Making the Business Case: Integration of Healthcare-Based Economic Evaluation Methodologies within Hospital QI Programs

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Abstract

Ultimately, the successful implementation of optimization and continuous improvement initiatives necessary to promote efficient, patient-centric care within a healthcare organization is dependent on management support. The process of linking quality initiatives to financial results has been termed 'building the business case' for quality improvements within healthcare.

Faculty from the Purdue College of Technology, in partnership with faculty from the Purdue Statewide Campuses, have developed and implemented a methodology for standardized evaluation of the financial impact of operational and patient care improvement projects. This standardized methodology includes an Excel based Return on Investment (ROI) Tool and a hands-on training exercise that enables project teams to appropriately quantify potential project economic impacts, such as implementation cost and improvement benefit, prior to project implementation and validate this assessment following implementation. To date, this methodology has successfully been used within 20 hospitals and over 36 projects to provide financial evaluation of quality improvement projects.

Introduction

Healthcare quality, cost and availability have become major financial, social and political issues in modern society.

In 2001, the Institute of Medicine published a report titled Crossing the Quality Chasm. This report provided a vision for the future of healthcare within this country, detailing improvement recommendations to reverse the cycle of medical errors reported in To Err is Human. The primary recommendation of this report lies in the creation of organizations that can "optimize and improve the care process".

In order to successfully implement and sustain the continuous improvement initiatives, management support must be obtained. Through our work in over 22 Indiana hospitals, we have found that healthcare administrators often hesitate to fully recognize and support improvement efforts until these efforts can be directly linked to financial improvements within their organizations. Investigations into the implementation of quality initiatives within healthcare have singled out the lack of a financial business case as one of the single most significant factors impacting implementation success [1,2].

What is preventing the development of the business case for quality within healthcare? Current literature sites multiple obstacles [3,4] including the level of complexity and systematic fragmentation within healthcare. In our experience, the lack of appropriate performance indicators often makes it difficult to determine performance gaps, effectively drive performance improvements and accurately measure the impact of improvement initiatives. Additionally, we have found that healthcare professionals are often unfamiliar with economic evaluation techniques and may even perceive that the assessment of economic impact of quality improvement projects may undermine patient care.

Faculty from the College of Technology at Purdue University, and the College of Engineering and Technology at Indiana University – Purdue University in Indianapolis (IUPUI) and Purdue-Calumet, in partnership with the Regenstrief Center for Healthcare Engineering (RCHE) at Purdue University and the Indiana University Center for Health Services and Outcomes Research at Indiana University (IU-CHSOR), have developed and implemented Lean Healthcare (LHC) and Lean Six Sigma Healthcare (LSSHC) Training Programs that have been administered in 22 Indiana hospitals, and 7 healthcare systems over the last 3 years. As a part of these programs, we have developed and implemented a methodology for standardized evaluation of the financial impact of operational and patient care improvement projects. The methodology includes an Excel based Return on Investment (ROI) tool and training exercise that is used to enable project teams to appropriately quantify potential project ROI prior to project implementation and validate ROI following implementation.

The objective of this methodology include providing the project team members with an in-depth understanding of 1) healthcare financial terms, 2) measurement and assessment of financial impact and 3) the importance of financial analysis in achieving management support of operational and patient care quality improvement efforts. These objectives are reinforced through a hands-on training exercise that provides a practical application in identification and quantification of hard and soft financial and productivity impacts as well as materials, equipment and purchased services cost savings.

To date, this methodology has been used successfully to provide assessment of financial impact for over 30 clinical practice guideline and operational improvement projects over the last 3 years.

The Quality Improvement Methodology

This methodology has primarily been applied for financial analysis of Lean and Six Sigma projects. This methodology is described in detail in works by Woodward-Hagg, et al [5,6]. The structured methodology presented in these projects is summarized below:

- *Define the problem, including aligning project goals to customer requirements and business objectives.*
- *Measure the process by collecting relevant data to identify operational barrier.*
- *Analyze to verify connection and cause of problems. Perform PDSA cycles to test assumptions and solution pathways.*
- *Improve or the process by developing and implementing future state processes.*
- *Control the process and improvements over time.*

Excel Based ROI Template

To enable effective and consistent ROI analysis between project teams, a standardized Excel based ROI tool was developed. This tool includes a user interface section for entry of financial information as well as an automated summary sheet that compiles overall project impacts from the data entry sections.

