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# **Linking Quality and Costs: An Analysis of the Hospital Quality Information Initiatives Measure**

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## Executive Summary

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*Introduction:* In this era of rising health care costs, numerous efforts have been made to link quality and cost through multiple approaches. It is important to assess the benefits of quality from the point of view of consumers. However, unless providers can harvest the benefits of QI for themselves, they often don't make a business case for QI. MPRO carefully assessed the costs and benefits of investment in quality for these organizations.

*Methods:* MPRO developed spreadsheets that accounts for development, transition and operations cost of implementing interventions retrospectively, along with the resultant revenue and savings that accrue in their organizations. The template makes certain assumptions about the organization and the health care market, and calculates the payback period of investment in quality. MPRO approached ten top-performing hospitals to provide cost and revenue information; and five of them participated. Interventions targeted in this study were related to the clinical area of Surgical Infection Prevention (SIP), which has a lot of importance from the patient safety standpoint. Five medium to large-sized, participating hospitals from South East Michigan provided cost and revenue information of implementing quality improvement interventions in their facilities, and MPRO retrospectively calculated their payback periods.

*Results:* Only benefits that could be assigned a monetary value were taken into account in the payback period calculation. There were variations across hospitals in terms of physical characteristics. The payback periods for investment in quality ranged from 0.1 months to 3.3 months. There could not be a payback for one hospital that had very high costs but low revenue. Non-monetized benefits were also realized in this process.

*Discussion:* Quality appears to pay for certain hospitals with a strong QI program. The payback periods relied on assumptions, infrastructure in terms of hierarchy, and the rigor with which the Quality Improvement team approached this challenge of implementing better processes at work. Improved patient outcome was the overwhelming objective of every institution, and they are looking forward to a quantitative evaluation of their investment in quality.

## I. Introduction

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Health care organizations must decide which quality improvement projects to pursue. In our interviews, organizations mentioned three most common reasons for selecting projects: regulatory requirements, financial considerations, and “because it’s the right thing to do.” Under contract with SOA, we have developed tools for helping facilities make and evaluate the business case for these decisions. In contrast to clinical evaluations reported in medical journals, the business case must be made from the point of view of the organization that adopts the intervention. In particular, it isn’t enough to make the case from society’s point of view, by showing that the monetized value of improvements in the patients’ quality of life exceeds any increases in health care expenditures. Rather, the organization must improve its own position as a result of the project. MPRO proposed to conduct the evaluation of whether quality pays or not in an inpatient setting by carefully selecting a few hospitals in Southeast Michigan and retrospectively calculate their return on investment (ROI) in quality improvement (QI) activities within their organization.

This report has been organized in the following manner: (2) literature review summarizes available work in linking cost and quality; (3) methodology to calculate the costs of implementing quality improvement (QI) interventions and the benefits; (4) results from five hospitals and their payback periods; (5) discussion of the components of payback calculations; (6) limitations and recommendations. The project team has developed Microsoft Excel™ workbooks dealing with inpatient interventions for collecting financial costs and gains, and detailed instructions for completing the forms.

## II. Literature Review

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Based on the notion that the process in QI is more important than the resulting product (Roster S., 1990; Mayer T., 1992) and WE Deming’s principles that Continuous Quality Improvement (CQI) efforts ultimately lead to financial dividends, there are numerous studies in the literature that focus on the business costs and benefits of Total Quality Management (TQM) and CQI management (Jones SB., 1995; Scutchfield F., 1997; Lanser EG., 1999). While some authors studied the cost-effectiveness of having several teams (Hunter DL., et al., 1995; Haynie L., and Garrett B., 1999) within an organization support CQI activities, others have singled out decision support (Rosenstein AH., 1999; Brailer DJ., 1998) and information system (Bates DW., et al., 1998) to be integrated into the care delivery process to improve outcomes of care. The cost-effectiveness of several models implementing clinical and critical pathways and practice algorithms (Schriefer J., 1994; Pryor DB., and Fortin DF., 1995) have been considered over time in an effort to establish the most practical approach (Waters EA., 1997).

