Multilevel Quality Improvement Teams: An Alternative Approach for Surgical Academic Training Programs to Meet ACGME Core Competency Milestones

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BACKGROUND: Quality improvement (QI) activities are an integral part of residency training. We started the process to implement team-based, multilevel QI project streams within our academic surgical residency by studying resident perceptions.

OBJECTIVE: Our residency carried out 6 QI projects in line with the American Council for Graduate Medical Education competencies. A resident survey was completed in 2016 to measure resident perceptions of an individual versus team-based QI project approach.

METHODS: This was a descriptive study looking at resident's preference for team projects and ongoing projects within the training program. We started in 2014 utilizing Wait's Team Action Projects in surgery paradigm to conduct 6 QI projects. After initiation of projects, we allotted 2 full years to pass prior to assessing resident perceptions via a 12-item survey.

RESULTS: Notably, this was a descriptive study aiming to capture resident perceptions on team-based QI and the foundational elements necessary to create and sustain such projects by integrating into our curriculum from the intern year. In 2016, 40 residents completed surveys (72.7% response rate), all (100%) opined that they preferred team-based approaches over individual ones, and 75% were on board to move forward with only a team-based approach in the future.

CONCLUSIONS: This was a pivotal start to adopting a team-based QI project strategy in the future and laid a solid foundation to build upon. We found residents in our program desire to work within teams early on to develop effective solutions to clinical problems. Residents perceived that the team-based model resulted in an improved resident experience with the QI process and improved patient care. We hope to publish a series of articles updating our progress as we move forward in this endeavor. (J Surg Ed 76:785−794. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEYWORDS: Workforce issue, Quality improvement in health care system, Mentoring, Learning, Problem-solving skills

COMPETENCIES: Practice-Based Learning and Improvement, Patient Care

INTRODUCTION

The American Council for Graduate Medical Education (ACGME) developed the core competencies in the 1990s, which were officially endorsed in 1999.[1] Within the domain of practice-based learning and improvement (PBLI), a key concept is developing the ability to implement a quality improvement (QI) project. The goals of PBLI, as outlined by ACGME, are action oriented.[2] Chiefly, these include to "identify strengths, deficiencies, and limits in one's knowledge and expertise," "set learning and improvement goals," and "systematically analyze practice using QI methods, and implement changes with the goal of practice improvement."[2] With the advent of the Clinical Learning Environment Review in 2011, the focus of the health care quality pathway intensified on individual resident participation in QI projects.[3,4]

However, programs are still struggling to understand and fulfill the requirements for QI in residency.[2,5,6] There are significant barriers to resident involvement in a QI project, which include[1]: increasing demand on resident time,[2] challenges associated with duty hour restrictions,[3] lack of adequate faculty mentorship,[4] lack of

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financial support for projects,[5] absence of institutional buy in and support,[6] difficulty measuring impact of developed projects on an institutional level, and[7] systemization of projects as residents move through training.

Previous research has demonstrated some positive attributes of successful QI program implementation. In particular, having a specific QI project in which residents participate is effective.[7,8] If residents help to initiate the project, they tend to be more engaged, although the project may not be aligned with the goals of the institution.[2,6,9] Lastly, a longitudinal component is desirable so as to be able to track outcomes and measure impact of interventions over time.[2,10] We sought to effectuate a series of QI projects in our surgical residency program and to assess impact on resident attitude over time after implementation had occurred.

METHODS

The setting of our program University of Maryland Medical Center, an extremely busy hospital with greater than 35,000 inpatient admissions and 165,000 outpatient visits each year. We are also home of the Adams Cowley Shock Trauma Center, receiving nearly 8000 people every year who have critical injuries, 97% of which survive because of the intricate and complex care given. Our busy hospital, and unique dynamic with Shock Trauma Center, provides our surgical residents a unique opportunity to develop QI projects that impact patient's lives in a significant way, especially in trauma settings.

The University of Maryland School of Medicine general surgery residency-training program accepts 6 categorical residents per year. The residency requires a 2-year research commitment, so there are a total of 42 categorical residents associated with our program, in addition to 11 nondesignated preliminary residents. Our present QI curriculum includes periodic lectures as well as independent course material in web-based modules (Institute for Healthcare Improvement, ihi.org; see Table 1).

We designed 6 projects starting in the fall of academic year 2014, aligned along the 6 core ACGME competencies, employing a "bottom-up" approach with substantial resident involvement (see Table 2). We utilized a team-based approach in line with Waits' Team Action Projects in surgery paradigm (see Fig. 1). After initiation of the projects, we allowed 2 full years to elapse to assess the system after the start-up phase, as many projects do not come to fruition within a year.[11,12] We administered a 12-item survey containing both demographics as well as resident assessment of the system on Likert scales (see Fig. 2). Residents were also encouraged to add commentary in a free text response. The study was exempt from the IRB as it was not considered research.