Methods

Preliminary ROI Model

As described by Woodward- Hagg[7], the project cycle begins with creation of a Champion team to identify an opportunity for improvement and complete a process improvement project charter document. An example of the project charter document is shown in Appendix A, Figure 1. The project team typically meets during multiple sessions to evaluate the project alignment to organizational strategic objectives, define the project goals and determine expected project deliverables.

While developing the process improvement project charter document, the Champion group is also required to create the 'preliminary' ROI model. This model is created through identification and estimation of financial impacts and implementation costs expected as a result of the project. To provide confidence within the preliminary financial model, financial officers within the organization validate the model to insure that assumptions and estimates are clearly outlined. Following this review, the preliminary ROI analysis is presented to the project team along with the project charter, insuring that the anticipated financial impacts are clearly understood. The ROI analysis is shown in Appendix A, Figure 2.

An additional advantage of creating the preliminary ROI model during the Champion phase is to quantify the anticipated ROI impact of selected projects prior to chartering the project team. Through the creation of standardized ROI analyses during project selection, multiple projects can be directly assessed and compared against organizational financial goals.

Project ROI Model

Following completion of the project charter, the Champion group typically charters a project team composed of front line staff members heavily involved in the process under investigation. The role of this team is to optimize the processes under investigation as outlined in the project charter.

The development of the detailed 'project' ROI model begins with the creation of detailed flow diagrams or process maps. Within the Lean and Six Sigma , these tools are developed during the process baseline. We have presented an example or a process flow diagram in Appendix A, Figure 3.

After the process maps are created and validated and ideas for improvement are developed and tested, the project team refines the project ROI model through identifying opportunities for increased revenue, cost reduction or cost avoidance within each step of the process. These cost impacts are categorized as productivity impact, hard operational savings and additional revenue generation. Information from economic analyses available from evidence based clinical literature is used to link the cost impacts to improved patient outcomes. Financial managers on the project or champion teams are tasked with providing information on hospital specific costs, such as payer mix, patient demographics, costs of billings and collections, specific productivity rates per department, contract pricing, service costs, materials, and equipment costs. Additionally, left without being seen (LWBS) rates,

diversions, market share, days outstanding on accounts receivables may be included within the spreadsheet depending on the project context.

Similar to the preliminary model, the project ROI model developed during this phase of the project includes estimates of implementation costs. This provides an updated, but not yet complete, project ROI analysis.

The project ROI model is again updated following any implementation pilot. As this point in the project cycle, the implementation plan is used to determine resources and investments required to achieve process improvements. This more complete project ROI model is presented to the Champion group for their approval during the pre-pilot tollgate review.

Model Validation
ROI model validation also occurs following the project pilot. The process improvements implemented during the pilot are linked to financial indicators and compared against the actual, required costs for the pilot implementation. This model is presented to the Champion group during the post-pilot tollgate for validation. As the project moves into full implementation, the ROI model is regularly updated using the dashboard measurements developed as part of the control plan.

Instructional Materials

To support development of the ROI model and use of the Excel based template, training tools and hands-on exercises have been created. These methods are used to introduce the Champion and project teams to healthcare based financial concepts and requirements for creating robust financial models.

Healthcare Financial Basics
The training exercise begins with instruction on "Healthcare Financial Basics" which includes an overview of how hospitals operate, make and spend money, including the components of healthcare operating and capital budgets. Specific definitions approved by the Financial department with respect to qualifications for hard and soft savings as well as revenue generation are also discussed. Note that these definitions often vary by healthcare organization and, as a result, team facilitators often meet with the organization financial executives to customize the template and definitions prior to the training exercise.

This instruction continues with a review of the Cost of Poor Quality (COPQ) and the different types of waste that is often present in healthcare systems, including discussions and examples of how these parameters are measured and allocated.

ROI Exercise
Following the hospital basics instruction, the team moves to an exercise developed to provide the project team with hands-on experience in assessing the project financial impact prior to application to the project focus area.