Understanding the importance of accuracy in capturing business costs of quality care, researchers have recommended methodologies like activity-based cost accounting (Stiles RA., and Mick SS., 1997; Castaneda K., and Bernstein L., 1997) to specify different components of business cost. Direct measurements of health care costs have been proposed in many studies (Smith MW; and Barnett PG., 2003; Adam T., Evans DB., and Koopmanschap MA., 2003) where alternative methods like time-and-motion methods, activity logs, and surveys are discussed. These studies point

to major sources of variation in costing methods applied to health care projects. Similarly, attempts to quantify both tangible and intangible benefits of QI led to an era of valuing health outcomes by means of quality-adjusted-life-years (QALYs). Comparing alternative procedures, numerous studies (Eckman MH., 1995; Chung KC., et al., 1998; Lafata JE., et al., 2000) conducted cost-effectiveness analyses measuring outcomes as QALYs gained. Studies have also attempted to capture intangible benefits like customer satisfaction using focus groups (Schwarz M., et al., 2000), surveys (Williams, et al., 1998) and National Committee on Quality Assurance (NCQA) accreditation (Mihalik GJ., et al.; 2003).

On the other hand, the application of QI techniques has been challenged in several studies (Goldfield N., and Schiff G., 1997; Ferris TG., 2000). The authors argue that the interventions, which at times require major structural and behavioral changes within an organization, are extremely challenging to implement.

### III. Methodology

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#### ***Elements of the Business Case***

What information is useful in making a business case for QI projects? Our method focused on two areas: finances and non-monetized<sup>1</sup> consequences. The financial part of the business case deals with the effect of the intervention on the hospital's bottom line. Any intervention is an investment and has immediate costs in development and transition, which ideally will lead to downstream financial benefits. All hospitals benefit from becoming more efficient and reducing the costs of providing particular services. However, if an intervention changes the mix of services provided, the resulting financial costs and benefits depend on how the hospital is paid and what expenses it bears<sup>2</sup>. Our methodology is designed to help staff estimate and summarize the immediate costs and downstream financial benefits to answer the questions:

- What is the QI project going to cost?
- What kind of return on investment (ROI) is likely and when will it be realized?

Other businesses evaluating investments to pursue might stop there, but providing health care is a business with an unusual emphasis on non-monetized goals. The non-monetized part of the business case includes all non-monetary arguments that the hospital feels will weigh in the decision to adopt or reject the intervention. Examples are:

- Maintaining accreditation;
- Satisfying reporting requirements;
- Avoiding exposure to liability;

<sup>1</sup> Non-monetized consequences are merely costs and benefits that are not expressed in dollar terms.

<sup>2</sup> If a hospital is paid on a fee-for-service (FFS) basis, it will not necessarily benefit from current or downstream reduction in needed services. However, if the payment is under the prospective payment system or a capitation arrangement, the hospital's incentives will be to reduce the overall quantity of services. A hospital will not benefit financially from interventions that reduce readmissions.

- Building goodwill or reputation; and
- "Because it's the right thing to do."

There are financial aspects to many of these non-monetized items. For example, the intervention may reduce the cost of meeting a pre-existing reporting requirement. Also, many hospitals, particularly non-profits, have non-financial goals (such as becoming a leader in cardiac care) in addition to financial goals. Our methodology will display these elements separately from the financial part of the business case because their financial aspects do not represent their primary importance to the hospital.

### ***Issue of Readmission***

Readmission within 30 days or beyond, for causes related to the initial admission is a qualitative subject that every hospital involved in QI intends to improve. From the societal point of view, this is a genuine gain that improves the quality of life. As much as reduced readmission is an indicator for improved patient outcome, and is a definite measure of quality, this notion has mixed impact on revenue from the hospital's perspective. Under the DRG type payment mechanism, a hospital cannot submit a separate claim for readmissions within 30 days. Therefore, reducing readmissions will definitely lead to cost savings. However, if the readmission occurs after 30 days, then the hospital is eligible to submit a separate claim. Revenue from reduced readmissions also depends upon whether the hospital is operating at capacity or not. Tracking readmissions for any timeframe can only be done with a surveillance system that is highly resource intensive. Acknowledging its importance in the cost-quality paradigm, this study developed a methodology that accounted for the benefit components of reduced readmissions.