DESCRIPTION OF PROJECTS AND RESULTS

Importantly, this was a descriptive study aimed at capturing the foundational groundwork to create sustainable team-based QI projects and integrating this into our educational curriculum during training years. The outcomes under study included residents' preference for team projects and ongoing projects within the training program.

Six projects were conducted in line with each of the ACGME competencies. Each competency, with the associated QI project, will be reviewed. First, the patient care QI project aimed to look at the effect of immunosuppression on percutaneous endoscopic gastrostomy (PEG) utilization. A detailed patient care analysis was performed, which did not demonstrate a change in

TABLE 1. Institute for Healthcare Improvement (IHI) Open School Online Courses Completed by all University of Maryland Surgical Residents*

Improvement Capability (2016 to 2017)		
	QI 101	Introduction to Health Care Improvement
	QI 102	How to improve with the model for improvement
	QI 103	Testing and measuring changes with PDSA cycles
	QI 104	Interpreting data: run charts, control charts, and other measurement tools
Patient Safety (2016 to 2017)		
	PS 101	Introduction to patient safety
	PS 102	From error to harm
	PS 103	Human factors and safety
	PS 104	Teamwork and communication in a culture of safety

*Residents obtain a Basic Certificate in Quality and Safety after successfully completing IHI Open School online course modules.

TABLE 2. Resident Quality Improvement Project Streams*

ACGME Core Competency	Project Focus	Outcome or Evident Impact	Future Directions
Patient care	Influence of immunosuppression (IS) on percutaneous endoscopic gastrostomy (PEG) utilization	No change in outcomes based on IS, PEG use continued	Looking at PEG associated morbidity and complications, making post op checklists (i.e., specifying bumper position) and order sets for nursing care (e.g., when to initiate tube feeds, etc.)
Medical knowledge	Developing a night float (NF) curriculum	2 papers published on this topic	Crafting study to assess pros/cons of night float system in our vascular surgery and transplant surgery rotations
Practice based learning and improvement	Postanesthesia care unit (PACU) handoff	Improving sign out of postop patient between surgeon and nurse	Handoff tool supplanted by electronic medical record (EMR)-EPIC, improvement of present system by working with IT in hospital
Systems-based practice†	Uploading outside hospital images/records from CDs promptly	Communication pathways improved, decreased repeat imaging	EMR has decreased CD traffic and necessity of uploading images, iMPAX, eUnity on iPhone
Professionalism	Accountability to profession and society	Using evidence to assess evidence-based surgery (EBS)	SBAR tailored to our program, not universally adopted, continually adapting to changing technology and practice paradigms
Interpersonal skills and communication	Assessing and improving the physician-physician sign-out process	Observations consistent with existing options in literature	Creating newer methods (i.e., iPhone app), Dragon dictation via EPIC

*Overall, these concurrent endeavors served as a starting point for refining future projects, continuing adoption of the team-based approach, and expanding on our progress for future academic years.
†Some of the initial projects we embarked on were notably self-limited, such as the endeavor to decrease repeat imaging (and associated radiation exposure) in patients by prioritizing imaging uploads, secondary to advances in the EMR and inter-hospital communication, partnership, and collaboration. For instance, the University of Maryland Medical System (UMMS) encompasses 12 hospitals, many of which have cross-communication via a common EMR such as EPIC, so images at affiliated hospitals are already available for viewing. ©2018 EPIC systems corporation.

