

The Use of Perioperative Information Technology to Improve Quality of Patient Care and Operating Efficiency in an Academic Teaching Hospital

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Background. Hospital perioperative services which include all pre, intra, and post surgical processes is a fast-moving, highly complex epicenter of most hospital organizations that not only account for a significant proportion of a hospital's expenses and revenue, but is also the key to improving quality of patient care, since over half of hospital-based medical errors occur in surgical settings.

The use of a perioperative information system when used to support proper workflow processes cannot only improve the quality of care but can improve operational efficiencies as well.

Local problem. Bassett Healthcare is a regional health system comprised of four hospitals and one free standing surgery center with 17 operating rooms, currently performing approximately 9,000 procedures annually by more than 50 surgeons serving a largely rural eight-county region in central New York.

The 180-bed Mary Imogene Bassett Hospital, a teaching hospital located in Cooperstown, New York is Bassett Healthcare's core inpatient facility was faced with a significant challenge: of preparing for an anticipated growth of 30% in its surgical services over a short period of time due to a planned expansion of Bassett's surgical services and the unanticipated closings and downsizing of other hospitals in the region. Since the hospital Operating Room (OR) used largely manual, paper-based processes; a new perioperative system was quickly needed to manage this rapid increase.

Intended improvement. The hospital sought an IT system that would provide timely automation of the entire perioperative process including initial scheduling, nursing documentation, PACU, patient flow, anesthesia, patient billing, supply inventory, and analytics to help the OR staff optimize their surgical processes.

In anticipation of success in our corporate expansion strategies, we recognized the need for improved connectivity in locations of practice. We were gaining another small local hospital, we were building two free standing surgery centers and expanding the existing scope of services being offered at our main campus. The most telling statistic of the nature of the "problem" is that over the past seven years we have seen a 23% increase in OR volume! Not quite the 30% anticipated but substantial.

With the anticipated growth we became acutely aware of the importance of such metrics as on-time first case starts, turn-around times and day of surgery cancellation rates. When we started, our first case starts were only on-time 48% of the time. We had 45-minute turn over in cases, and our day of surgery cancellation rate hovered between 6-9% cancellations day of surgery.

In order to meet the aggressive goals of their surgical services expansion the hospital's Information System (IS) Executive Team, composed of the COO, CIO, CFO, physicians, and various department heads, oversaw and approved the project and were supported by a sub-team including the OR Director, a senior surgeon and Perioperative staff and was instrumental in the selection and implementation process.

Planning the intervention. A complete review of the current perioperative work flow processes was undertaken to reduce redundant processes and generally streamline processes that could in turn be supported by the new IT system. One of the work flow issues that immediately was identified for improvement were our preference cards. Hand written, 5X7 cards for each procedure for each surgeon. Updates were annotated in the margins, and most were not used due to their inaccuracy. All of our documentation was hand written which not

only challenged legibility but a single piece of paper transiting to the entire team as a communication tool was less than optimal.

The hospital then began to identify, evaluate and select a perioperative vendor, using an RFP proposal process, scheduling presentations and demos with finalist, conducting reference checks, and site visits prior to final selection.

Final vendor selection was made based on the following criteria:

- the vendor's product specifications and match with Bassett's RFP requirements
- cultural fit including a willingness to work with the hospital as a true partner
- pricing
- contractual flexibility
- feedback and satisfaction levels of other hospital users
- future vision and direction of the vendor's development plans for perioperative IT
- level of customer support guarantees

Due to limited in-house resources a full time senior IT consultant was hired to lead the IT implementation process and to document the process. She worked closely with a senior surgical nurse to assure IT and clinical goals were aligned.

A detailed implementation roll out plan was then developed which specified the operational specifications for each application module required before implementing the next module. The first application to be implemented was scheduling followed by pre-op, intraop, and post op applications.

During each application "go live" the hospital ran a parallel process (paper-based and automated process) to assure a back up was available for quality control and to demonstrate to perioperative staff that all data in the paper-based system was, in fact, being captured by the automated system.

Staff training was a key component of the implementation process. Since several of the perioperative staff had never used a computer before, basic classroom computer courses including the use of Microsoft Windows were conducted and mandatory for new computer users.

As basic computer proficiency was gained, progressively in-depth training on the perioperative IT system began. A comprehensive training program was initially conducted by the vendor for a 5 member implementation team, who in turn acted as trainers for the remainder of the staff. To establish proficiency on the system every user was required to enter 5 cases with 0 errors. Those staff exhibiting especially strong skills were identified as super users, in-house expert resources and IT trainers for new staff. Currently, to assure continuity of training all new training is conducted by the OR IT Support Team.

The primary method to measure success of the implementation was to establish key goals and expectations for the new system, identifying both hard and soft metrics for pre and post implementation that could be simply reported and easily understood by senior management and perioperative staff.