### ***Selection of Hospitals***

Government agencies, health care providers and health plans have joined together to offer quality information via the internet in the public domain in an effort to enable consumers to make informed choices about the products/services they purchase in the health care market. To that end, the American Hospital Association, Federation of American Hospitals, Association of American Medical Colleges, and the US Department of Health and Human Services, initiated the "Public Resource on Hospital Performance" database that reports performances of hospitals on select process indicators in the areas of heart failure, AMI, and pneumonia. Surgical infection prevention (SIP) indicators are not publicly reported yet. However, SIP is a clinical area of growing importance, specifically in the light of patient safety concerns. It has been incorporated in the Center for Medicare and Medicaid Service (CMS)'s 7<sup>th</sup> Scope of Work project, and there were 21 hospitals that participated in MPRO's South East Michigan (SE MI) SIP Collaborative during February –December, 2003. Therefore, MPRO carefully evaluated the top-performing hospitals based on their adherence rates in the process indicators (including SIP indicators from the SE MI Collaborative), and invited them to participate in this project. Each of the five participating hospitals was then asked to provide information retrospectively (since these hospitals had QI interventions implemented), on the detailed costs and benefits of having QI processes in place. Table 1 displays the basic structure of these participating hospitals, the names of which have been blinded for confidentiality purposes.

**Table 1: Structure of Hospitals Participating in the Project**

Hospitals	# of Beds	Teaching Status	JCAHO/AOA <sup>†</sup> Accreditation
A	900	Yes	Yes
B	302	No	Yes
C	330	Yes	Yes
D	325	No	Yes
E	270	Yes	Yes

<sup>†</sup>JCAHO: Joint Commission on Accreditation of Health Care Organizations

AOA: American Osteopathic Association

### ***Prospective and Retrospective Methodologies***

For each class of interventions, there is a prospective and a retrospective methodology. The prospective methodology helps predict the labor and capital that will be used in developing and implementing the intervention. Additionally, a prospective methodology will predict the impact on long-range costs and revenues.

The retrospective methodology is used for evaluating the interventions after they have been implemented. This methodology uses the same concept, but gives techniques to access and process the data that will replace the prospective estimates with actual results. The results from retrospective assessments can be used to improve future project selection and implementation. MPRO adopted the retrospective approach in calculating the payback periods for the participating hospitals.

### ***Approaches to Estimating Financial Effects***

MPRO will consider two approaches to assessing an intervention. First, if the hospital has implemented the intervention, its records can be examined (accounting data, claims, patient charts, etc.) both before and after the intervention was implemented. This is the *accounting approach*, and it is useful only for retrospective estimates. Second, the intervention, and the process of implementing it, can be modeled as a series of activities. Each activity is assumed to be similar to some experience by the staff before, albeit in a different context. Cost, revenue and other results from each activity from the experience in that other context can be combined to assess this intervention. This approach is called *activity-based accounting* (ABC); it is useful for making prospective estimates.

The ABC approach (for prospective estimates) and the accounting approach (for retrospective estimates) have certain differences, and those will be allowed to compare prospective and retrospective estimates for the same intervention. First, the ABC approach connects costs and revenues directly to the "nuts and bolts" (e.g., labor hours) of the intervention. By contrast, most accounting systems employ an item-of-expense accounting structure. Resources are associated with cost centers (e.g., a laboratory),<sup>3</sup> not activities. As a consequence, the ABC approach yields expressions for cost and revenue that depend on the frequency with which one expects to perform each activity; these frequencies relate directly to the number of patients affected by the intervention. The accounting approach generally does so only for revenues.

<sup>3</sup> In a small organization, the entire organization may be a single cost center.

Second, the ABC approach provides cost and revenue estimates that are independent of any other changes occurring in the hospital at the same time the intervention is adopted. Estimates from the accounting approach may be contaminated by changes such as increases or decreases in overall patient volume, or new regulatory requirements. This gives an advantage to the ABC approach when these other changes are unrelated to the intervention, but it can be a disadvantage when the changes are related through resource constraints. For example, it may be possible for existing staff to perform more work, but if workload rises too much, more staff must be added. The ABC approach could predict that cost will be a smooth function of workload, while in reality the cost will jump abruptly at the point where new staff must be added. Alternatively, work unrelated to the intervention may be reduced as staff makes time to do the work the intervention requires.<sup>4</sup>

However, the accounting system provides the official picture of the hospital's finances. No matter how attractive the ABC method says an intervention will be, if the accounting system does not show a positive result, then the result will not be positive.

### ***Outline of the Workbook***

The workbook for inpatient interventions contained five sheets, as follows. On the first sheet, the hospital recorded a brief description of the interventions and the expected benefits. These benefits comprised the main objectives of the intervention.

The second, third, and fourth sheets recorded the costs and benefits that accrued during the three phases of the implementation process for interventions. The three phases are:

- Development – The interventions are designed, tested on a pilot or demonstration basis, evaluated and redesigned as necessary.
- Transition – The interventions are implemented throughout the hospital, replacing the previous processes.
- Operations – The interventions become the status quo. Costs and benefits accrue in a steady stream, month by month.