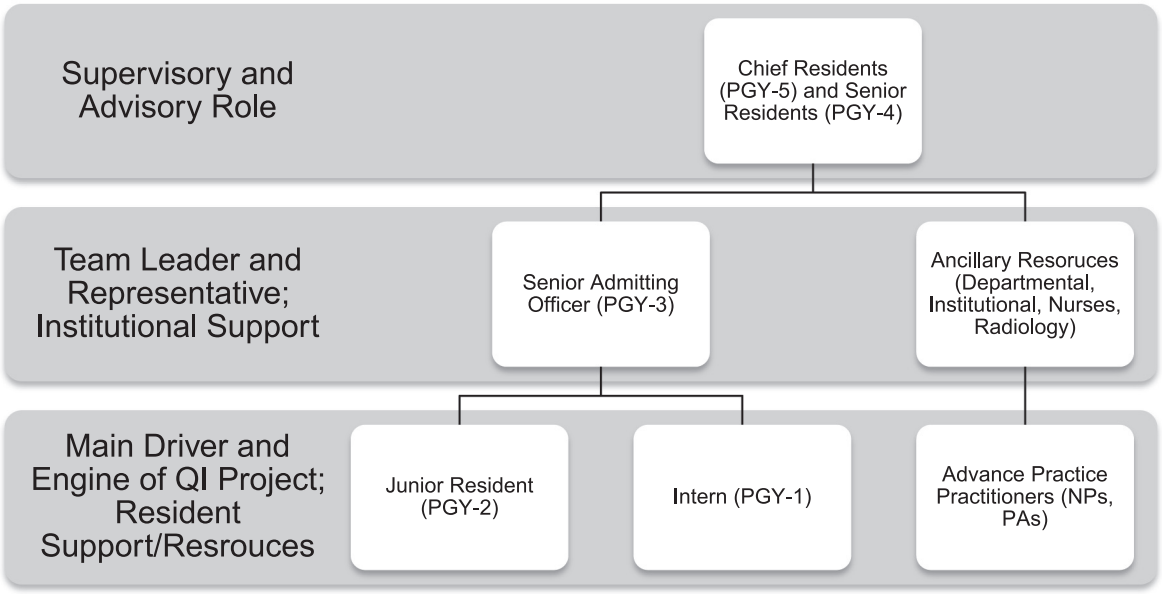


FIGURE 1. University of Maryland Schematic Showing Team Oriented Approach to QI projects.[10] Each stream is comprised of a representative from each postgraduate year (PGY) level. Every resident in our residency program is required to participate in QI research based on ACGME requirements. The PGY-1 intern was introduced to the project. Also, the program provides residents the opportunity to tailor or modify assigned topics under guidance by the faculty and program director. The PGY-2 resident was the main driver of the project and the PGY-3 resident was the team leader and representative. PGY-4 and PGY-5 residents served a supervisory and advisory role on the team. It is our overarching goal to lay a firm foundation with this initiative so that rigorous, systematic QI projects are performed on a regular basis at our institution under the guidance of the Program Director (PD), senior program coordinator, and faculty. Each year residents present current QI projects at our annual Chairman's Retreat.

outcomes based on immunosuppression regimens. This reinforced the surgical program's current practice in performing PEG tube placement for immunosuppressed patients. Second, under the Medical Knowledge competency, our residents chose to work on developing a night float curriculum. Notably, 2 papers were published as a result of this project.[13,14]

Third, under the PBLI category, a group of residents chose to focus on the physician to nurse sign-out postoperatively in the postanesthesia care unit. A handoff tool was created and well received by residents and nursing staff. However, the following year it was supplanted by a similar instrument built into the electronic medical record. Fourth, under systems-based practice, in order to decrease unnecessary repeat imaging as a result of patients transferred from outside hospitals, compact disc were uploaded expeditiously via the Medical Imaging office. However, this has become less of a viable strategy as CD traffic has decreased secondary to the electronic medical record and improved systems communication pathways. Fifth, under the professionalism domain, a standardized sign-out tool was developed, however it was not universally adopted. In the sixth and final competency, interpersonal and communication skills, residents undertook a thorough assessment and improvement of the physician-to-physician sign-out process. Our observations echoed other studies conducted in this realm, however, there was considerable variability in results attained.

