of respondents, 77% (26 of 34) reported they would be "likely" or "extremely likely" to use the OpEx process to achieve QI goals in the future.

Upon further survey data review, two questions emerged:

1. Was there a relationship between experience and comfort levels with roles in the OpEx process?
2. Was there a relationship between experience, years of posttraining, comfort level with roles, and the potential to use the OpEx process in the future?

Nine potential experiences that respondents could have in the OpEx process shed light on these questions. A scale that summed all nine scores created a measure of experience. Figure 2 shows the percentage of participants who took part in each experience. The scale ranged from 0 (one participant; 2.9%) to 9 (two participants; 5.9%), with a mean of 3.5. The survey assessed comfort level by summing the seven comfort questions, each ranging from very comfortable (4) to very uncomfortable (0). The summed scale ranged from 6 to 28, with a mean of 19.4. The means for each of the OpEx role comfort questions appear in Figure 3.

The first analysis measured the correlation between levels of OpEx experience and comfort, yielding a significant and positive relationship, $r(34) = .523$, $p = .01$. This could mean that as the level of experience increased, so did the level of comfort. Further analysis examined whether participants would consider using this process in the future. A correlation examined the univariate relationship between future use and each of the three independent variables (OpEx, comfort and experience, and professional experience), which showed no significant bivariate relationships using Pearson's R calculation (sum experience = .191; sum comfort = .314; sum professional = .211).

An ordinary least squares regression model was used to test whether experience, comfort, and years of posttraining would be significant predictors when controlling for the other variables. In a test for multicollinearity,

TABLE 3 Participant Comfort Levels With OpEx Activities ($N = 34$)

OpEx component	"Very" or "Somewhat" Uncomfortable		"Very" or "Somewhat" Comfortable	
	n	%	*n*	%
Suggest a KPI	1	2.9	29	85.3
Present the KPI board	0	0.0	28	82.4
Collect KPI data	1	2.9	22	64.7
Complete Pareto chart	9	26.5	14	41.2
Complete run charts	9	26.5	14	41.2
Hardwire improvement for sustainability	6	17.6	15	44.1
Close a KPI	5	14.7	16	47.1

Note. KPI = key performance indicator; OpEx = Operational Excellence.

none of the variables demonstrated significance. A visual inspection of the *p*-plots for the residuals demonstrated no need for further investigation into heteroscedasticity issues. A histogram of the dependent variable demonstrated an acceptable distribution across scores, with a mean of 2.9 and a standard deviation of 0.99.

The model (constant value of 1.805; $n = 34$) was not a significant predictor of whether participants would use OpEx again, $F(3, 29), = 1.609$, $p = .209$. The R^2 indicated that the model accounted for 14% of the total variance in future use. Using ordinary least squares analysis, none of the predictors were significant. Although 76.5% of participants indicated they would use OpEx again, betas for sum experience (.032), sum comfort with the technique (.040), and years of posttraining (.017) did not predict future use.

Of survey participants, 56% wrote survey comments indicating that the OpEx program led to unanticipated benefits, including the opportunity to engage with administrators and leaders and build group cohesion around goals, the availability and acquisition of resources necessary to improve care delivery, and the expansion of programs due to successes achieved. Participants identified factors that enhanced their ability to implement OpEx: supportive resources such as human resources, change champions, space, and technology; the support of leadership and administrators; progress in clinically relevant and meaningful KPIs; development of common