The case study used during this exercise is typically an Environmental Services waste removal project. During the hands-on exercise, the project team is divided into 2-3 groups, with each group receiving the following:

- Written Project Charter
- Process Map for case study
- Process Observation Worksheets and Time trials data for case study
- Poster Sized Return on Investment Analysis calculation template, with screen shots corresponding to the Excel based template worksheets
- Other tools a required, including markers and calculators

Each group reads the case study project charter to understand the project scope, reviews the current state process maps, the project observation notes and time trial data. The teams are allocated approximately 30 minutes to discuss the information and data they have received, assess and quantify operational barriers (waste) present in the current processes and enter this information into the ROI templates. The teams are then given another 30 minute segment to develop action plans to remove or mitigate these barriers, estimate implementation costs and enter this information into the ROI template.

After the groups have completed the ROI exercise for the case study, they are asked to present it to the other groups. Very often, there are significant differences between assessments conducted by the groups, and conceptually, this is important in the learning cycle, as the team members begin to recognize the variation that can occur in quantifying financial impact. Intense discussions related to minimizing this variation and model validation often occur and are used to further develop and refine the economic evaluation methodology.

Following the completion of the hands-on exercise using the Environmental Services case study, the team is then challenged to apply the methods learned to development and validate a ROI model for the process under investigation by their project team. The team is encouraged to present and discuss their model with their respective Project Financial Champions to validate the approach prior to any project tollgates or management reviews.

Conclusions and Recommendations

We have developed and implemented a standardized methodology for economic evaluation of quality improvement projects within healthcare. This methodology includes an Excel based ROI template and instructional materials and exercises.

There are multiple recommendations that have been developed as a result of implementing this methodology across 21 Indiana healthcare facilitates.

These recommendations include:

- *Meet with the Hospital Financial Executive prior to the project start.* It is imperative that the healthcare financial methodology, terms, definitions and the Excel based ROI template are customized to meet the needs of specific healthcare institutions and requirements of specific hospital financial executives prior to introduction to the project team.

- *Insure that healthcare based financial basics are introduced.* Healthcare professionals are often not familiar with the financial aspects of patient care and without knowledge of these definitions and terms will not be confident in their analyses.

- *Designate a project team member as the ROI analysis 'owner'.* Given the negative perception of financial analysis for healthcare professionals, it is often difficult to find a team member or members to 'own' the ROI model. It is very important to identify individuals within the project team to work with the Financial Champion to regularly update and validate the model results and assumptions.

- *Recognize that the financial models are a 'work in progress'.* As the project progresses, the financial impact models will become more realistic, with the final and most accurate model created following the pilot implementation.

References

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[6] Woodward-Hagg, H., El-Harit, J., Vanni, C., Scott, P., (2007). Application of Lean Six Sigma Techniques to Reduce Workload Impact During Implementation of Patient Care Bundles within Critical Care – A Case Study. *Proceedings of the 2007 American Society for Engineering Education Indiana/Illinois Section Conference*, Indianapolis, IN, March 2007.

[7] Woodward-Hagg, H., Doebbeling, B , Workman-Germann, J., Flanagan, M., Scachitti, S., Suskovich, D., Corum, C., Implementation of Systems Redesign: Approaches to Spread and Sustain Adoption, AHRQ Advances in Patient Safety: New Directions and Alternative Approaches, (In progress).

Biographical Sketch

Heather Woodward-Hagg is a Health Services and Implementation Researcher at the VA Center of Excellence, Center for Implementing Evidence Based Practice at the Roudebush VA Medical Center in Indianapolis. Prior to joining the VA, she was an Assistant Professor of Industrial Technology at the College of Technology at Purdue University in West Lafayette, Indiana. She is a Certified Six Sigma Black Belt and a Certified Quality Engineer. Heather spent 9 years at Intel as a process and quality engineer and manufacturing statistician within semiconductor manufacturing, specifically in the areas of Photolithography, Plasma-Enhanced and High Density Chemical Vapor Deposition. Heather's research concentration involves adapting the quality and continuous improvement methodologies and tools (i.e. Six Sigma, Lean) used within high volume manufacturing for the service and healthcare industries. Heather is currently leading the effort for development of a statewide, regional campus Healthcare based Lean and Six Sigma Healthcare initiative.

