White Paper:

Reduction of Verification Errors at the PSC that Lead to Billing-Related Errors

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Version 5

Problem Background

In 2006, a large regional provider of clinical lab services implemented Lean Six Sigma in order to improve services to its customers. Its goal was also to improve its competitive position relative to the large providers of the same type of services, such as Quest Diagnostics or LabCorp. A Six Sigma council was established and determined that one of the initiatives of the first year should be to reduce the billing-related data errors that resulted in delayed collections or rejects from the private and government insurance sectors. In accordance with well established Lean Six Sigma principles, a champion, a green belt, a team, and a process owner were identified. The scope of the project was determined from the time the patient is called from the waiting room to finalize the registration to the time the patient is ready for draw. As part of this project, the actual drawing process and the preparation and hand off to the courier were excluded from the process. Thus, the main focus of the project was the inputs, throughputs, and outputs of the registration process into the billing and medical LIS system; the accuracy of the information for billing and reporting purposes; and the time impact the existing registration process of the multiple locations had on receiving payment for the rendered services from the client.

Define Phase

The **business case** for the project was that the non-verification of key patient information at the patient service center (PSC) resulted in multiple errors. This impacted patient and physician satisfaction, increased the need for problem resolution upstream in the process by customer service, and, most importantly, caused large accounts receivables outstanding and then resulted in bad-debt write-offs, particularly at the end of the year.

The **problem statement** was defined as follows: The current process of verification of patient information differed between various sites and provided multiple opportunities for data entry errors affecting upstream processes such as accessioning, test reporting, and, most importantly, billing. In addition, a first review of the registration process revealed that the time to register patients was too long, resulting in long wait times for patients at peak hours. These long wait times typically occurred in the morning when patients were fasting prior to their blood being drawn.

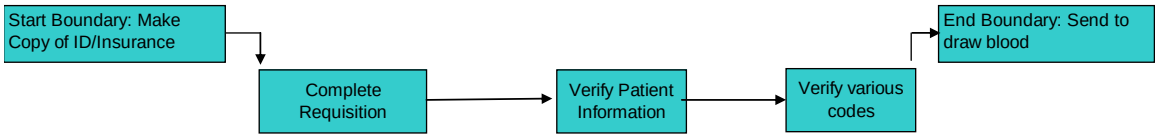
A **high-level process map** called a SIPOC (Supplier, Input, Process, Output, Customer) was developed in order to determine the exact scope of the project and to prepare the green belt for feedback from suppliers, a review of the inputs, the measurement and determination of the sigma score of the output, and the voice of customer review. A SIPOC is a high-level process map used in the Define stage to focus the project and stands for Supplier, Input, Process, Output, and Customer. Figure 1 shows the SIPOC for the project.

Figure 1: High-Level Process Map (SIPOC)

SIPOC DIAGRAM

Process/Project Name:	**Green Belt Name**
Date:	**7-Oct**
Prepared By:	**Green Belt Name**
Notes:	**N/A**

Suppliers	Inputs	Process	Outputs	Customers
Provider	Input Description		Output Description	Recipient of Output
Patient	ABN Code	See High Level Process Steps Below	Verified Patient Information	Accessioning
Physician	ICD 9 Code			Reporting Technician
Other administrators	Patient ID			Medical Director
	Driver's License			Biling
	Social Security #			Client
	Insurance Card			Insurance
	Script			Physician
	Physician Name			
	Physician UPIN			
	Physician Follow up			



The SIPOC is a critical tool because it focuses the project leader on key suppliers and their inputs into the process, a listing of the key inputs that determine the output of the process, and the key customers. In Lean Six Sigma, we operate based on the principle that the definition of defects are determined by our customers (for example, billing information missing or wrong) and that the level of defect output is a function of the inputs from the suppliers into the process. Outputs and their defect rates are often symbolized by an uppercase "Y" while inputs are symbolized by lowercase "x's." In the Measure phase, we determine the level of defects in Y (billing errors), while in the Analyze phase we determine which inputs (x's) have the most impact on the current defect rate. By reducing the defects of the inputs, we then reduce the number of defects. The simple formula for this idea is often symbolized by $Y = f(x)$. The formula also focuses the project leader on identifying the "vital fews" that create the defect rate.

Measure Phase

The Measure phase also follows a structured procedure. In a first step, the project leader and his or her team determine the current measurement and its validity. This is also known as a measurement systems analysis (MSA). At the beginning of this project, the procedure to sample the errors that could have been caught at the PSC was non-scientific, according to the following procedure.

Existing Measurement System

Each PSC sent three randomly selected requisition numbers daily to a clerical assistant. It became immediately clear that the randomization procedure was not defined. Also, the

number of requisitions was determined based on convenience rather than scientific calculations.