To assure quality levels of the new system, certain benchmarks were established internally that had to be achieved prior to "go live" of an application. For example, the CIO required that 1,000 surgeon preference cards had to be complete and accurate before the new system went "live".

Importantly the hospital understood that the implementation of a new automated perioperative system would only serve as a tool – although an important one- to support new work flow processes in the perioperative

operations. As the new system was being readied for implementation every aspect of the perioperative workflow process was reviewed and refined. This process reduced redundant data entry, and addressed bottlenecks in the current perioperative process.

HIT Dimensions Utilized. A detailed timeline was established with key metrics. Modules were implemented sequentially in accordance with the following schedule after the project kickoff:

- Scheduling 4 months
 - Pre Admission 5 months
 - Preop and postop 6 months
 - Intraop 9 months
 - PACU ready in 12 months (delayed due to staffing shortages)
- One of the most challenging metrics given to us to accomplish was to have 1,000 accurate preference cards completed *before* go-live. We also created dashboards that allowed us to track our successes in such areas as on-time first case starts, turn over time, room utilization and day of surgery cancellation rates. We were also held to a tight time line and budget. With everyone on the team working on meeting the metrics, we had a system that went live on-time, on-budget and fully functional day one.

The new system(from Surgical Information Systems) operated on a standalone basis for the first year due to IT resource shortages and was then interfaced to the hospital's adt system (IDX now GE) through the use of a simple batch interface. Initially reports were generated by a series of access database reports; eventually Crystal reports were used as the standard report generator. Another new applications, Rules Based Charging was later added and connected to the hospital's billing system.

Our team was skilled in the use of MS Access and had a number of "home grown" reports prior to implementation of SIS, therefore the flexibility of the SIS system was of particular interest, because it allowed us to build on our existing data sets. The SIS system is an Oracle database that is easy to work with, which allowed us to create a flat file to be able to continue to use some of the "recognized" reports the staff had become used too.

Our original reporting tool was IQ, with upgrades to the system, we have evolved into using Crystal Reports for the reporting function. Although Crystal is very flexible, the ease and speed with which our staff can write reports in MS Access continues to add to the value of the system. If individuals have an interest in reviewing a particular issue as an ad hoc report for themselves, they simply tap into the flat file using Access and write their own report.

The other significant advantage that we have found with the system is our ability to change the data collection details at the local level, without affecting the data-base. When external agencies indicate that they will be monitoring a specific area of care, we are able to change both the data collection that our nursing staff does as well as choose if we are going to make it a mandatory field or not, without going back to the company. This task is done in a module called "Forms Builder", this level of flexibility at the local level has allowed us to be extraordinarily responsive to JCAHO, SCIP, National Patient Safety Goals reporting etc.

Outcomes. The initial successes and outcomes measured following the implementation of the perioperative system included the following which were documented within 3 months following "go live":

- On-time first surgical case starts increased by 35%
- OR suite turnaround times improved from 45 minutes to 25-30 minutes (44%-33% improvement)
- case supply costs decreased by \$200 per case
- surgery-related supply charge capture rates increased by 30%

- hand written surgeon preference cards were automated eliminating hand writing errors and redundant data entry processes. Staff were able to use the preference cards 100% of the time in picking cases and in room case delays were reduced.
- improved staff satisfaction from both surgeons and perioperative staff

Following the initial implementation of the perioperative system in 1999 and 2000 several additional changes since have been introduced:

- Integrated anesthesia and nursing documentation reducing redundant data entry, improving documentation accuracy and contributing to improved patient satisfaction

Improved compliance, based on enhanced documentation capabilities. Through the use of their IT system, Bassett increased quality measure compliance statistics in a number of quality measures required by JCAHO, (applicable National Patient Safety Goals), Surgical Care Improvement Project (SCIP), American College of Surgeons National Surgical Care Improvement Project (ACS NSQIP), and Core Measures from, in some cases, 50% to nearly 100%. One of the most recent successes, for example, is NPSG #2 on Hand off Communications. Documentation of hand off communication between providers for Anesthesia went from 50% to 97% compliant within 3 months of implementation of new requirements. To demonstrate long term viability of these perioperative improvements, an independent consulting review to measure sustained OR outcomes four years following implementation showed the following:

- OR utilization rates improved 10% -11% compared to preimplementation rates, accompanied by a 22.7% increase in case volume
- On time first case start times at Bassett was 87% , the highest rate ever observed in an academic teaching hospital by the consulting company

Success Factors. The initial perioperative IT implementation did not differ greatly from the proposed plan due to the following factors and this process was used to implement additional future perioperative applications as they became available from the vendor:

1. The project had strong support from senior management
2. The governance approach included senior multidisciplinary representation from throughout the hospital as well as the perioperative department
3. The project was appropriately staffed by an experienced outside consultant familiar with perioperative systems and whose efforts were closely coordinated with a senior OR nurse.
4. The implementation roll out plan was extremely detailed.
5. By requiring each application to be successfully installed and operational prior to implementing the next application, the project was successfully at each stage.
6. In depth training resources for all staff and the use of a train the trainer model resources were key.