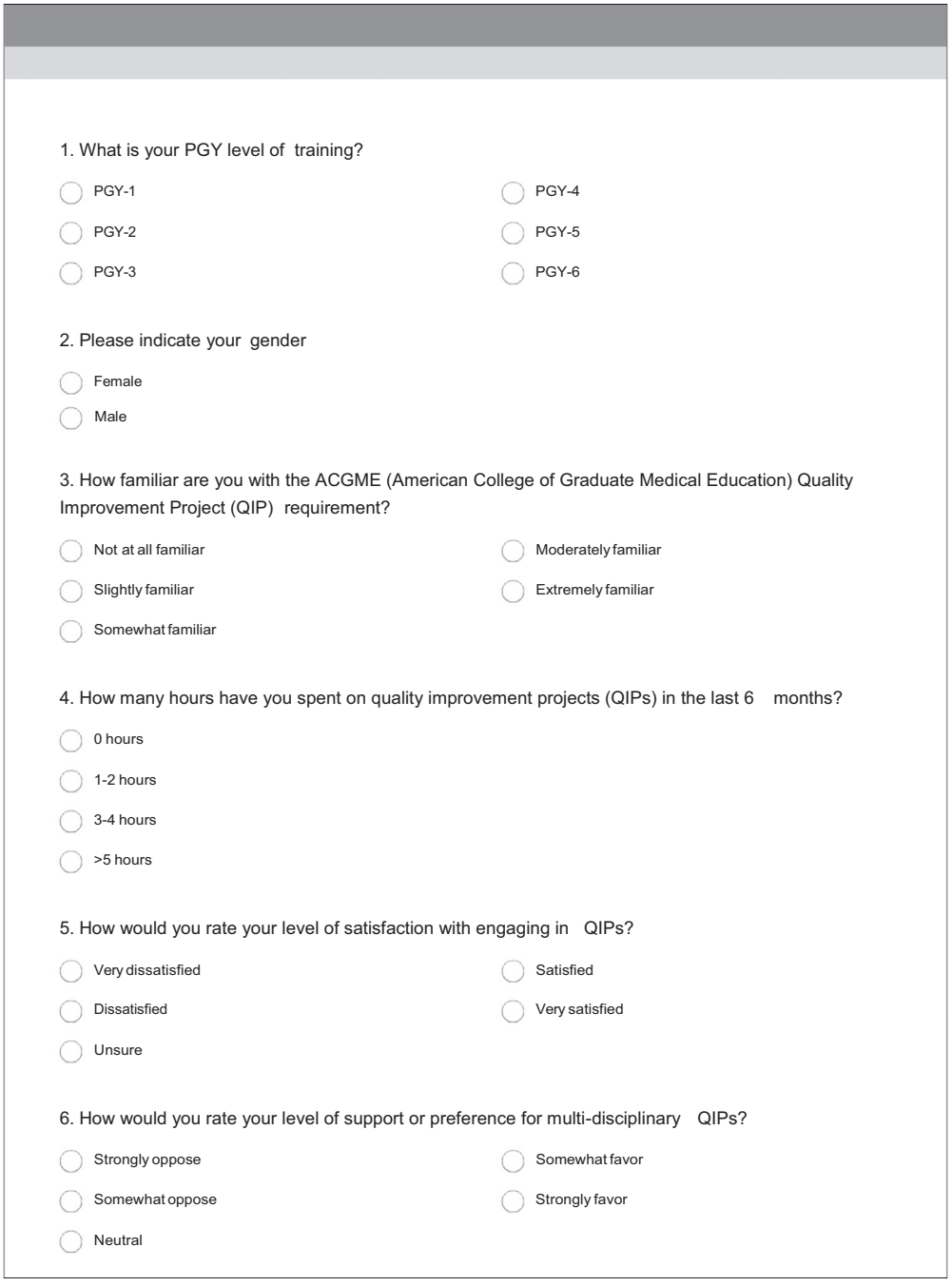
During 2016, after completion of our 6 projects, we distributed our survey to 55 residents and 40 returned completed surveys (72.7% response rate). Certain surveys were excluded secondary to lack of completion. All respondents (100%) opined that they preferred team-based QI projects to individually driven ones. Seventy percent conveyed support for team-based QI projects in moving forward for our surgical program (see Table 3). 32.5% indicated various degrees of preference (from somewhat to strongly favoring) for individually based QI projects. 57.5% of residents opined they would remain involved in QI projects as attendings and 62.5% expressed varying grades of confidence that QI projects help to improve patient care. There were no statistically significant differences between sex of residents or PGY level.

DISCUSSION

The ACGME requires residents to engage in QI projects. Our residents have a unique opportunity to develop integrated and collaborative projects both with University and Shock Trauma hospitals to impact patient care. Also, we aim to implement this QI project requirement from

day one of our residents starting in the program in order to embed research and clinical care from the outset. Residents also have numerous dedicated faculty mentors to choose from to work on QI projects, both on the trauma and University side.

However, meaningful participation can be difficult to achieve in larger residency programs. It requires coordination of resources with the hectic schedules of residents and faculty, garnering organizational support, and having dedicated leadership to oversee the entire process. Our program launched a multilevel, team-based model with resident selected topics. Specifically for our program, the aim was to increase engagement in QI projects, foster accountability of individual residents who


1. What is your PGY level of training?

- PGY-1
- PGY-2
- PGY-3
- PGY-4
- PGY-5
- PGY-6

2. Please indicate your gender

- Female
- Male

3. How familiar are you with the ACGME (American College of Graduate Medical Education) Quality Improvement Project (QIP) requirement?

- Not at all familiar
- Slightly familiar
- Somewhat familiar
- Moderately familiar
- Extremely familiar

4. How many hours have you spent on quality improvement projects (QIPs) in the last 6 months?

- 0 hours
- 1-2 hours
- 3-4 hours
- >5 hours

5. How would you rate your level of satisfaction with engaging in QIPs?

- Very dissatisfied
- Dissatisfied
- Unsure
- Satisfied
- Very satisfied

6. How would you rate your level of support or preference for multi-disciplinary QIPs?

- Strongly oppose
- Somewhat oppose
- Neutral
- Somewhat favor
- Strongly favor

FIGURE 2. Resident survey on team-based QIP. QIP, quality improvement project.