Deanna Suskovich is an Affiliated Researcher at Indiana University Purdue University Indianapolis and a Certified Six Sigma Master Black Belt (CSSMBB). Deanna educates and facilitates Healthcare worker teams in Lean Six Sigma methodology and project execution. Deanna has applied Six Sigma and Lean methodologies in other markets and has worked to adapt them to Healthcare over the last six years.

Jamie Workman-Germann is an Associate Professor of Mechanical Engineering Technology at Indiana University – Purdue University, Indianapolis (IUPUI) and Foundry Educational Foundation Key Professor. She teaches courses in Materials Science, Manufacturing Processes, and Metallurgy. Prior to teaching at the university, Jamie spent 4 years at Allison Transmission Division of General Motors as a Reliability Engineer and Test Engineer for heavy duty transmissions. Her efforts at Allison Transmission included quality, reliability, and cost reduction studies and the comparison of duty cycles to analyze the effectiveness of in-house simulated transmission testing vs. actual vehicle testing. At IUPUI, Jamie's most recent area of applied research centers around the adaptation and implementation of Lean Six Sigma processes from the manufacturing industry into the hospital healthcare environment and the development of discrete event simulation models for operations within the hospital healthcare system.

Susan Scachitti is an Associate Professor of Industrial Engineering Technology at Purdue University Calumet. Professor Scachitti consults and teaches in traditional areas of Industrial Engineering which include Total Quality Management techniques and organizational change, Six Sigma methodologies, methods engineering, Lean thinking, facility layout, process improvement, and ergonomics. She holds degrees in Industrial Engineering Technology from the University of Dayton and a Master of Business Administration in Management from North Central College. Recent grant work has focused her current research on applications of Lean and Six Sigma principles in Healthcare environments. Prior to working in education, she spent ten years in various engineering and supervisory roles in the telecommunications industry which focused on high volume electronics manufacturing. Susan's accomplishments include implementation of Total Quality principles including Lean Manufacturing concepts, Demand Flow Technology, self-directed work teams and various other techniques that improve overall process efficiencies within the organization. Also, she held key roles in successfully attaining ISO9001 certification, establishing a benchmark for a self-directed workforce, conducting economic analysis and cost justifications for new manufacturing technologies as well as utilizing various other industrial engineering concepts to reduce cycle times and increase production efficiencies.

Appendix A:

Figure 1. Example Project Charter Document

Project Charter

Project Name: Emergency Department Admissions Process

Date Chartered	Start Date:	Target Completion Date:
1-24-2007	2-12-2007	Training 4-12-2007, Implementation 5-12-2007
Project Team	Phone	Title
{Insert Team Members Name Here}		Emergency Dept Nurse Clinician, RN
		Clinical Care Services - ICU
		Emergency Department Manager
		Environmental Services
		Registration
		Post Surgical Nurse
		House Supervisor
		Quality Services
		Clinical Manager Outcomes
Process Owner	Phone	Title
		Director Emergency Services & House Supervision

Problem Statement

There is an extended length of time between when the ED physician determines a patient needs to be admitted to an inpatient unit and when the patient is received in the care unit. (xx *minutes*) This is resulting in customer and staff dissatisfaction, ED waiting room patient left without being seen (LWBS) and against medical advise (AMA), delayed treatment, increase ED LOS, patient safety and outcomes.

Goal Statement

Decrease length of time to *xx minutes* from ED phys bed request to patient received by a staff member in the care unit by June 30, 2007. *Assess* impact on patient and staff satisfaction, pt LWBS rate, and pt delay of treatment.

