Applying a Quality Improvement Framework to Operating Room Efficiency in an Academic-Practice Partnership

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ABSTRACT

- **Objective:** To improve operating room (OR) scheduling efficiency at a large academic institution through the use of an academic-practice partnership and quality improvement (QI) methods.
- **Methods:** The OR administrative team at a large academic hospital partnered with students in a graduate level QI course to apply QI tools to the problem of OR efficiency.
- **Results:** The team found wide variation in the way that surgeries were scheduled and other factors that contributed to inefficient OR utilization. A plan-do-study-act (PDSA) cycle was applied to the problem of discrepancy in surgeons’ interpretation of case length, resulting in poor case length accuracy. Our intervention, adding time on the schedule for cases, did not show consistent improvement in case length accuracy.
- **Conclusion:** Although our intervention did not lead to sustained improvements in OR scheduling efficiency, our project demonstrates how QI tools can be taught and applied in an academic course to address a management problem. Further research is needed to study the impact of student teams on health care improvement.

Operating rooms are one of the most costly departments of a hospital. At University Hospitals Case Medical Center (UHCMC), as at many hospitals, operating room utilization is a key area of focus for both operating room (OR) and hospital administrators. Efficient use of the OR is an important aspect of a hospital’s finances and patient-centeredness.

UHCMC uses block scheduling, a common OR scheduling design. Each surgical department is allotted a certain number of blocks (hours of reserved OR time) that they are responsible for filling with surgical cases and that the hospital is responsible for staffing. Block utilization rate is a metric commonly used to measure OR efficiency. It divides the time that the OR is in use by the total block time allocated to the department (while accounting for room turnaround time). An industry benchmark is 75% block utilization [1], which was adopted as an internal target at UHCMC. Achieving this metric is necessary because the hospital (rather than each individual surgical department) is responsible for ensuring that the appropriate amount of non-surgeon staff (eg, anesthesiologists, nurses, scrub techs, and facilities staff) is available. Poor utilization rates indicate that the staff and equipment are inefficiently used, which can impact the hospital’s financial well-being [2]. Block utilization is the result of a complex system, making it challenging to improve. Many people are involved in scheduling, and a large degree of inherent uncertainty exists in the system.

At UHCMC, block utilization rates by department ranged from 52% to 80%, with an overall utilization of 64% from February to July 2014. Given this wide variation, higher level management staff in the OR initiated a project in which OR administrators partnered with students in a graduate level QI course in an effort to improve overall block utilization. They believed that improving block utilization rate would improve the effectiveness, patient-centeredness, and efficiency of care, health care delivery goals described by the Institute of Medicine [3].

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Methods
Setting

The OR at UHCMC contains 4 operating suites that serve over 25,000 patients per year and train over 900 residents each year. Nearly 250 surgeons in 23 departments use the OR. The OR schedule at our institution is coordinated by block scheduling, as described above. If a surgical department cannot fill the block, they must release the time to central scheduling for re-allocation of the time to another department.

Application of QI Process

This QI project was an academic-practice collaboration between UHCMC and a graduate level course at Case Western Reserve University called The Continual Improvement of Healthcare: an Interdisciplinary Course [4]. Faculty course instructors solicit applications of QI projects from departments at UHCMC. The project team consisted of 4 students (from medicine, social work, public health, and bioethics), 2 administrative staff from UHCMC, and a QI coach who is on the faculty at Case Western. Guidance was provided by 2 faculty facilitators. The students attended 15 weekly class sessions, 4 meetings with the project team, numerous data gathering sessions with other hospital staff, and held a handful of outside-class student team meetings. An early class session was devoted to team skills and the Seven-Step meeting process [5]. Each classroom session consisted of structured group activities to practice the tools of the QI process. The students concurrently led the project team in applying 7 quality improvement tools (Table 1) based on the Institute for Healthcare Improvement (IHI)