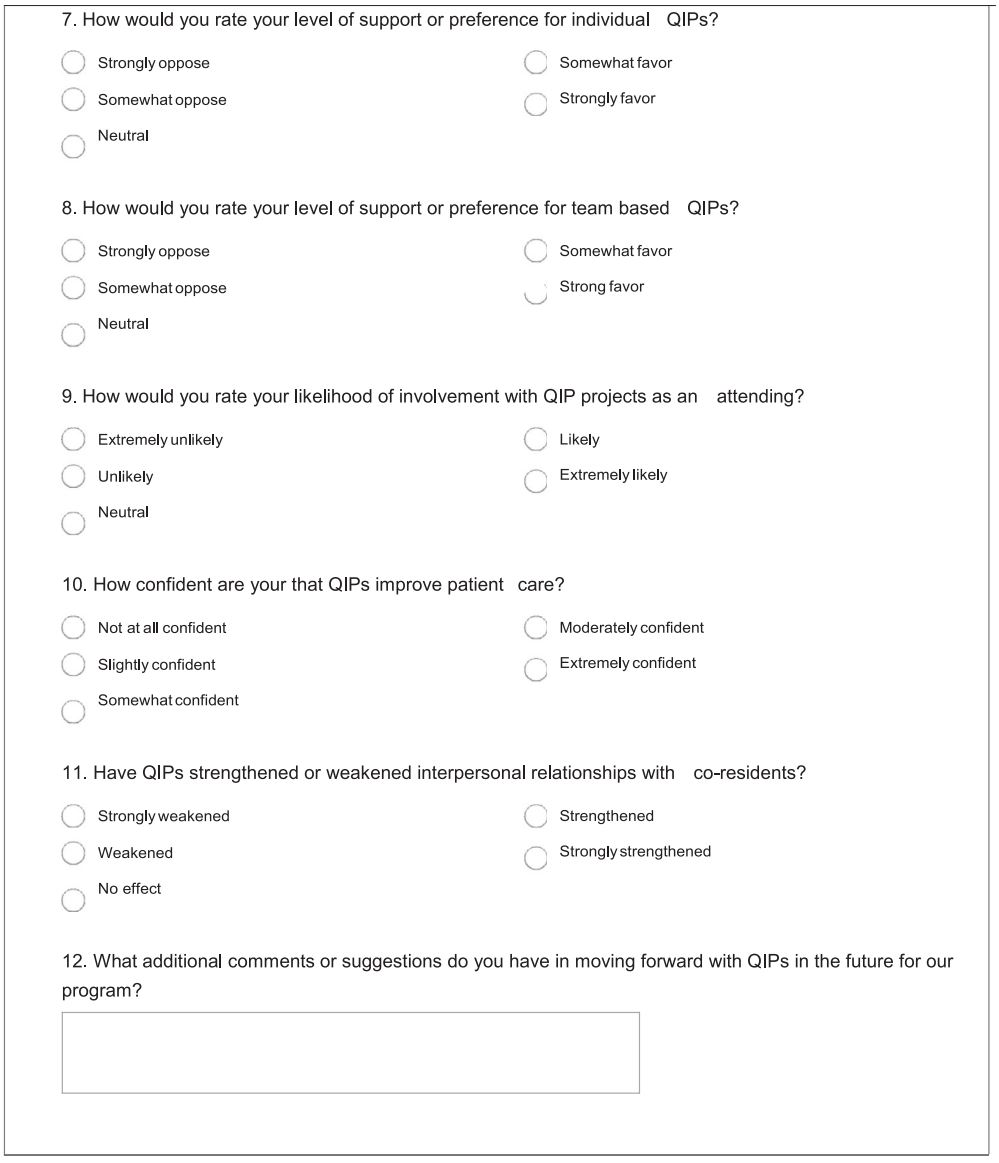


FIGURE 2. Continued.

were assigned to small teams, and ensure relevance of topics to residents. Residents were given leeway and support to tailor assigned topics or to choose new areas that were clinically important to them. Importantly, we were able to translate some of our work into presentations and publications, with those tangible results helping to provide positive feedback to reinforce this team-based model.[13,14] Residents perceived that the team-based model resulted in a better resident experience with the QI process. This was also supported in that almost 60% expressed interest to continue working on QI as attendings and 62.5% thought the work they performed positively impacted patient care.