Project Scope

Start: ED physician determines in-patient admit
Stop: Patient is received by a staff member in care unit
In Scope: all admissions from ED,
Out of Scope: Construction, Added beds

Figure 2. Example Process Map

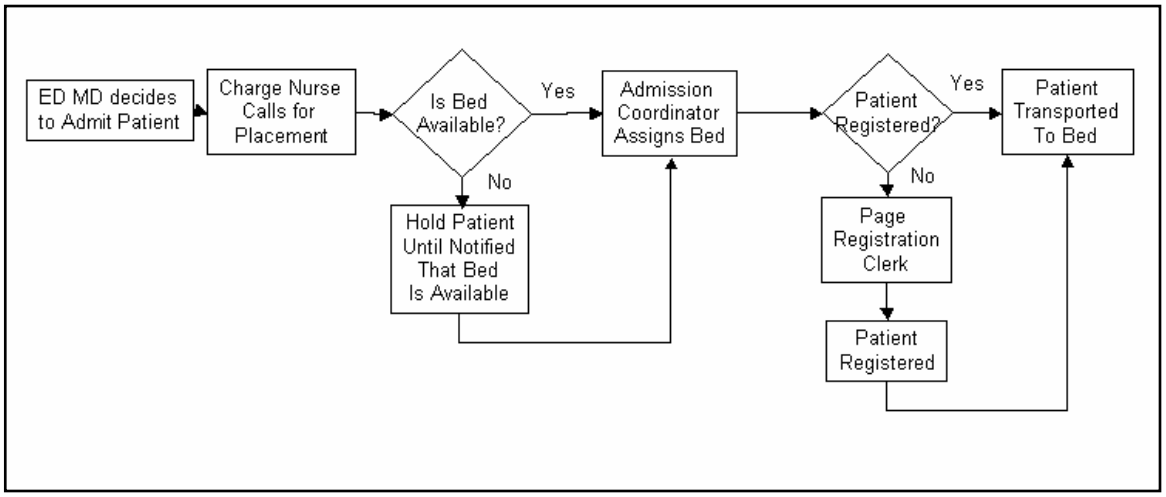
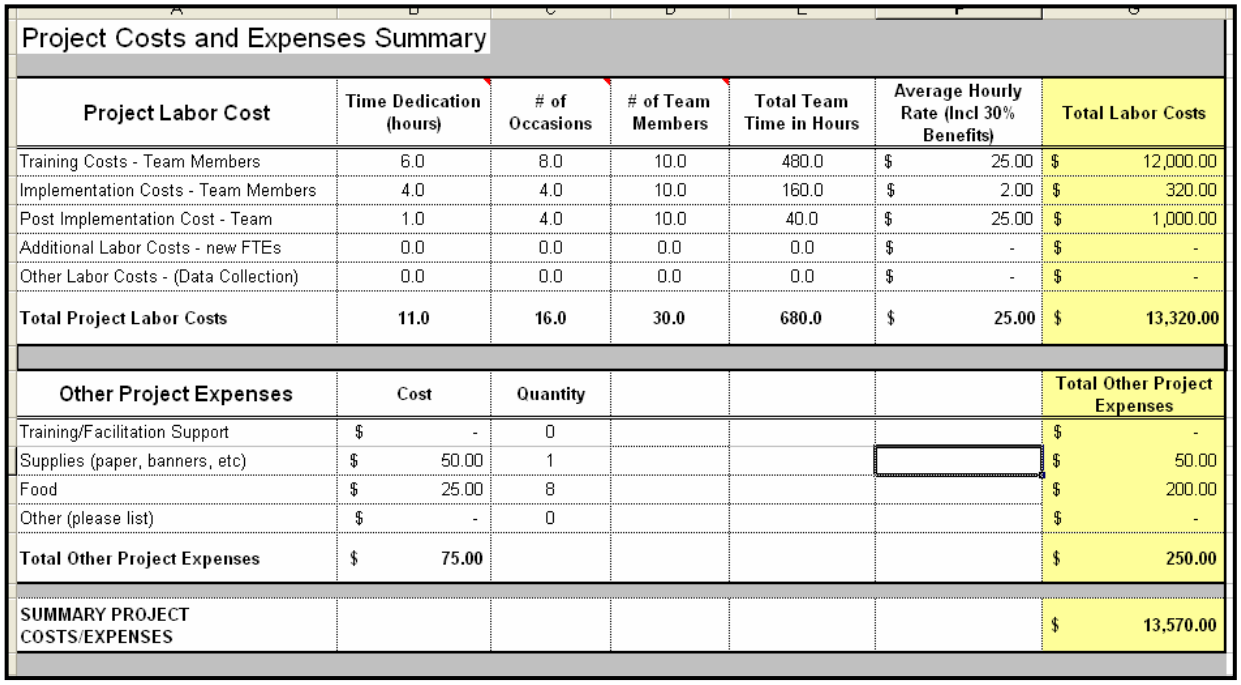