The fifth and final sheet of the workbook automatically summarized the costs and benefits of the interventions and calculated the payback period.

### ***Describing Intervention***

The methodology was developed with the interventions that aimed at improving health outcomes in the clinical topic areas of Acute Myocardial Infraction (AMI), Heart Failure (HF), Pneumonia and Surgical Infection Prevention (SIP). However, in all practicality, even with a retrospective approach of obtaining data, the participating hospitals in this project could go as far back as 2002 to provide various cost and revenue information. All of these hospitals were selected based on their exemplary performances in quality measures, and they had QI activities in place approximately

<sup>4</sup> This is an “opportunity cost”, the “cost” lies in the fact that the organization is foregoing the value of the work that is not done.

nine to ten years back. SIP is a relatively new topic that was introduced in CMS’s 7<sup>th</sup> Scope of Work (Nov 1, 2002 – Oct 31, 2005), and all the top-performing hospitals in the areas of AMI, HF and Pneumonia, also started with SIP-related interventions. Although the five top-performing hospitals did not have an outside agency like MPRO evaluate their cost-effectiveness of having QI processes in place, targeting the ten clinical measures in the areas of AMI, HF and Pneumonia, each of these hospitals practiced evidence-based medicine and was quite confident in their publicly-reported performance rates. Follow-up phone calls with the hospitals asserted the fact that although there are opportunities for improvements, success in each of the three clinical topics prompted them to adopt QI activities in SIP as well. This project focused on interventions that targeted the three process indicators listed in the “Quality Improvement Project (QIP) Title” column, and their goals are to increase the proportion of patients in the appropriate group that receive the services mentioned in the “QI Description” column of Table 2. However, MPRO believes that the methodology is sufficiently general that it could be applied in broader terms.

**Table 2: CMS’s National Inpatient SIP Project: 7<sup>th</sup> SOW**

Quality Improvement Project Title	Quality Improvement #	Quality Improvement Description
Surgical Infection Prevention	1	On-time antibiotic administration
	2	Appropriate antibiotic selection
	3	Discontinuation of antibiotics in 24 hours

**Sheet 1**

The worksheet prepared by MPRO accounted for the hospital’s prospective/retrospective costs and benefits of having QI initiated within the facility. The first sheet included an overview of interventions and the changes in the processes of care before and after the interventions were implemented. The process of care included all phases that were paid for or performed by the hospital that adopted the intervention. Interventions may primarily use one or a combination of the following:

- Practice guidelines and critical pathways
- Care management and teams
- Physician motivation and education
- Audit, feedback and performance incentives
- Physician and nurse reminders, warnings, and alerts
- Computerized physician order entry (CPOE)/decision support
- Systems or process improvement such as Continuous Quality Improvement (CQI)
- Standing orders
- Patient reminders and education



**Sheet 2: Development**

Second sheet<sup>5</sup> included the costs associated with development. This consisted of planning the intervention in meetings, preparation time outside the meetings for collecting data, preparing work documents, etc. Services may be purchased from consultants. There may be equipment purchases and employee time devoted to testing the intervention on a small scale. The second sheet included data on:

- person hours in meetings by type of personnel (e.g., physician, senior administrator)
- person hours for meetings preparation
- person hours for testing or experimentation
- consultant fees
- equipment purchases
- supplies

**Sheet 3: Transition**

In the transition phase, the intervention is implemented throughout the hospital, replacing the previous process of care. The third sheet included the following types of costs that are expected as a part of transition:

- Selling and training
  - off-site conferences, workshops, etc.
  - mentoring
  - preparation of materials (posters, memos, handouts, etc.)
- Outsourcing or contracting, short term
- Equipment purchases (NOT equipment leases as this is included in the fourth sheet - operations)
  - new computer hardware and software costs
  - other
- Facilities investment (NOT facilities leasing, for the abovementioned reason)
  - add more space
  - free up space for another use

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<sup>5</sup> All cost and revenue data should be collected based upon the accounting or ABC approach.

### ***Sheet 4: Operations***

The operations phase begins when the intervention becomes the status quo. Costs and revenue (the financial consequences) accrue in a steady stream, month by month.

Four major categories of data elements must be specified in this sheet on operations. These include: resources, number of patients involved, revenue factors, and non-monetized consequences.

