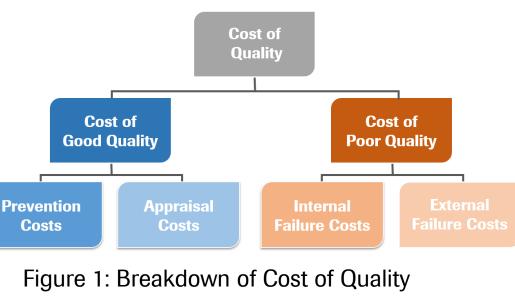# Calculating the Cost of Poor Quality: A Multi-Facility Study

Roche

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Abstract

The Cost of Poor Quality (COPQ) concept was first described by Joseph Juran in 1951[1]. COPQ can be defined as the cost of not doing something right the first time or "the costs associated with providing poor quality products or services" [2] Although it is widely accepted that poor quality costs organizations significant amounts of money[3,4,5], postulated at 20% of sales for an average company [4], there is not much published work on COPQ in the context of the clinical laboratory. Another obstacle for application and adoption of the COPQ concept is that there is no standardized and widely accepted methodology to calculate COPQ. The COPQ concept can be useful in demonstrating the financial value provided to a clinical laboratory or hospital by its quality program through the cost avoidance and cost savings realized through elimination of root causes of nonconforming events. Without the intervention provided through the nonconforming event management system and quality improvement initiatives provided by the quality program, the laboratory and/or hospital would continue to experience financial losses for these events, in addition to potential patient safety risks. This study sought to develop a standardized tool incorporating feedback from leaders from multiple facilities in different geographical locations and across a variety of types and sizes of laboratories. A standardized COPQ worksheet, referred to as the COPQ Calculator, was developed and tested by seven leaders from multiple facilities across the USA. Feedback was incorporated and the resulting COPQ Calculator was then deployed at the same seven facilities for a study on seven types of nonconforming events commonly encountered in the clinical laboratory: Specimen Mislabel, Instrument Downtime, Test Reruns, Proficiency Testing Failures, Corrected Reports, Product Recalls, and Turnaround Time Delay. This poster presents ranges for each type of event, as well as the median and average COPQ figures for each event type. The goals of this study are to provide a widely available, interactive tool for laboratory professionals to calculate COPQ as well as to provide COPQ figures for common event types that laboratory professionals can reference when articulating COPQ in their facilities. It is the hope of the authors that understanding, articulation and examples of the COPQ concept in the clinical lab will help laboratories to gain financial investment and executive buy in for their quality programs.

Introduction

The Cost of Poor Quality (COPQ) concept was first described by Joseph Juran in 1951[1]. COPQ can be defined as the cost of not doing something right the first time or "the costs associated with providing poor quality products or services" [2] Although it is widely accepted that poor quality costs organizations significant amounts of money[3,4,5], postulated at 20% of sales for an average company [4], there is not much published work on COPQ in the context of the clinical laboratory. Another obstacle for application and adoption of the COPQ concept is that there is no standardized and widely accepted methodology to calculate COPQ. The COPQ concept can be useful in demonstrating the financial value provided to a clinical laboratory or hospital by its quality program through the cost avoidance and cost savings realized through elimination of root causes of nonconforming events. Without the intervention provided through the nonconforming event management system and quality improvement initiatives provided by the quality program, the laboratory and/or hospital would continue to experience financial losses for these events, in addition to potential patient safety risks. Internal failure costs are incurred to remedy defects discovered before the product or service is delivered to the customer[6]. External failure costs are incurred to remedy defects discovered by customers[6]. COPQ figures can be either hard or soft. Hard COPQ data arises from cost accounting calculations related to an event resulting largely from rework (labor, supplies, reagent, QC materials, etc.). Hard costs directly impact the budget and Profit & Loss statements. Soft costs are those costs for which we know there is a financial implication, but it is not possible to calculate via cost accounting. Examples of soft costs include low morale and reputational damage. This study sought to develop a standardized tool incorporating feedback from leaders from multiple facilities in different geographical locations and across a variety of types and sizes of laboratories. The goals of this study are to provide a widely available, interactive tool for laboratory professionals to calculate COPQ as well as to provide COPQ figures for common event types that laboratory professionals can reference when articulating COPQ in their facilities.

Figure 1: Breakdown of Cost of Quality

Materials & Methods

A standardized COPQ worksheet, referred to as the COPQ Calculator, was developed utilizing Microsoft Excel and tested by seven leaders from multiple facilities across the USA. Both hard and soft costs were considered in the calculations. Feedback was incorporated and the resulting COPQ Calculator was then deployed at the same seven facilities for a study on seven types of nonconforming events commonly encountered in the clinical laboratory: Specimen Mislabel, Instrument Downtime, Test Reruns, Proficiency Testing Failures, Corrected Reports, Product Recalls, and Turnaround Time Delay. Refer to the COPQ Calculator in Figure 2 (note version 1.4 used for study, version 1.6 displayed). The group met August 16th, 2017 in Indianapolis, Indiana for a full day to discuss use of the COPQ calculator and to calibrate on COPQ calculations. Data was collected from 6/27/2017 to 10/16/017. Microsoft Excel was utilized to analyze the data.