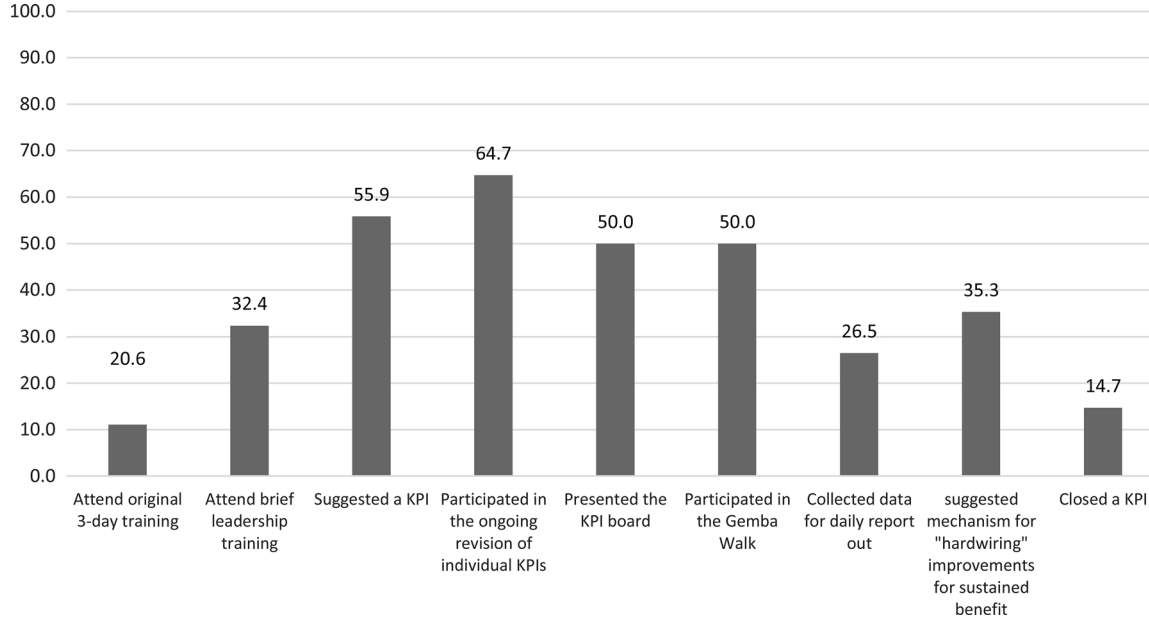

Figure 2. Percentage of participation in the different aspects of the OpEx module. KPI = key performance indicator. OpEx = Operational Excellence.

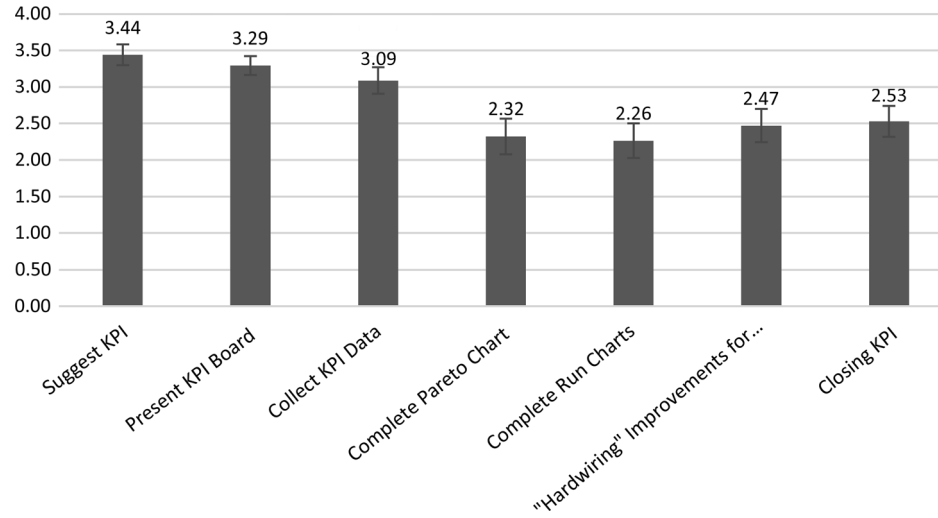

Figure 3. Quantification of the comfort levels depicting the different OpEx roles. Means were obtained and quantified from the results of the staff survey. KPI = key performance indicator. OpEx = Operational Excellence.

goals and a common language to discuss progress; and commitment from other team members. Participants also identified barriers: lack of engagement from surgeons and resident physicians, uncertainty regarding methods of data collection, lack of clarity in program communication, failure to identify formal project owners, and difficulty in choosing among potential KPIs.