- Resources are people, equipment, facilities, supplies, and contract services. People (staffing) are expressed in person hours per month, with full-time monthly salaries (burdened with fringe and overhead) recorded separately. Equipment, facilities, supplies, and contract services are expressed in dollars per month. The data elements are:
  - Staffing
  - Equipment leases (NOT equipment purchases)
  - Facilities leases (NOT facilities purchases)
  - Supplies
  - Outsourcing or contracting, long term
- Number of patients must be specified for the previous processes of care and for the new processes of care. There must be an estimate of:
  - Number of patients per month affected by the intervention, before and after (by DRG for Medicare patients)
  - Number of patients per month receiving each service, before and after
- There should be revenue factors associated with the number of patients.
  - Revenue per patient by DRG
  - Revenue per service

The revenue factors will depend upon the reimbursement scheme, which will differ according to the insurance plan. Medicare reimburses by DRG, so revenue factors will be associated with the number of patients affected by the intervention. Under a FFS structure, the payer will pay provider(s) for each service. Under the capitation structure, revenue to hospitals is no different whether the patient does or does not receive a service. So, all revenue factors have been set to zero in the case of capitated hospital reimbursement structures.

- All non-monetized consequences will be stated clearly in the final report that includes:
  - Accreditation/Reputation factor
  - Changes in mortality and morbidity

**Sheet 5: Summary**

Sheet five is the summary report from various cost collection and revenue forms. It displays the assumptions and calculates the payback period.

**Financial Indexes**

For the financial part of the business case, our method will collect data on the direct costs of interventions during the development and transition phases, and all costs and savings per month during the operations phase. We defined:

$C_d$  = direct costs in the development phase

$C_t$  = direct costs in the transition phase

$C_m$  = net of all monthly costs and savings in the operations phases

Combining the above financial data elements into a single index, the final report will contain net present value (NPV) and payback period (PP). NPV represents the current financial value of the project taking into account the timing of costs and benefits. It assumes that money can be borrowed or invested at an interest rate 'r' throughout the project, so that future costs and benefits are discounted relative to present ones. The investment entails an immediate loss of ( $C_d + C_t$ ) followed by an unending stream of monthly payments of amount  $C_m$ . If  $C_m$  is negative (i.e., if the project produces financial gains in the operational phase) then for sufficiently small interest rates, NPV is positive. It is common to specify a discount rate 'r' close to the prime rate or the rate of return on 30-year federal notes. Currently a rate of 0.05 (5%) is reasonable, but a hospital may have other rates that they typically use in planning. In addition to choosing a discount rate, hospitals must select a planning horizon for the financial analysis. Effects past the horizon are not considered because of uncertainties in the context of the hospital and in medical progress.

The payback period is the number of years it takes to recoup the cost of the development and transition phases. It is calculated as:

$$PP = T_o + (C_d + C_t)/(-12 * C_m)$$

The quantity  $T_o$  is the time in years spent in the development plus transition phases, which is assumed to be one year. This formula only makes sense if  $C_m$  is negative (i.e. if the project produces financial gains in the operational phase). If instead  $C_m$  is positive, i.e., monthly costs exceed savings in the operations phases, the project can never pay back the investment.

## IV. Results

Ten of the top performing hospitals in SE Michigan were approached for the study. Seven of these hospitals agreed to participate, although a couple of them could not meet the timelines to provide all the financial information. Typically, interviews at the five facilities involved the CFO or equivalent of the hospital, a nurse who initiated the interventions, and a QI person who acted as a liason between MPRO and the hospital. Results are presented below in three separate tables. Table 3 describes the interventions adopted at each hospital and their expectations of financial and/or other gains. Table 4 shows the costs of implementing interventions. Table 5 summarizes the assumptions made to calculate the payback periods. Table 6 displays the revenue, and the payback periods calculated retrospectively.