Results

COPQ data was collected by the contributors for the seven facilities for the seven nonconforming event types. Refer to figures 4 and 5 for a full summary of the results.

Discussion

Most participants expressed frustration with the use of the COPQ calculator initially, particularly when calculating or estimating soft costs. All facilities took a different approach to the calculation of soft costs largely based on availability of data and management's tolerance for inclusion of estimated figures. All agreed that after a few times using the calculator, it became much easier and they were able to utilize it in a standardized, reproducible way. Hard costs were easier and more straightforward to calculate. All agreed that these cost accounting portions of the calculator were performed in a standardized manner. Contributors devised creative calculations for soft costs such as low morale. Examples include percentage of overall daily revenue or percentage of an employee's wages. Most contributors expressed the inability to fill out COPQ calculators for all nonconforming events reported in their labs due to lack of resources. Considerable intrafacility and interfacility variability exists for COPQ for the same event type. All participants agreed that capturing COPQ was eye opening as it provided insight not previously available to them about the financial impact of quality issues in their laboratories. Ongoing use of the tool will vary amongst the participating facilities.
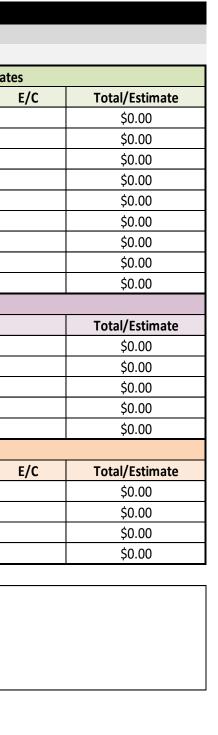
Cost of Poor Quality Calculator (v1.6)

Figure 2 (above): COPQ Calculator

Figure 4 (below): Summary of Results

Conclusion

The contributors to this study reached consensus on a standardized tool for COPQ calculation. All contributors to this study successfully utilized the tool to collect COPQ data for the seven types of nonconformities for the duration of the study. The COPQ data from the 119 nonconformities captured will be published and available for laboratorians to reference in order to articulate the financial implications of nonconformities in their laboratories.

Key takeaways from this study include:

- The COPQ Calculator is a useful tool that aids laboratories in calculating COPQ in a standardized manner
- Calculating COPQ helps labs to understand the large amount of waste in their everyday operations
- Capturing COPQ data allows labs to more effectively triage nonconforming events for remediation
- It is necessary to meet with management prior to starting collection of COPQ data to ensure that you are collecting meaningful data for your organization
- There are varying levels of buy in to the inclusion of soft costs in COPQ calculations
- Although difficult to collect data and gain buy in for soft costs, it is a worthwhile exercise in order to fully understand the holistic impact of events
- Demonstration of cost avoidance and/or cost savings can help justify additional investment in quality
- The variation within and amongst labs for the same event type was significant despite the use of a standardized tool. This is due to the variables surrounding each event and the unique laboratory environments in which they occur. For this reason, external benchmarking of COPQ data has limited value. Internally however, aggregate COPQ data can be useful for reasons listed above.
- Different approaches to collection of COPQ data are taken based on availability of resources and number of events. Some labs will choose to calculate COPQ data for all events, while others will take a few representative events for each type to determine an average COPQ for the event, enabling application of an average number to their monthly and annual frequency of occurrence number to obtain an understanding of the overall COPQ impact. Additionally, some may choose to only calculate COPQ for single issues that are particularly problematic or ongoing.
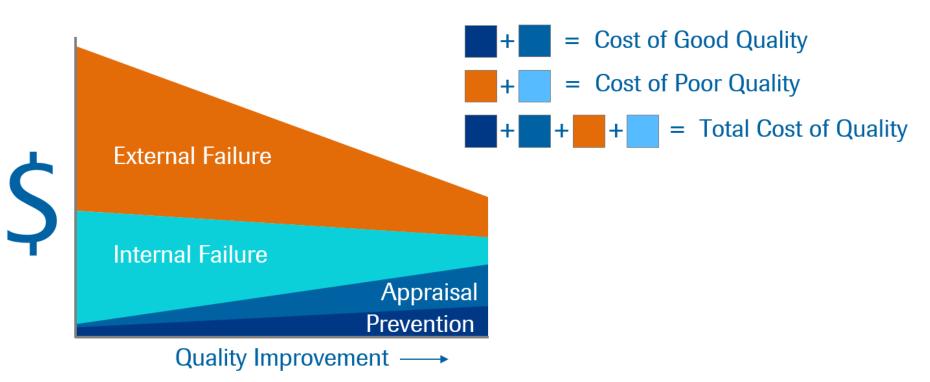
Capturing the COPQ associated with each nonconforming event or near miss allows laboratory leadership to quantitate the financial benefit of quality initiatives. This further allows lab leadership to speak the language of key executives in the organization whose interest invariably lies in the financial bottom line. Approaching executive management armed not only with quality and patient safety benefits, but also with an indication of financial benefit will allow the lab to sell proposed quality initiatives effectively. Poor quality and rework create unnecessary financial losses to an organization. Assigning a monetary value to that waste provides the motivation to eliminate it. Figure 6 summarizes the concept that investment in cost of good quality results in lower cost of poor quality and overall cost of quality reduction[1]. It is the hope of the authors that understanding, articulation and examples of the COPQ concept in the clinical laboratory will help laboratories to demonstrate the implication of nonconforming events in their laboratories and the cost avoidance and cost savings achieved through elimination of root causes enabling them to gain financial investment and executive buy in for their quality programs.