Our training program has started to utilize multilevel QI teams to meet ACGME PBLI requirements. We were able to garner strong support by allowing residents to select those topics most relevant to the trainees. Rather than being perceived as an additional external requirement, the QI projects were seen as a means to improve problems directly encountered in the course of surgical residency. Additionally, this endeavor permitted our residents to view problems with a solutions oriented perspective.

Conversely, a weak aspect of this study was that pre- and postintervention surveys were not conducted. The only survey data garnered at this initiation phase was after concluding this first series of projects and

TABLE 3. Breakdown of Resident Survey Responses

Characteristic	Resident Response (N = 40)
Gender-no. (%)	
Female	15 (37.5%)
Male	25 (62.5%)
Postgraduate year (PGY)	
PGY-1	10 (25.0%)
PGY-2	9 (22.5%)
PGY-3	3 (7.50%)
PGY-4	5 (12.5%)
PGY-5	5 (12.5%)
PGY-6	8 (20.0%)
Familiarity with QI project (QIP) requirement no. (%)	
Not at all	4 (10.0%)
Slightly	7 (17.5%)
Somewhat	11 (27.5%)
Moderately	6 (15.0%)
Extremely	12 (30.0%)
Hours spent on QIP last 6 months no. (%)	
0	19 (47.5%)
1-2	13 (32.5%)
3-4	1 (2.50%)
>5	7 (17.5%)
Satisfaction with QIP no. (%)	
Very dissatisfied	4 (10%)
Dissatisfied	3 (7.5%)
Unsure	19 (47.5%)
Satisfied	6 (15.0%)
Very satisfied	7 (17.5%)
No response	1 (2.5%)
Support for multi-D* QIP no. (%)	
Strongly oppose	5 (12.5%)
Somewhat oppose	1 (2.5%)
Neutral	11 (27.5%)
Somewhat favor	14 (35%)
Strongly favor	9 (22.5%)
Support for individual QIP no. (%)	
Strongly oppose	8 (20.0%)
Somewhat oppose	9 (22.5%)
Neutral	8 (20%)
Somewhat favor	7 (17.5%)
Strongly favor	6 (15.0)
No response	2 (5.0%)
Support for team-based QIP	
Strongly oppose	2 (5.0%)
Somewhat oppose	0 (0.0%)
Neutral	6 (15.0%)
Somewhat favor	18 (45.0%)
Strongly favor	12 (30%)
No response	2 (5.0%)
Likelihood of QIP involvement as attending no. (%)	
Extremely unlikely	5 (12.5%)
Unlikely	3 (7.5%)
Neutral	7 (17.5%)
Likely	20 (50.0%)
Extremely likely	3 (7.5%)
No response	2 (5.0%)
Confidence QIP improves patient care no. (%)	
Not at all confident	13 (32.5%)
Slightly confident	7 (17.5%)
Somewhat confident	12 (30.0%
Moderately confident	4 (10.0%)
Extremely confident	2 (5.0%)
No response	2 (5.0%)
Has QIP strengthened or weakened interpersonal relationships with coresidents no. (%)	
Strongly weakened	0 (0.0%)
Weakened	1 (2.5%)
No effect	25 (62.5%)
Strengthened	8 (20%)
Strongly strengthened	3 (7.5%)
No response	3 (7.5%)

*Multi-D = multidisciplinary.

conducting a survey well after everything was done. The resident survey data was the main data gathered after completion of this first series of team based QI projects. Moreover, surveys were distributed to all residents in the program at that specific time point, and they did not all have a reference point for how the QI system was before the team-based approach was implemented. Resultantly, interns, who made up 25% of respondents, were either unable to report their perceptions of individual based QI projects, or did not answer those comparative questions, or had some reference point from medical school to base their answers on for the survey. Our interns were integrally involved with the entire process, from suggesting topics to work on, literature review, data gathering, and data compilation. We involved both preliminary and categorical interns in this process. While no specific time was allotted for working on these projects, residents utilized Thursday morning protected times and free time to work on projects. Annually, at our Chairman's retreat, residents would have the opportunity to share with faculty and colleagues their work and results. At the end of each academic year, final data and progress on projects would be submitted to our program coordinator, who would at the beginning of the next academic year notify residents of current projects and allow opportunity to move in new directions as well. This allowed for continuity of current projects and ensuring residents see each selected topic to completion. Program faculty also provided mentorship, supervision, and support.