**Table 3: Interventions and Assumptions**

Hospitals	Interventions	Financial and/or other benefits
A	<ol style="list-style-type: none"> <li>1. Remove razors from pre-op</li> <li>2. Tight glucose control in SICU and OR</li> <li>3. Anaesthesiology to take responsibility for antibiotics</li> <li>4. Pharmacist driven antibiotic ordering process</li> </ol>	<ul style="list-style-type: none"> <li>• Reduce Surgical Site Infections</li> <li>• Reduce Antibiotic Use</li> </ul>
B	<ol style="list-style-type: none"> <li>1. Preprinted physician orders for total (Hip and Knee) procedures</li> <li>2. Clinical pathway for total (Hip and Knee) procedures</li> </ol>	<ul style="list-style-type: none"> <li>• Reduce LOS</li> <li>• Reduce Antibiotic Use</li> <li>• System Efficiency</li> </ul>
C	<ol style="list-style-type: none"> <li>1. Surgical Prophylactic Program in pharmacy</li> </ol>	<ul style="list-style-type: none"> <li>• Reduce Surgical Site Infections</li> <li>• Reduce Antibiotic Use</li> <li>• Reduce postoperative re-admissions</li> </ul>
D	<ol style="list-style-type: none"> <li>1. Anaesthesiology to take responsibility for antibiotics</li> <li>2. Cardiac standing order revised</li> <li>3. Recovery administers first post-op dose of antibiotic</li> </ol>	<ul style="list-style-type: none"> <li>• Reduce Surgical Site Infections</li> <li>• Reduce Antibiotic Use</li> <li>• Reduce LOS</li> </ul>
E	<ol style="list-style-type: none"> <li>1. Multidisciplinary team implemented and the team made aware of baseline results</li> </ol>	<ul style="list-style-type: none"> <li>• Reduce LOS</li> <li>• Reduce Staff Time</li> <li>• Improved Patient Outcomes</li> </ul>

While interventions adopted in each hospital differed, all five hospitals had common financial interests, which were sought to have been achieved via the benefits mentioned above in Table 3. The interventions were planned by the QI team who carefully evaluated their current care-delivery processes, and the new ones that would be acceptable in their institutions. Their ultimate objective was to reduce surgical site infections that lead to better patient outcomes. In the process, reduced LOS and increased efficiency due to more staff time is expected to pay off. Reduced antibiotic

expenses for discontinuing antibiotics after 48 hours is a process measure that dictated clinical guidelines and the emergent savings is expected to help the hospitals in their pay-off calculation.

**Table 4: Costs of QI**

Hospital	Development Costs			Transition Costs			Operational Costs		
	Duration (in months)	Nominal Cost	Present Value	Duration (in months)	Nominal Cost	Present Value	Duration (in months)	Nominal Cost	Present Value
A	5.03	151,390	149,192	4.07	58	56	25.9	1,052	24,319
B	1.03	6,752	6,719	0.97	1,585	1,569	33.9	96	2,966
C	3.03	39,448	39,063	3.03	5,547	5,412	29.9	54	1,454
D	0.9	2,808	2,799	1	468	465	34.0	188	6007
E	3.03	144,230	142,826	2.03	3,098	3,030	30.9	936	26,106

All five hospitals started the SIP project not before 2002 and the duration of the different phases varied across hospitals along with the nominal costs as shown in Table 4. Nominal costs for the development of interventions had a wider variation and much higher than the nominal costs for the transition phase. In the operations phase, when all changes become status quo, the nominal costs were minimal. The duration of the operations phase also varied across hospitals between 25.9 months to 34 months.

**Table 5: Assumptions for Payback Calculation**

Hospital	Overhead rate for personnel	Annual Salary: Physician	Annual Salary: Nurse
A	50%	150,000	50,000
B	22%	350,000	125,361
C	20%	150,000	50,000
D	20%	235,000	58,000
E	50%	200,000	48,000

Some of the assumptions in payback period calculation stayed the same across institutions. These included the total time of three years these interventions were expected to last; annual discount rate of 6%; estimated costs of a normal bed-day and ICU/CCU day of \$450 and \$900 respectively; and \$21 per mg for Vancomycin and \$7.8 per mg for any other standard antibiotics. As evident in Table 5, there is quite a range in overheads (20% - 50%) across hospitals. The average salaries of both nurses and physicians varied; with hospital B having much higher average salaries for both involved in the QI process.