Figure 3a. Project Costs and Summary Template

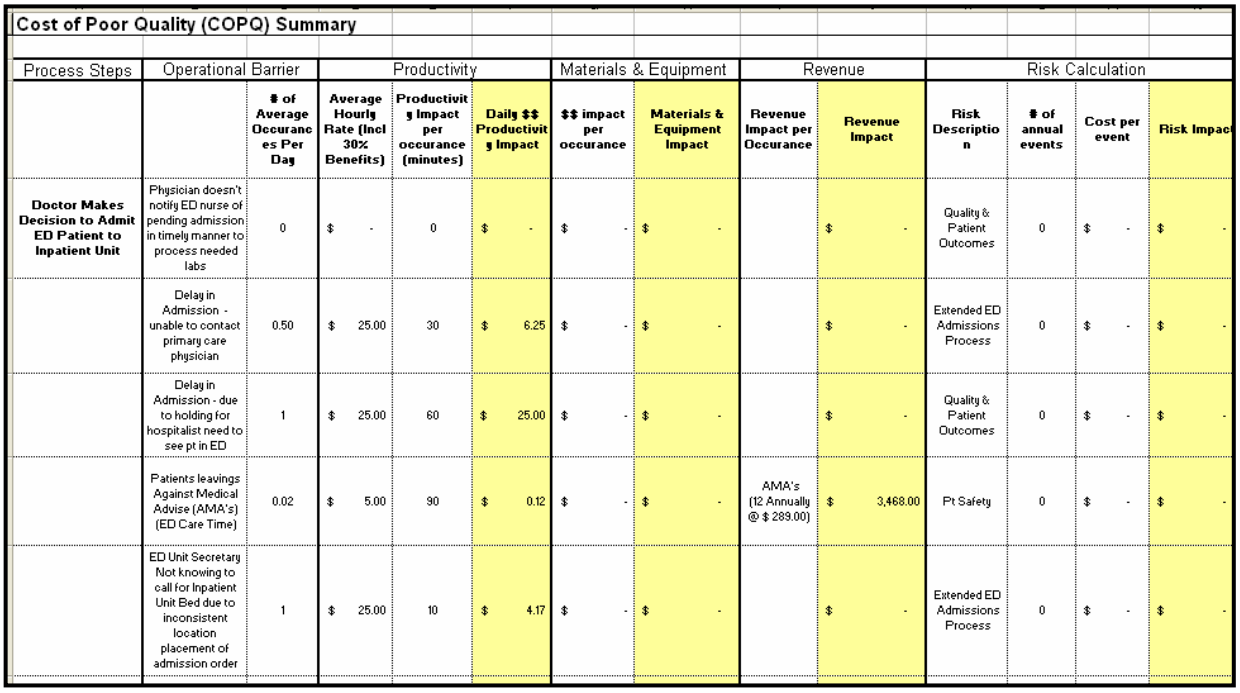


Project Costs and Expenses Summary

Project Labor Cost	Time Dedication (hours)	# of Occasions	# of Team Members	Total Team Time in Hours	Average Hourly Rate (Incl 30% Benefits)	Total Labor Costs
Training Costs - Team Members	6.0	8.0	10.0	480.0	$ 25.00	$ 12,000.00
Implementation Costs - Team Members	4.0	4.0	10.0	160.0	$ 2.00	$ 320.00
Post Implementation Cost - Team	1.0	4.0	10.0	40.0	$ 25.00	$ 1,000.00
Additional Labor Costs - new FTEs	0.0	0.0	0.0	0.0	$ -	$ -
Other Labor Costs - (Data Collection)	0.0	0.0	0.0	0.0	$ -	$ -
Total Project Labor Costs	**11.0**	**16.0**	**30.0**	**680.0**	**$ 25.00**	**$ 13,320.00**

