How To Analyze The Benefits And Return On Investment Of A Perioperative Information System

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Abstract

INTRODUCTION

In health care, information systems are not a commodity that is sold to the patient. There are no billable services and thus no direct income. The inherent benefit of an information system is indirect—it is a tool to improve patient care. The value of any tool lies in its ability to help accomplish a desired task. In this case the task is the delivery of highest quality perioperative care for the lowest cost while meeting all regulatory and third party payer requirements.

From the clinician's perspective the most obvious function of an information system is the documentation of the perioperative experience and the integration of information relevant to the case. It can also be done with a computer; however, it is difficult to justify based solely on its use as a documentation tool.

From an administration perspective the greatest benefit will result from more accurate tracking of the resources devoted to patient care in the operating room. Hospitals and clinics have traditionally used paper records to follow intraoperative activities, but there are real shortcomings to relying upon paper records coming from the OR to track the most resource-intensive part of a hospital admission.

Deming and others would contend that it is virtually impossible to improve any process without measuring it.[1] Once one can measure the performance of a process then one can begin to improve it with a variety of different process improvement tools. Obviously, measurement and process improvement can be done with pen and paper. The key to understanding the value of a perioperative information system is in examination of its ability to facilitate the measurement of the process performance and enhance standardization and process improvement. It is virtually impossible to discuss the inherent value of the information system as it is intimately entangled with measurement and process improvement.

This paper draws from the literature to illustrate how to create an ROI document, for clarity I have entered values basic and qualitative values that were appropriate for my own institution—but each OR is different and you will have to adapt the methods to your own institution.

THE RETURN ON INVESTMENT CALCULATION

The decision to purchase new equipment in the manufacturing sector has traditionally been decided based upon a Return on Investment calculation (ROI). Simply put, does the new machine pay for itself in terms of reduced expenses and/or increased profits?

In healthcare the purchase of electronic records systems has been subjected to the same cost scrutiny as other new equipment but the calculation is almost immeasurably complicated, as we can see some parts of the economic model but not all.

The ROI analysis [2] is divided into three sections:

Basic criteria

- Is the project consistent with long term IS plan?
- Is the project consistent with the strategic direction of the organization?
- Does it have a strong user support?
- Will the project assist in redesigning or streamlining existing manual processes?

Quantitative analysis

- Time horizon—how long will the system last?
- Capital costs
- Ongoing operating costs
- Future capital improvements
- Cost reductions / process improvements
- Cash flow improvements
- Revenue enhancements
- Discount factor (time value of money and hurdle)

Qualitative analysis (rate impact on a 1-5 scale)

- Improvement in overall patient care quality
- Improvement in customer service delivery
- Enhancement of employee morale
- Increased employee and physician productivity
- Enhancements of redesign and re-engineering incentives
- Increase competitive advantage
- Enhance ability of hospital to profitably assume risk
- Enhance risk management
- Facilitate clinical problem solving
- Supports practitioners in measuring and managing cost and improving quality
- Documents clinical reasoning and rationale
- Enhances physician productivity

An Example of analysis based on the criteria

Here follows an analysis for my medical center based on the peer-reviewed literature, the strategic plan for deployment of an electronic record and interviews with perioperative department personnel.

Basic Criteria

Is the project consistent with long term IS plan? Yes

Is the project consistent with the strategic direction of the organization? Yes

Does it have a strong user support? Yes

Will the project assist in redesigning or streamlining existing manual processes? Yes

QUANTITATIVE ANALYSIS

TIME HORIZON—HOW LONG WILL THE SYSTEM LAST?

Monitor systems have a life of about ten years but the life of the systems seems to be getting longer. Anesthesia machines last even longer with good maintenance—up to fifteen years. In contrast, the life of computer operating systems has been the usfulness-limiting factor for anesthesia record keeping systems. The solution is to use an OS with strong momentum or at least a clear upgrade path

CAPITAL COSTS

Both Picis and Saturn (Drager) cost in the region of $15-25,000 per operating location plus the cost of servers, printers and interfaces

ONGOING OPERATING COSTS

These are not presently available but will need to be calculated with the assistance of the vendors—who must be held contractually liable for overruns.