**Table 6: Revenues and Payback Periods**

Hospital	Revenue		LOS		Pharmacy Savings	NPV of Interventions	Change in monthly net revenue - Operations	Months to reach break-even
	Total Change per month	Present Value	Total Change per month	Present Value				
A	0	0	360,000	8,321,953	3,604	8,148,386	362,552	0.4
B	-3,448	-106,520	2,250	69,520	531	-48,254	-763	none
C	6,794	182,899	6,534	175,900	567	312,871	13,841	3.3
D	0	0	36,864	1,177,810	1,020	1,168,539	37,696	0.1
E	-3,597	-100,320	173,162	4,829,728	1,638	4,557,446	170,267	0.9

Two of the five participating hospitals had no change in revenue, because they did not have any patients in their pilot population that were eligible for non-DRG type payments. Two of the hospitals actually incurred a loss in total revenue; and one experienced some gain. Change in LOS was not only positive for all hospitals in the study, but the main driving force for benefits in the payback calculation. There were positive savings in pharmacy costs because of clinical standards to discontinue antibiotics within 24 hours of surgery. Net Present Value (NPV) of interventions was positive for all but hospital B, although it varied across hospitals. The resulting change in monthly net revenue was also positive for all but hospital B. When both costs and revenues were computed to calculate the payback period, there could not be a break-even point for hospital B. The others had a rapid payback for investing in quality ranging from 0.1 month to 3.3 months. Although readmissions were attempted to be factored in the NPV calculation, the data gathered from the participating hospitals in this study was unreliable and therefore unreported.

## V. Discussion-

Hospital A started developing its interventions in May 2002 with a team of physicians, nurses, quality improvement staff and a pharmacist. The interventions were very specific to the improved outcomes they wanted to attain. The staffing costs in this institution were moderate and duration of the operational phase indicated efficiency in their system. Larger hospitals like Hospital A may be more seasoned in the development and implementation of quality improvement interventions. Their costs of additional materials and supplies included purchase of 3M clippers, additional insulin and two glucometers that were specific to the interventions targeted. Hospital A did not experience a change in operational revenue. Their primary source of revenue was from reduced surgical site infections (27 per month to 17 per month), and the resultant reduction in ICU/CCU (Intensive Care Unit/ Critical Care Unit) days; although savings in pharmacy cost was also present. Revenue generated due to fewer ICU/CCU days was adequate enough to cover the costs of development, transition and operations within 0.4 months. Hospital A reported that their participation in a national SIP collaborative and the resultant image of a leader in SIP efforts in Michigan rewarded them with increased recognition in the community and they foresee this reputation to better their financial position in the long run.

Hospital B started the developmental phase of interventions in March 2003 with clearly defined objectives and a QI team that consisted of an anesthesiologist, a director of nursing, CRNA/OR director, pharmacist and QA coordinators. The staffing costs in this institution were above the Michigan average, and higher than any other facilities in the study. Hospital B focused on development and transition phases for approximately one month each. They focused a significant amount of time in the operations phase compared to other hospitals in the study. The interventions pursued by Hospital B resulted in a decrease in revenue (\$9563 to \$8184) per capita from patients not paid by DRG. Additional revenue was realized by reducing LOS (3.32 to 3.23), yet this revenue was not adequate enough to cover the loss in operations net revenue even with moderate savings from pharmacy and low overhead expenses. This hospital would not be able to cover the costs of their interventions, however may still be able to realize “non-monetized” rewards. Hospital B claims that they conceptualized a uniform post-op drug dosing, which when implemented would reap significant financial benefits. They also take tremendous pride in the fact that evidence-based medicine is practiced at their institution, made possible through QI interventions.

Hospital C ventured on SIP related interventions around July 2002. The surgical prophylactic program started by the pharmacy unit of this organization had clear objectives and was led by the pharmacist, QA assistant and public relations staff. The duration of different phases of intervention in this hospital was average and nothing out of the ordinary was noted in terms of costs. However, this hospital needed 45 meetings with an average of 1.5 hours per meeting in their developmental phase to plan the interventions. This is much higher than the average of 4-5 meetings needed by all other hospitals in the study. Although this hospital recorded an increase in revenue (\$5346 to \$8743) for its non-DRG patients, a reduction in LOS (4.3 days to 3.8 days) for DRG patients, and a decent pharmacy savings, the gains were not substantial to cover the high meeting expenses in a short period of time. Their payback period was 3.3 months. Better patient outcomes in terms of decreased mortality and morbidity were cited by Hospital C as their non-monetary gains from QI interventions.

Hospital D started planning for interventions in March 2003, with a very short development and transition phases of intervention (one month or less). Their QI team comprised of physicians, nurses, pharmacist, CRNA and Infection Control Practitioner. The costs incurred by the team in each of the phases were lower than other hospitals, with average salaries for personnel and low overhead costs. Despite the fact that this hospital did not experience any gain in revenue from non-DRG patients, their moderate gain from reduced LOS (6.3 days to 5.1 days) was sufficient to cover the costs. Their pharmacy savings were high resulting in a 0.1 month payback period. Hospital D mentioned meeting regulatory compliance as their main non-monetary benefit from a better QI process.