Figure 6 (above): Typical Progression & Relationship of Cost of Quality Components (not to scale)

Nonconforming Event Categories & Phases of Examination

Phase	Event
Preexamination	Specimen Mislabel
Examination	Instrument Downtime
	Test Reruns
	Proficiency Testing Failures
Postexamination	Corrected Reports
	Product Recalls
Total Testing Process	Turnaround Time Delay

Figure 3 (above): NCE Types & Corresponding Phases

COPQ by Event Type

Figure 5 (above): Box & Whisker Plot of COPQ Data by Event Type
(2 points >$100,000 excluded from figure)

References

1) http://www.contesolutions.com/PP_Cost_of_Poor_Quality.pdf, Accessed 9/22/2017
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3) Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations, Mikel Harry, PH.D., and Richard Schroeder. Crown Business, 2006.
4) CLSI. Understanding the Cost of Quality in the Laboratory; A Report. CLSI document QMS20-R. Wayne, PA; Clinical and Laboratory Standards Institute; 2014.
5) Clark T. *Success through Quality*: ASQ Quality Process, 1st edition, 1998.
6) American Society for Quality, www.asq.com, Accessed 10/21/2017.

Nonconforming Event Category	n	Total Hard Cost COPQ				Total Soft Cost COPQ				Total Internal Failure COPQ				Total External Failure COPQ				Total COPQ		
		Range Low	Range High	Mean	Median	Range Low	Range High	Mean	Median	Range Low	Range High	Mean	Median	Range Low	Range High	Mean	Median	Range Low	Range High	Avg	Median
Specimen Mislabels	10	$79.03	$1,318.87	$399.43	$189.42	$0.00	$29,450.30	$7,266.65	$206.93	$61.89	$13,124.91	$1,087.78	$206.14	$0.00	$16,630.00	$6,578.30	$100.00	$114.86	$29,754.91	$7,666.08	$206.93
Instrument Downtime	22	$56.33	$3,565.00	$591.42	$203.65	$0.00	$16,285.54	$3,251.23	$116.46	$87.54	$3,965.00	$887.74	$320.11	$0.00	$14,404.00	$2,954.91	$0.00	$100.15	$17,700.89	$3,842.65	$338.36
Test Reruns	4	$136.12	$8,949.00	$840.29	$692.47	$3.50	$16,236.20	$550.00	$50.00	$1,055.40	$9,249.00	$890.29	$742.47	$0.00	$13,754.00	$500.00	$742.47	$1,056.98	$17,193.75	$1,390.29	$742.47
Proficiency Testing Failure	14	$139.78	$5,520.00	$52.09	$41.04	$0.00	$50,000.00	$82.14	$50.00	$206.53	$5,920.00	$52.09	$41.04	$0.00	$50,000.00	$82.14	$50.00	$206.53	$51,680.18	$134.23	$107.02
Corrected Reports	35	$28.43	$2,469.66	$981.44	$174.77	$0.00	$52,056.74	$3,931.86	$100.00	$28.43	$4,511.97	$2,054.24	$541.38	$0.00	$50,014.43	$2,859.06	$50.00	$31.41	$54,526.40	$4,913.30	$541.38
Product Recall	6	$127.20	$1,849.00	$103.74	$87.08	$0.00	$2,100.00	$200.00	$100.00	$127.20	$1,949.00	$83.72	$87.08	$0.00	$2,000.00	$220.01	$160.04	$127.20	$3,949.00	$303.74	$267.77
Turnaround Time Delay	28	$20.92	$2,849.98	$291.14	$88.08	$0.00	$103,529.50	$6,529.16	$175.00	$20.92	$6,212.48	$459.45	$88.08	$0.00	$99,967.00	$6,360.85	$175.00	$20.92	$106,179.48	$6,820.30	$232.16

Note for Figure 4: Total Hard Cost COPQ, Total Soft Cost COPQ, Total Internal Failure COPQ and Total External Failure COPQ low and high range values are lowest and highest reported values for each event type, independent of Total COPQ values. Total Hard Cost COPQ + Total Soft Cost COPQ and/or Internal Failure COPQ + Total External Failure COPQ will not necessarily equal Total COPQ for a given event type because the low and high values may have come from different events in that NCE category Total COPQ low and high range values are the lowest and highest reported Total COPQ values for a single event for each event type using the COPQ calculator.

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