FUTURE CAPITAL IMPROVEMENTS

There will almost certainly be reasons to upgrade the hardware during the life of the project, using Moore's law it is reasonable to predict a cost of about $1000-2000 per workstation

COST REDUCTIONS / PROCESS IMPROVEMENTS

Quality Assurance Wagner [3] demonstrated more than 100% more static and time related QA data was collected following adoption of a perioperative information system. Records with missing QA data fell from 60% to 20% (a 67% reduction). The number of cases where no adverse events occurred increased by over 80%. Some malpractice insurance companies have offered discounts to organizations that use perioperative information systems. This is a reflection of their observation that they have lower liability risk with better records.

Intuitively, most people feel that there is a significant advantage to high quality data that is easily accessible.

However, it is difficult to put a definitive dollar value on it. Care process improvement involves measuring the performance of the process, analyzing the data, feeding it back to the staff, stabilizing the process and changing the process. All of these can be done with traditional pen and paper information tools; however, our experience has been that these projects are not simple or cheap. Frequently, it involves significant retrospective chart review and data management. Many hospital QA systems have a very low effective cost because clinicians without logistic support are induced to perform without reimbursement. It is unsurprising that these QA systems achieve little. Building a QA system has saved money in other industries, but because the QA process in the operating room is generally so poorly funded, the opportunity to use quality measurement to increase efficiency is often lost. Accurate measurement of quality would open the door to opportunities to save money.[4]

Medicolegal defense. There is some evidence that better, more complete electronic records have helped defend practitioners. This suggests that better records will help reduce professional liability exposure. In my own institution, on the few occasions when practitioners laboriously created an electronic record out of stored trend data following a bad outcome, their "electronic records" have exonerated their level of care.

More appropriate preoperative work up. Roizen et al. [5] designed and implemented a computerized pre-op assessment tool with integrated decision support logic that encouraged users to undertake a complete and appropriate assessment. The system also recommended appropriate consults and diagnostic tests. They saved $68/case in pre-operative evaluation costs.

Automated physician order entry systems with feedback of charges and decision support in the hospital setting were shown to reduce costs by 12.7%. Extrapolating Tierney's finding to the perioperative setting would reduce diagnostic test costs by $6.68/visit in an outpatient setting.[6,7]

Time savings. The accurate and timely identification of delays can lead to opportunities for process improvement; reduced OR time/case, reduced overtime, reduced drug costs and reduced volatile anesthetic drug costs. Cofield [8] noted an overall savings of $100/case much of which was attributable to time savings. Wagner 3 demonstrated a timesaving of 5 minutes in pre-op, waiting and transport; 3 minutes in patient preparation and 5 minutes in the operative time. The savings in each hospital or system will be different but Table 1 gives starting point for examination of the delays.

Table 1: List of Variables needed to calculate potential impact upon costs from an Electronic Anesthesia Record Keeping system

Variable

- Operating Rooms
- Cases per month
- Operating Minutes per month
- Cost of OR time (per minute)
- OR Overtime cost/min
- % of cases with overtime

Reasons for delay in surgery. Automated records enable precise ongoing assessment of reasons for delay—thus enabling timely troubleshooting and correction.

- Transportation Delay
- Patient unstable or ill
- Patient had food or drink
- Needing anesthesia or medical clearance
- Abnormal/pending labs
- Abnormal/pending x-ray
- Abnormal/pending ekg
- Patient wanted to talk to surgeon
- Patient needed blood prior to proc
- Patient needed med prior to proc
- No blood avail
- Patient undecided to have proc
- No consent
- Other documentation delay
- Anesthesia late
- Other anesthesia related problem
- Other Preoperative delay

- Delayed operating room clean up
- Operating room not available
- Anesthesia plan change
- Delay in surgical team arrival
- Delay in OR nursing team arrival
- Anesthetic induction delay
- Patient preparation and positioning delay
- Other intra op delay
- PACU Bed Not Avail
- ICU Bed Not Avail
- Transportation Delay

Reduced Drug Costs. Lubarsky [9,10,11] demonstrated that education alone can reduce drug costs by 16% (from $66/case to $55/case), but guideline implementation using a computer and standard process improvement techniques could save an additional 36% (from $55 to $35/case). McNitt, et al. [12] observed a $32/case reduction in drug costs following implementation of a process improvement program. Szocik, et al. [13] had a drop in neuromuscular blockade drug costs from $19 to $12/case (37%) with the use of education and process improvement. These papers report a drugs cost reduction of 30-40%.