Barriers. An early barrier that was the shortage of IT department resources available to support the implementation. This barrier was successfully addressed by hiring an IT consultant and by relying on input from the perioperative vendor. In addition, clear lines of communication between the hospital and the vendor were established and maintained. There was a single point of contact from the hospital (the OR director) and two points of contact with the vendor - the project manager for technical implementation and the sales executive for economics. Physician support was never a barrier to IT adoption due to the fact that senior medical staff were represented on the IS Executive Team. Also by providing in-depth training, perioperative staff regardless of their computer skills were thoroughly trained prior to implementation reducing their concerns about the new system.

Challenges Faced. One of the most challenging issues we faced is that we were planning to move ahead with a major IT implementation within three months of Y2K. Due to our timing, one of our major barriers was the shortage of IT department resources available to support this initiative.

Lack of IT resources combined with the lack of computer skills within the Perioperative area at the time of implementation presented a daunting hurdle. In order to meet the aggressive goals of the expansion of our surgical services, we choose to rely on the innovation and determination of the team to overcome the challenges, and it worked.

The next challenge faces was to map our current state / future state plans and assure that our future state was best in practice. This effort had been started several months prior to the decision to go with an electronic documentation system. The nursing staff had taken the JCAHO standards of documentation and best practice identified by AORN and redesigned our paper documentation system, affectionately called the “four page wonder”. It was four pages of 10-point type nursing documentation on NCR paper. One of the most daunting challenges was that our systems consultant was adamant that we began our project with the end in mind, this was a new concept for us to grasp, however was instrumental to our success.

Summary. The overall success of this intervention was due to the fact that Bassett’s perioperative workflow processes were transformed, supported by a new automated perioperative information system necessitated by a rapid growth in surgical case volume. Observed improvements were demonstrated in both operational efficiencies (improved on time first case starts and improved lost charge capture) as well as clinical care improvements (improved compliance with regulatory clinical care standards). Importantly, these benchmarks were tracked over several years as new perioperative applications were added and work flow processes continually refined.

The particular strengths of this study includes the ability to identify pre and post metrics regarding implementation of a new perioperative IT system. This was due to the hospital’s willingness to be transparent in openly identifying both pre and post implementation metrics. In addition, the hospital maintained the rigor to measure these variables despite limited resources during this period of rapid transformation.

An on-going challenge identified was the need to continually benchmark performance of perioperative services and consider new work flow processes in the delivery of perioperative services as new IT solutions are introduced.

Interpretation. The expected outcomes were generally achieved due to a strong planning document, commitment from senior management, a clear governance structure with clear communications channels both internally and externally to the vendor, and a lock step implementation approach under which each application was required to be fully operating and approved by the hospital before the next application was installed.

Going forward the hospital may want to more formally establish post implementation benchmarks to measure benefits following future implementation of new applications.

The hospital is continuing with its single vendor perioperative vendor approach and is currently considering new applications including a tissue tracking solution that is expected to provide improved patient safety as well as increased administrative efficiencies in tracking biologics implants used in surgical procedures.

Conclusions. This intervention resulted in substantial improvements in Bassett’s perioperative services through the use of new workflow processes supported by an automated perioperative information system. The system continues to be used today with the addition of new IS applications to support the perioperative services. This approach should be utilized with other hospital systems with similar surgical volumes and service areas to test whether or not this approach is transferrable and if similar positive outcomes can be realized.

Financial Considerations. Within the first 18 months of implementation we were able to affect our first case starts, turn around times and OR utilization due to scheduling enhancements. These improvements allowed us to

add an OR case per day using the same OR staff, within the same time frame. This impressive improvement was further enhanced by our improved supply charge capture rates when we added Rules Based Charging Module. In addition to these quantifiable, bottom-line improvements, we were able to set into motion the efforts of the staff and surgeons to improve supply costs by \$200 / case within the first 18 months. Subsequently, significant additional savings were realized as we did focused work on spine cases, total hip and knees as well as some bariatric procedures.

One of the more challenging areas to quantify financially, is the impact on our improved performance in the areas of quality. Although we remain pleased with our dashboard report performance on compliance with the various quality initiatives, we have not quantified the impact of those improvements in monetary terms. i.e. >90% of all patients coming out of the OR normothermic, we have yet to quantify the length of stay due to reduced infection rates in these patients.

The funding source for this project was from Bassett's foundation funds and the hospital's operating funds. No grant funds were utilized. However, given that the perioperative information is now successfully integrated into the hospital's main HIS, it is expected that the perioperative department will support efforts to document meaningful use requirements of the AARA legislation that could result in additional funding for the hospital.