DISCUSSION

A key concept of OpEx is to make small incremental changes interspersed with frequent reassessments to continually improve processes (Rother, Shook, Womack, & Jones, 2003). Operational management strategies require a continuous, long-term, methodical approach. Isolated victories and improvements fail to improve the system as a whole.

Participants put forth significant effort to improve the quality and efficiency of referral to CPFP[3], aiming to increase value in patient care through access to preventative services. The team was able to make meaningful advancement in referral compliance without adding excessive steps/tasks to the process by using existing reporting functionality in the shared electronic health record. With careful and dedicated execution, daily management methodologies offered promise in improving quality and efficiency, optimizing patient care, and providing greater access to preventative health services for patients. Despite the sparse health care-related research, the results of this QI project are consistent with those of others in which DMSs were used to improve quality (Barnas, 2011; Michael, Schaffer, Egan, Little, & Pritchard, 2013; Ulhassan, Schwarz, Westerlund, Sandahl, & Thor, 2015), further supporting use.

Quality improvement projects and/or intervention care in elderly patients with a fall have shown to be associated with higher indicators of function and mobility within the community (Lightbody, Watkins, Leathley, Sharma, & Lye, 2002). Furthermore, the elderly participants with a history of falls who visited the ED and did not receive any guidelines, intervention, or follow-up had not only higher risks of additional falls and fractures but there was an increased risk in depression and decreased confidence in balance as well (Salter et al., 2006). These findings show promise that with a focus on increasing QI and referrals to CPFP[3], which provide intervention strategies, the disposition of the fall-injured trauma patients will also increase.

CONCLUSION

The results of this project provide support favoring the use of the framework set forth in DMS and PDSA improvement methodologies as a feasible option to implement quality and process improvement projects. Lean techniques, including the team-oriented KPI board, provide an opportunity to enhance the success of QI projects of any kind. These tools, in combination with PDSA cycling and diligent follow-through, are critical to project success. That said, equally critical is a high level of staff engagement and empowerment to enable the change. Both concepts are central to the lean philosophy. Although the individual tools are important to initiate change, it is the overall culture and lean philosophy that will sustain results over time. Using these strategies, the trauma team was able to increase referrals to a CPFP[3] from 0% to almost 100%; this increase was sustained with a high degree of reliability.

The OpEx process provided the foundation and structure for the trauma team to achieve the common goal of increasing referrals to the CPFP[3]. Although comfort, experience, and potential engagement levels varied, the majority of respondents reported that the OpEx program was important in increasing referrals to the CPFP[3] and the majority agreed they would use the program in the future. Participants were able to engage with the program and make measurable improvements in patient-oriented improvement goals. Future efforts may include further development of the staff survey to better understand their experiences, as well as their satisfaction in using DMS in other QI endeavors. Because the OpEx process is one of constant evolution, the team has had an opportunity to use the methodologies introduced during this project to pursue several other clinical and administrative challenges. Some challenges addressed included increasing compliance with established clinical pathways and protocols; increasing compliance with verification metrics such as alcohol screening, brief intervention, and referral to treatment; and daily monitoring of trauma QI program-eligible reporting metrics. Since project completion, the team has used this methodology to successfully complete 19 additional QI projects.

LIMITATIONS

The QI project had several limitations: a small sample size for the referral group and survey participants, use of a convenience sample, and lack of validity testing of the survey instrument. This QI project offered only a baseline in supporting the strategies implemented during the pilot, resulting in meaningful improvement in consistency of referrals to the CPFP[3]. Future replication and a rigorous evaluation methodology will provide increased support for the use of visual management systems in implementing future process improvement efforts.

The small sample did not allow for the data to be adjusted for potential confounding variables. This creates difficulty discerning an exclusive attribution for the positive results. With that said, the initial findings from this project support the use of a visual management system as an implementation tool for QI initiatives in a trauma service.

KEY POINTS

- Daily management systems offer a unique opportunity to implement and advance QI initiatives.
- Plan, do, study, and act cycling can lead to high levels of success in grassroots QI projects.
- Leadership engagement in QI efforts can empower and engage frontline staff.

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