Table 1. Quality Improvement Tools Applied to Operating Room Efficiency

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
<th>Purpose</th>
<th>Insight Gained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global aim statement</td>
<td>The overall purpose of the project</td>
<td>To give a direction to the group</td>
<td>The team understood the need for improvement in the OR scheduling process and the big picture goal for the hospital.</td>
</tr>
<tr>
<td>Industry assessment</td>
<td>Background research on industry benchmarks, best practices, and other QI projects in the topic area</td>
<td>To gain knowledge on the topic and understand how the problem has been addressed elsewhere</td>
<td>Students learned the language of OR management and learned that OR efficiency is a common problem, but solutions tend to be specific to institutions, as factors such as case mix, size of institution, and numbers of trainees can affect solutions.</td>
</tr>
<tr>
<td>Process map</td>
<td>Flowchart showing the sequence of events in a process</td>
<td>To understand the steps required for the system to function</td>
<td>The level of variation in the process between departments was so high that multiple process maps were necessary. Each department required its own. No one person understood all of the steps in scheduling and utilizing OR time.</td>
</tr>
<tr>
<td>Fishbone diagram</td>
<td>Diagram that collects and categorizes factors that may impact outcome</td>
<td>To generate hypotheses for potential areas of intervention</td>
<td>Any one of the 19 potential factors could impact our global aim. The project team needed to focus on only one in order to understand if any change had an impact.</td>
</tr>
<tr>
<td>Specific aim</td>
<td>Measureable goal that works towards the global aim</td>
<td>To allow the team to assess the success of an intervention.</td>
<td>Based on interviews and quantitative data gathering, the team created a S.M.A.R.T. aim that the project team could achieve with an intervention (“To improve the percentage of “accurate” cases, for surgeons being studied, by 10% in 1 week”).</td>
</tr>
<tr>
<td>PDSA cycle</td>
<td>An iterative plan of action for designing and testing a specific improvement change</td>
<td>To methodically test a change and determine its effectiveness</td>
<td>The team’s intervention made some progress, but did not have a large overall impact. The next step would have been to determine whether a new intervention should be used, or if the current intervention could be improved.</td>
</tr>
<tr>
<td>Control chart</td>
<td>A graph displaying data over time with lower and upper control limits</td>
<td>To understand variation and determine if change is due to change</td>
<td>The team found that surgeons were consistently over their requested case time, helping us to identify a potential intervention and understand its effectiveness.</td>
</tr>
</tbody>
</table>
Tool 1: Global Aim
The team first established a global aim: to improve the OR block utilization rate at UHCMC. This aim was based on the initial project proposal from UHCMC. The global aim explains the reason that the project team was established, and frames all future work [7].

Tool 2: Industry Assessment
Based on the global aim, the student team performed an industry assessment in order to understand strategies for improving block utilization rate in use at other institutions. Peer-reviewed journal articles and case reports were reviewed and the student team was able to contact a team at another institution working on similar issues. Overall, 2 broad categories of interventions to improve block utilization were identified. Some institutions addressed the way time in the OR was scheduled. They made improvements to how block time was allotted, timing of cases, and dealing with add-on cases [8]. Others focused on using time in the OR more efficiently by addressing room turnover, delays including waiting for surgeons, and waiting for hospital beds [9]. Because the specific case mix of each hospital is so distinct, hospitals that successfully made changes all used a variety of interventions [10–12]. After the industry assessment, the student team realized that there would be a large number of possible approaches to the problem of block utilization, and a better understanding of the actual process of scheduling at UHCMC was necessary to find an area of focus.

Tool 3: Process Map
As the project team began to address the global aim of improving OR block utilization at UHCMC, they needed to have a thorough understanding of how OR time was allotted and used. To do this, the student team created a process map by interviewing process stakeholders, including the OR managers and department schedulers in orthopedics, general surgery, and urology, as suggested by the OR managers. The perspective of these staff were critical to understanding the process of operating room scheduling.

Through the creation of the process map, the project team found that there was wide variation in the process and structure for scheduling surgeries. Some departments used one central scheduler while others used individual secretaries for each surgeon. Some surgeons maintained control over changing their schedule, while others did not. Further, the project team learned that the metric of block utilization rate was of varying importance to people working on the ground.

As each department used a unique process to schedule surgeries in their assigned block times, the project team decided to focus on one department. Urology was chosen because they were a smaller department and demonstrated readiness for change. The process map for urology is shown in Figure 1.

Tool 4: Fishbone Diagram
After understanding the process, the project team considered all of the factors that could influence block utilization rates using a fishbone diagram (Figure 2). Many people and systems could impact the global aim of improving block utilization rate and the fishbone diagram served as an organized way to visualize and consider which of the many contributing factors to focus on first.

Tool 5: Specific Aim
Though the global aim was to improve block utilization, the project team needed to chose a specific aim that met S.M.A.R.T criteria: Specific, Measureable, Achievable, Results-focused, and Time-bound [7]. After considering multiple potential areas of initial focus, the OR staff suggested focusing on the issue of case length accuracy. In qualitative interviews, the student team had found that the surgery request forms ask for “case length,” and the schedulers were not sure how the surgeons defined it. When the OR is booked for an operation, the amount of time blocked out is the time from when the patient is brought into the operating room to the time that the patient leaves the room, or WIWO (Wheels In Wheels Out). This WIWO time includes anesthesia induction and preparations for surgery such as positioning. Some surgeons think about case length as only the time that the patient is operated on, or CTC (Cut to Close). Thus, the surgeon may be requesting less time than is really necessary for the case if he or she is only thinking about CTC time. The student team created a survey and found that 2 urology surgeons considered case length to be WIWO, and 4 considered case length to mean CTC.

In order to understand the potential impact of this difference, the project team compared the recorded
case length (WIWO time) with the time that had been requested for the urology surgeons in 2014. Surgeons in this department varied from 21%-40% in their case length accuracy (Table 2). Given these discrepancies, the project team established the following specific aim: We will improve the percentage of “accurate” case lengths by 10% in one week (with “accurate” defined as within 15 minutes of the scheduled time).