In support of our initial findings, other groups have adopted a team-based approach, and recommend its benefits.[2,6,11] One group from the University of Michigan developed 5 resident QI projects through crafting of multilevel team-based approaches.[11] Both qualitative and quantitative analysis reflected "significant value" for learners and stakeholders in their QI projects.[11] Post hoc evaluation conveyed high levels of satisfaction with the Team Action Projects approach and resident driven QI projects.[6] Generally, numerous works convey the importance of utilizing team-based approaches in achieving goals. Authors from this work found training residents on projects relevant to the resident experience is effective and productive.[6]

Thoughtful implementation increases resident familiarity with the QI process.[2] Also, described benefits to resident participation in QI projects are manifold. These include[1]: improved patient care outcomes,[2] greater resident learning and professional growth, and[3] closer inter-resident and resident faculty collaboration.[2] Furthermore, a strong attribute of our program is that the participation with QI and PBLI initiatives is integrated with the clinical training from early on, prior to the formal research years, which permits residents to draw necessary connections and reflect more effectively in improving their performance in key competencies.[2] Therefore, the learning is truly practice-based. We believe that undertaking this initiative early on in training can improve the quality of resident training and enrich educational experience. We remain in the process of improving our team-based QI projects today and are encouraged by the innovative ideas and thoughtful projects being undertaken by current residents. For instance, one group of residents is working on a "smart" operative note for enteral access patients (i.e., feeding tubes, Stamm gastrostomy, etc.), which can be tracked across EPIC for all hospital services doing such procedures, with a linked order set, conveying to nursing and teams times to initiate tube feeds, when medications can be given, and ensuring an abdominal binder is on at all times. This in turn, has reinforced our residents' communication and practices after simple procedure such as PEGs, realizing the serious complications that can arise from inattention to simple details associated with such procedures.

Importantly, truly objective assessment of QI initiatives is difficult.[15] O'Connor et al. (2010) found that operationalizing ACGME's action oriented objectives was challenging in the sense that programs must create "meaningful educational opportunities," while also crafting "reliable methods for measuring individual performance outcomes in PBLI."[2] Significantly, a possible method to improve measuring impact of certain interventions is a pre- and postintervention survey strategy.[2,6] Also, one optimal solution presented by other groups is following the SMART (specific, measurable, achievable, relevant, and time-based) rubric for goal setting,[2] Six Sigma methodology and quality model,[6] or DMAIC (Define, Measure, Analyze, Improve, and Control).[6] We have found as a group that these projects do positively impact patient outcomes. Now we are in the process of demonstrating this by formulating projects with pre- and postintervention designs that measure impact. Also, we are in the process of disseminating a standardized formal survey, purchased from an outside consultant, on resident well-being and satisfaction. Additionally, we plan to look at the effect of QI projects on academic productivity by studying specific metrics or outcomes. Our initial work utilized a nonvalidated survey, and the majority of the projects had qualitative approaches. Next, we would like to determine if residents are learning from this process (externally assessed) and whether the projects are sustained/result in measurable changes. The reason we would like to study additional outcomes is for other programs to determine if the process should be replicated. These outcomes will focus on QI (i.e., PDSA cycles, run charts) or educational research (e.g., resident learning, particularly in terms of sustained knowledge and behavior changes). Also, in our upcoming studies, we aim to measure specific, discrete, and performance outcomes to measure the impact of our interventions.

From a practical standpoint, any surgical program embracing these ACGME core competences should contemplate potential problems to gaining faculty or resident participation. A key strategy employed by many groups was providing performance improvement and continuing medical education credits as incentives to participate.[2,6] Also, many faculty nowadays need such credits to adhere to maintenance of certification requirements. It is critical to have a dedicated group of faculty on board with such endeavors and projects for expert consultation, guidance, and direction to the resident teams.[6] Our program director (PD) and program coordinator have provided strong mentorship and were supportive in motivating residents to continue to move the QI projects along throughout the year. Notably, a key strategy for ensuring success of QI initiatives is to begin with a bottom-up approach[11] to lay an infrastructure with necessary teams and ideas, and then transition to a top to bottom[2] approach to garner institutional buy-in and support (see Fig. 3).

To illustrate, Miller et al.[6] conducted a QI initiative at Memorial University Medical University, with graduate medical education support, among 6 residency