Other Project Expenses	Cost	Quantity				Total Other Project Expenses
Training/Facilitation Support	$ -	0				$ -
Supplies (paper, banners, etc)	$ 50.00	1				$ 50.00
Food	$ 25.00	8				$ 200.00
Other (please list)	$ -	0				$ -
Total Other Project Expenses	**$ 75.00**					**$ 250.00**
SUMMARY PROJECT COSTS/EXPENSES						**$ 13,570.00**

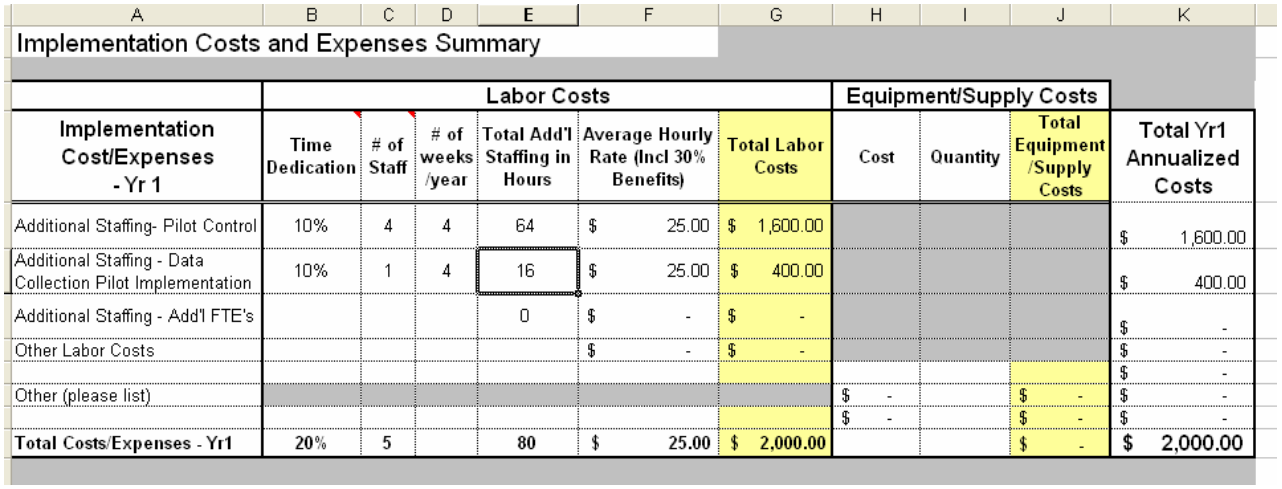
Figure 3b. Cost of Poor Quality (COPQ) Summary Template



Cost of Poor Quality (COPQ) Summary

Process Steps	Operational Barrier	Productivity				Materials & Equipment		Revenue		Risk Calculation			
		# of Average Occurances Per Day	Average Hourly Rate (Incl 30% Benefits)	Productivity Impact per occurance (minutes)	Daily $$ Productivity Impact	$$ impact per occurance	Materials & Equipment Impact	Revenue Impact per Occurance	Revenue Impact	Risk Description	# of annual events	Cost per event	Risk Impact
Doctor Makes Decision to Admit ED Patient to Inpatient Unit	Physician doesn't notify ED nurse of pending admission in timely manner to process needed labs	0	$ -	0	$ -	$ -	$ -		$ -	Quality & Patient Outcomes	0	$ -	$ -
	Delay in Admission - unable to contact primary care physician	0.50	$ 25.00	30	$ 6.25	$ -	$ -		$ -	Extended ED Admissions Process	0	$ -	$ -
	Delay in Admission - due to holding for hospitalist need to see pt in ED	1	$ 25.00	60	$ 25.00	$ -	$ -		$ -	Quality & Patient Outcomes	0	$ -	$ -
	Patients leavings Against Medical Advise (AMA's) (ED Care Time)	0.02	$ 5.00	90	$ 0.12	$ -	$ -	AMA's (12 Annually @ $ 289.00)	$ 3,468.00	Pt Safety	0	$ -	$ -
	ED Unit Secretary Not knowing to call for Inpatient Unit Bed due to inconsistent location placement of admission order	1	$ 25.00	10	$ 4.17	$ -	$ -		$ -	Extended ED Admissions Process	0	$ -	$ -