Tools 6 and 7: PDSA Cycle and Control Charts
The Plan-Do-Study-Act cycle is an iterative plan of action for designing and testing a specific change [7]. This part of the QI cycle involved implementing and testing a change to address our specific aim. As the first cycle of change, the team requested that the scheduler add 15 minutes to the surgeons’ requested case time over 1 week. Of the urologists scheduled that week, one had used CTC and the other had not completed the student team’s survey. In order to study the change, the project team used control charts for the 2 surgeons whose case times were adapted. Prior to the intervention, the surgeons averaged at least 20 minutes over their scheduled time, with wide variation. Surgeons were infrequently completing cases at or below their requested case time. Most of the inaccuracy came from going long. The team used control charts to understand the impact of the change. The control charts showed that after the change in scheduling time, the 2 surgeons still went over their allotted case time, but to a lesser degree.

After gaining new information, the next step in the PDSA cycle is to determine the next test of change. The student team recommended sharing these data with the surgeons to consider next steps in improving block utilization, though time constraints of the semester limited continued involvement of the student team in the next PDSA cycle.
DISCUSSION

Through the application of QI tools, new insight was gained about OR efficiency and potential improvements. The student team talked to numerous staff involved in scheduling and each discussion increased understanding of the issues that lead to OR inefficiency. The process map and fishbone diagram provided a visual expression of how small issues could impact the overall OR system. Application of QI tools also led the team to the discovery that surgeons may be interpreting case length in disparate ways, contributing to problems with scheduling. Though the intervention did not have significant impact over 1 week, more time for subsequent PDSA cycles may have resulted in clinical improvements. Despite the limitations, the student team uncovered an important aspect of the block scheduling process, providing valuable information and insight for the department around this scheduling issue. The student team’s work was shared between multiple surgical departments, and the QI work in the department is ongoing.

Implications for Health Care Institutions

Nontraditional Projects Can Work

The issue of OR utilization is perhaps not a “traditional” QI project given the macro nature of the problem. Once it was broken down into discrete processes, problems such as OR turnover, scheduling redundancies, and others look much more like traditional QI projects. It may be beneficial to institutions to broaden the scope of QI to problems that may, at first glance, seem out of the realm of process mapping, fishbone diagramming, and SMART aims. QI tools can turn management problems into projects that can be tackled by small teams, creating an culture of change in an organization [13].

Benefits of Student Teams

There are clear benefits to the institution working with students. Our hospital-based team members found it beneficial to have independent observers review the process and recommend improvements. Students were able to challenge the status quo and point out inefficiencies that have remained due to institutional complacency and lack of resources. The hospital employees were impressed and surprised that the students found the misunderstanding about case length, and noted that it suggests that there may be other places where there are misunderstandings between various people involved in OR scheduling. The students’ energy and time was supported by the QI expertise of the course instructors, and the practical knowledge of the hospital-based team members. Similar benefits have been noted by others utilizing collaborative QI educational models [14,15].
Benefits for Students

For the students on the team, the opportunity to apply QI concepts to the real world was a unique learning opportunity. First, the project was truly interdisciplinary. The students were from varied fields and they worked with schedulers, surgeons, and office managers providing the students with insight into the meaning and perspectives of interprofessional collaboration. The students appreciated the complexity and tensions of the OR staff who were working to balance the schedules of nurses, anesthesiologists, and other OR support staff. Additionally, interdisciplinary collaboration in health care is of increasing importance in everyday practice [16,17]. A strong understanding of collaboration across professions will be a cornerstone of the students’ credentials as they move into the workforce.

There is also value in adding real work experience to academics. The students were able to appreciate not only the concepts of QI but the actual challenges of implementing QI methodology in an institution where people had varying levels of buy-in. Quality improvement is about more than sitting at a whiteboard coming up with charts—it is about enacting actual change and understanding specific real-world situations. The hospital collaboration allowed the students to gain experience that is impossible to replicate in the classroom.

Limitations and Barriers

As noted in other academic-practice collaborations, the limitation of completing the project in one semester presents a barrier to collaboration; the working world does not operate on an academic timeline [14]. Students were limited to only testing one cycle of change. This part of the semester was disappointing as the students would have liked to implement multiple PDSA cycles. The OR managers faced barriers as well; they invested time in educating students who would soon move on, and would have to repeat the process with a new group of students. The department has continued on with this work, but losing the students who they oriented was not ideal.

The course instructors were flexible in allowing the project team to spend the majority of time breaking down the problem of OR block utilization into testable changes, which was the bulk of our work. However, the skill that the team was able to dedicate the least amount of time to, testing and implementing change, is useful for the students to learn and beneficial for the organization. Moving forward, allowing teams to build on the previous semester’s work, and even implementing a student handoff, might be tried.

Future Directions

Although our intervention did not lead to sustained improvements in OR scheduling efficiency, our project demonstrates how QI tools can be taught and applied in an academic course to address a management problem. Research to specifically understand institutional benefits of academic-practice collaborations would be helpful in recruiting partners and furthering best practices for participants in these partnerships. Research is also needed to understand the impact of QI collaborative models such as the one described in this paper on improving interprofessional teamwork and communication skills, as called for by health care professional educators [16].

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