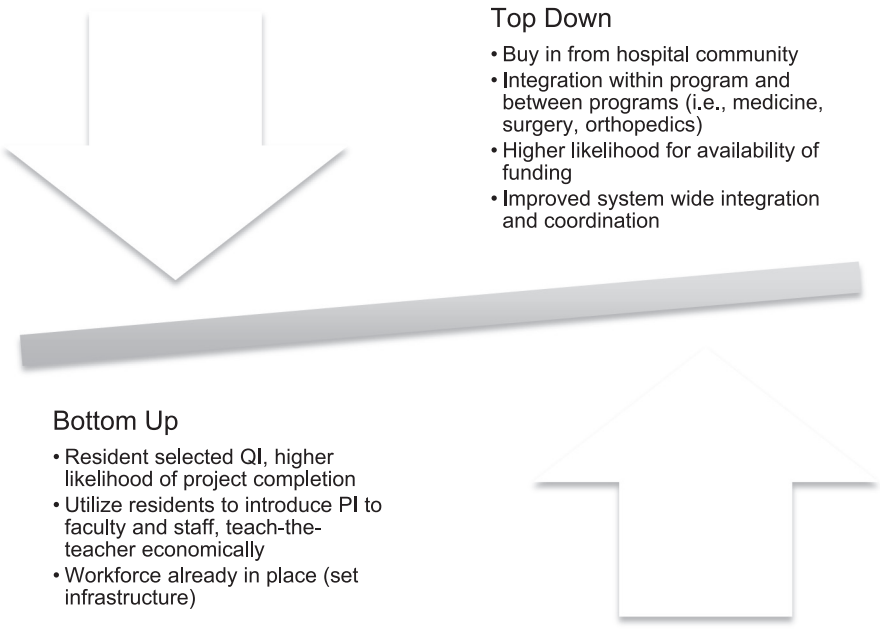


FIGURE 3. Top down versus bottom up approaches in implementing QI and PBLI initiatives. Notably, a key strategy for ensuring success of QI initiatives is to begin with a bottom-up approach[11] to lay an infrastructure with necessary teams and ideas, and then transition to a top to bottom[2] approach to garner institutional buy-in and support.

programs. The authors emphasized that strategic planning between various divisions led to better institutional performance and long-term sustainability.[6] The University of Wisconsin Department of Surgery was able to integrate a comprehensive clinically based curriculum into a rotation and found numerous benefits to such an approach.[2] Resultantly, it is paramount to address both aspects of the institutional dynamic in order to ensure sustainability of viable programs and continued results and improvement.

CONCLUSIONS

Our program conducted a descriptive study to assess resident perceptions regarding team-based, multilevel QI projects within our hospital. Outcomes under study included residents' preference for team projects and ongoing projects within the training program. We found residents in our program desire to work within teams early on to develop effective solutions to clinical problems. Residents perceived that the team-based model

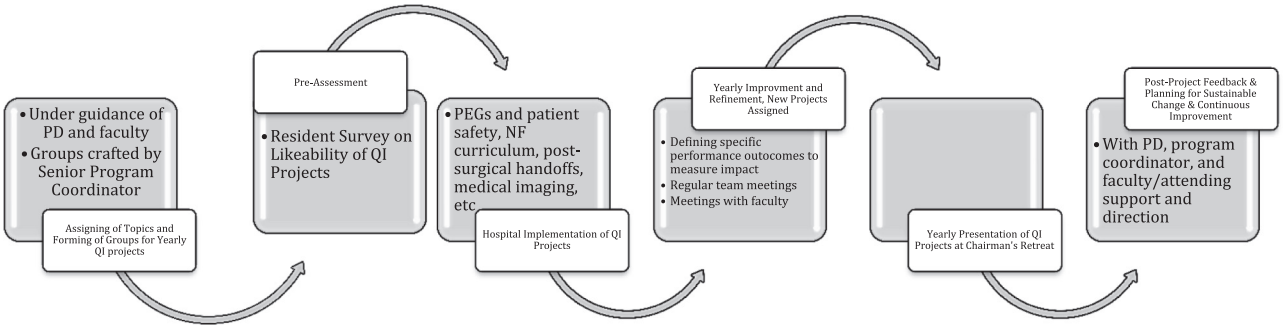


FIGURE 4. Continuous QI project initiative utilizing TAPS approach: flow diagram. In our program, our PD and program coordinator have provided strong mentorship and were supportive in motivating residents to continue to move the QI projects along throughout the year. During our yearly Chairman's retreat, our program director reviews group projects and ensures specific performance metric outcomes have been delineated by groups of residents. Significantly, a possible method to improve measuring impact of certain interventions is a pre- and postintervention survey strategy.[2,6] Also, one optimal solution presented by other groups is following the SMART (specific, measurable, achievable, relevant, and time-based) rubric for goal setting,[2] Six Sigma methodology and quality model,[6] or DMAIC (Define, Measure, Analyze, Improve, and Control).[6]

resulted in a better resident experience with the QI process and improved patient care. Our training program involves residents early on in QI projects and annually residents report results in our Chairman's Retreat. We continue to develop new projects yearly and improve or add performance outcome measures to study to assess impact of our interventions. As our journey into team-based QI projects continues and matures further, our goal is to publish a series of articles updating colleagues on our progress and additional insights gained (Fig. 4).

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SUPPLEMENTARY INFORMATION

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