Lubarsky 9,10,11 showed that using an anesthetic record keeping system and process improvement techniques one can save 15% on volatile anesthetic costs. Szocik 13 had a drop in volatile anesthetic drug costs from $19 to $15/case (21% reduction) with the use of education and process improvement. We could hope to reduce volatile agent use 5 %.

In addition, because of the constrained environment and very detailed information entered into automated systems it will be possible to accurately measure rather than deduce costs of care—a feat that is impossible in most other areas of the hospital.

CASH FLOW IMPROVEMENTS

Improved charge capture for drugs and volatile anesthetic gases.[9,14] The actual amount saved depends on the current billing and accounting practices. I would conservatively estimate we could manage a 5 % improvement in drug charge capture and 5 % improvement in volatile anesthetic drug charge capture.

REVENUE ENHANCEMENTS

Medicare reimbursable DRG co-morbidities are often not evident during coding for same day admit and inpatient Medicare surgical patients. The surgical history is frequently incomplete because the surgeon is focused on the surgical procedure but it used for coding at the time of discharge. During coding for billing some co-morbidities never appear and revenue is lost. While some co-morbidity may be picked up by ancillary services (e.g. a code for an abnormal chest x-ray), they reflect only a small portion of a patient's overall medical condition. Anesthesiologists are very concerned with concomitant illnesses and Gibby, et al. [15] observed that a computerized pre-op assessment resulted in better recognition of co-morbid diseases and more accurate DRG and ICD9 coding. The result was a 1.5% increase in hospital reimbursement.

QUALITATIVE ANALYSIS

Qualitative analysis impact scale

- 0.1. No impact
- 0.2. Some impact
- 0.3. Moderate impact
- 0.4. High impact
- 0.5. Substantial impact

Qualitative Impact & Impact factor

- Improvement in overall patient care quality - 3
- Improvement customer service delivery - 2
- Enhancement of employee morale - 4
- Increased employee and physician productivity - 4
- Enhancements of redesign and re-engineering incentives - 5
- Increase competitive advantage - 2
- Enhance ability of hospital to profitably assume risk - 5
- Enhance risk management - 5
- Facilitate clinical problem solving - 5

- Supports practitioners in measuring and managing cost and improving quality - 5
- Documents clinical reasoning and rationale - 4
- Enhances physician productivity - 4

CONCLUSIONS

This Return on Investment analysis suggests that purchasing an anesthesia record keeping system that integrates with the hospital information system meets the strategic objectives of the organization and is both quantitatively and qualitatively positive.

In order to complete an exhaustive quantitative analysis the following baseline information is required: exact investment in hardware, software and support for the new system, two years of historical perioperative drug costs and perioperative testing, the number and types of all operative procedures, number of nursing overtime hours, annual maintenance and repair fees, cost of paper records system including printing, completing, scanning, recovering from chart and storage.

The exact financial benefit could be predicted, but with only a very low degree of certainty as there is a limited real world experience with these systems over the longer term. The greatest benefits to a hospital will accrue only if the anesthesia record keeping system is connected to the hospitals other information systems, making the OR an "island of automation" may satisfy anesthesiologists but will not work for a hospital. Integration of a new anesthesia system with existing and future hospital information systems can be complex and expensive but can be greatly improved if the manufacturers make an effort to use industry standards based protocols including but not limited to HL7 messaging.

Chief Information Officers and CEOs spend a lot of time and effort trying to minimize the pain of implementation of inpatient and outpatient encounter documentation systems. In our hospital the anesthesia departments have been crying out for automation for many years but that will not persuade the CEO to buy you " new toy". Administration often needs reminded that the perioperative area has the biggest cash flow, the highest acuity of care and greatest liability risk in the hospital.

Implementing an EMR in the perioperative area holds considerable opportunities for cost savings and offers a relatively easy implementation. Furthermore, perioperative physician users are committed to the success of the system.
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