Hospital E developed interventions in April 2002. The duration of their development and transition phases was three and two months, respectively with an operational phase that lasted 31 months. Their QI team consisted of physicians, nurses, pharmacists, and quality management personnel, although they involved more professionals from each of these areas. The team was efficient from the stand point of resource use, because they accomplished their objectives in three meetings. Although revenue from non-DRG patients decreased after the interventions (\$2840 to \$2200), there were significant reductions in LOS for both DRG (7.5 days to 6.0 days) and non-DRG (5.7 days to 4.9 days) patients in this institution. The hospital could successfully reduce their infection rate and the number of ICU/CCU bed days declined from 21 days per patient to 17 days per patient. This gain in LOS, coupled with savings from

pharmacy led to a payback period of 0.9 months. Hospital E cited better reputation and meeting regulatory requirements as their major non-monetized benefits.

Studies by RAND, IHI, the Leapfrog Group and others report inadequacies and inconsistencies in health care. One study by RAND concluded only one-third of diabetic patients receiving adequate care leading to one-quarter of all Medicare costs. [Payers should use quality as an incentive in buying and selling services in order to reduce costs. Quality is not rewarded in either of the current payer constructs like fee-for-service which encourages overuse, or capitation which rewards under-use. Payers can promote quality through several initiatives including pay-for-performance based on quality and patient satisfaction, focusing on population based care, and use of evidence-based medicine. Although there are no statistics available as to the dollar amount payers might save with quality initiatives at various provider-institutions, all payers can benefit from patient safety measures.]

Rapidly rising health care costs are a large concern for health care purchasers who face the daunting task of reducing or eliminating benefits for their employees and retirees. These purchasers are beginning to choose payers who promote hospital quality and patient safety. In 1997, eight regional employer coalitions began to develop nationwide standards to be used by employers to compare health plans by quality measures. These standards are used to benchmark the performance of payers and raise the bar from year to year. Purchasers also play a role in promoting payers to employ quality standards.

## **VI. Limitations and Recommendations**

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In an ideal situation, perhaps the non-monetized attributes of QI could be imputed a dollar value and accounted in the formula for ROI and Payback Period. However, because of subjectivity, these remain as non-monetized benefits of investment in QI. Further, the extent to which some of the cost and revenue information could be collected was limited by the organization's infrastructure. There were gridlocks in getting to the exact accounting schema of the participating hospitals. In addition, the methodology in calculating the payback period being retrospective, a few cost details in implementing the processes may have been lost.

There is also an intangible cost for providers not to invest in QI programs because payers may be evaluating them on how they rank such programs. Lack of investment in these programs will rank them low, and payers may not choose them.

Although the selection of hospitals was based on the performance indicators in specific clinical areas, where all patients were ideal, the data was not risk-adjusted. This might potentially create a certain amount of selection bias in the estimates. Even within the State of Michigan, the cost and quality estimates that were used to calculate the payback periods depended on the hospital's location, infrastructure, bed size, teaching status, the size of the QI Department, and several other elements including patient's severity of illnesses. Adjustment for the severity of



illnesses in calculating the payback periods for these participating hospitals was beyond the scope of this study. It is therefore, advisable that comparisons of these paybacks across hospitals be made with caution.

### ***Recommendations***

Each hospital sustained minimal costs to develop, transition, and implement proposed interventions. Teams including physicians, nurses, quality improvement specialists, pharmacists and other health professionals contributed to each phase of the intervention resulting in changes in revenue and the length of stay savings. Team structure is seemingly a priority in building an organized and appropriate “think tank” conducive to carrying out an intervention as well as determining what interventions should be pursued. Team physicians and nurses must be seen as intervention champions in order to influence peers and support staff. Team structure should not be trivialized. The interventions that the team chooses to pursue have much more of an effect on the gain or loss in revenue generated by the intervention. Without the appropriate team members, hospitals and agencies may unknowingly choose interventions that do not generate revenue and therefore result in monetary loss without “non-monetized” gains. Teams must be qualified to fully examine the appropriateness of monetized and non-monetized goals in order to make accurate decisions to pursue interventions.

On the subject of readmissions, we observed that although hospitals have QI processes in place, they do not have appropriate surveillance systems to monitor infections after surgery. The tabulations for infections are often erroneous and real reductions in SSIs can only be attained through proper monitoring of these infections.