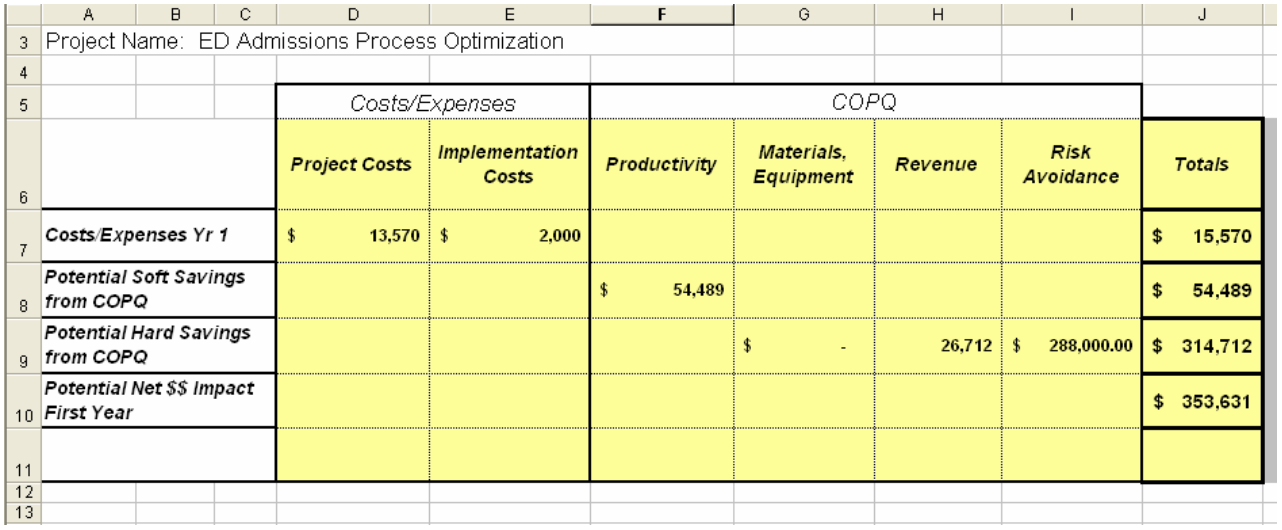
Figure 3c. Implementation Costs and Expenses Summary Template



Implementation Costs and Expenses Summary

Implementation Cost/Expenses - Yr 1	Labor Costs: Time Dedication	# of Staff	# of weeks /year	Total Add'l Staffing in Hours	Average Hourly Rate (Incl 30% Benefits)	Total Labor Costs	Equipment/Supply Costs: Cost	Quantity	Total Equipment /Supply Costs	Total Yr1 Annualized Costs
Additional Staffing- Pilot Control	10%	4	4	64	$ 25.00	$ 1,600.00				$ 1,600.00
Additional Staffing - Data Collection Pilot Implementation	10%	1	4	16	$ 25.00	$ 400.00				$ 400.00
Additional Staffing - Add'l FTE's				0	$ -	$ -				$ -
Other Labor Costs					$ -	$ -				$ -
										$ -
Other (please list)							$ -		$ -	$ -
							$ -		$ -	$ -
Total Costs/Expenses - Yr1	**20%**	**5**		**80**	**$ 25.00**	**$ 2,000.00**			**$ -**	**$ 2,000.00**

Figure 3d. Project ROI Summary



Project Name: ED Admissions Process Optimization

	Costs/Expenses: Project Costs	Costs/Expenses: Implementation Costs	COPQ: Productivity	COPQ: Materials, Equipment	COPQ: Revenue	COPQ: Risk Avoidance	Totals
Costs/Expenses Yr 1	$ 13,570	$ 2,000					$ 15,570
Potential Soft Savings from COPQ			$ 54,489				$ 54,489
Potential Hard Savings from COPQ				$ -	26,712	$ 288,000.00	$ 314,712
Potential Net $$ Impact First Year							$ 353,631