At the end of each week, the clerical assistant logged onto the requisition scanning tool, reviewed each requisition that had been provided, and recorded the findings on an audit spreadsheet. Twelve categories for billing were reviewed and errors recorded. The total number of requisitions reviewed per site was then multiplied by the total number of categories. Total correct was then calculated as a percentage. All categories being audited were determined after dialogue with the Billing Department in response to the most frequent errors being reported on OSFERs (Offsite Fixable Edit Reports). The problem with this procedure was that it deflated the error rate by making each field on the requisition rather than the requisition itself the unit of measurement. In addition, the clerical assistant had no guidelines as to what constituted an error as defined by Billing other than the verbal discussion.

The same procedure was followed for the calculation of the percentage rate of patient demographics. A total of 11 categories were reviewed and errors recorded. The total number of requisitions reviewed per site was then multiplied by the total number of categories. Total correct was then calculated as a percentage. These categories were determined in response to most frequent registration errors after dialogue with Customer Service.

Finally, for standing orders, twelve categories were reviewed and errors recorded. The total number of requisitions reviewed per site was then multiplied by total number of categories. Total correct was then calculated as a percentage. These categories were determined in response to most frequent errors on standing orders.

Interestingly, the measurement system with all its flaws was only used for purposes of monthly reporting that was stored on a shared drive and never communicated to the managers of the PSC nor to the PSC employees.

The first step in the Measure phase, therefore, was to totally revamp the measurement system. Sample size became determined using scientifically-derived formulas. In addition, the unit of measurement was changed to the requisition rather than the individual field in order to counteract the deflation of error rates that are a product of the unit of measurement. Random sampling was conducted using a random number generator rather than haphazard sampling, which technically is not a form of random but of convenience sampling. Finally, the team went through an exercise to determine which of the fields on the requisitions truly have an impact on the reporting and the billing of information. The purpose was to reduce the number of fields to be reviewed by the auditor. At the inception of the project, the auditors were reviewing a total of 39 fields. In order to reduce the number of audited fields to the "vital few," an XY matrix was used. It showed the requisition fields in the rows and the outputs in the columns. The team decided on five critical outputs: (1) accuracy of reporting, (2) timeliness of the reporting, (3) accuracy of billing, (4) timeliness of billing, and (5) call volume. The relative impact of missing or wrong information in each field was then correlated with the impact on the

output using a scale from 1-9. After reviewing the fields and their impact on the five critical outputs, the number of fields was reduced to a total of 23. Figure 2 shows the XY matrix. The color scheme clearly indicates which fields are related to what output. The XY matrix also shows the relative ranking on the right hand side of the matrix.

Figure 2: XY Matrix

XY Matrix

Project: Improved Verification of Information at PSC

Date: #######

DEMO | View Results | Delete | Instructions

		1	2	3	4	5	6	7	8	9	10		
	Output Variables (Y's)	Accuracy of Report	Timeliness of Report	Accuracy of Billing	Timeliness of Billing	Call Volume							
	Output Ranking	9	7	9	7	3							
	Input Variables (X's)	Association Table										Rank	% Rank
1	Last Name	9	9	9	9	7						309	8.00%
2	First Name	9	9	9	9	7						309	8.00%
3	Test Requested	9	9	9	9	7						309	8.00%
4	Date of Service	7	7	9	9	7						277	7.17%
5	Ordering Physician	3	7	9	9	7						241	6.24%
7	Date of Birth	7	1	9	9	7						235	6.08%
8	Gender	7	1	9	9	7						235	6.08%
9	Street/City/Zip	1	1	9	9	7						181	4.68%
10	"Billed To" is Marked	1	1	9	9	7						181	4.68%
11	Patient Relation	1	1	9	9	7						181	4.68%
12	UPIN	1	1	9	9	7						181	4.68%
13	Diagnosis	1	1	9	9	7						181	4.68%
14	Policy #	1	1	9	9	7						181	4.68%
15	Plan Name	1	1	9	9	7						181	4.68%
16	Insurance Company Address	1	1	9	9	7						181	4.68%
17	Insurance Name	1	1	9	9	7						181	4.68%
19	"Billed To" is Marked	1	1	9	9	7						160	4.14%
21	ABN	1	1	9	9	7						160	4.14%
22	Subsriber Name (from Card)	1	1	9	9	7						160	4.14%
23	Time collected	7	7	1	1	1						128	3.31%
24	Home Phone	1	1	1	1	1						32	0.83%
26	SSN	1	1	1	1	1						32	0.83%
28	Frequency and Duration	1	1	1	1	1						32	0.83%
29	Ordering Physician Address	1	1	1	1	1						32	0.83%
30	Start/End Date	1	1	1	1	1						32	0.83%
18	Phlebotomist Initial	1	1	1	1	1						32	0.83%
31	Order expired	1	1	1	1	1						32	0.83%
15	Group #	1	1	1	1	1						32	0.83%

Also, a continuous audit system for timely completion of the measurements was established, and the report was distributed to upper management within five business days of the following month. This intervention in itself proved to be fruitful because it created an awareness at the manager level and also engaged the supervisors of the PSC staff to give feedback to their employees about reoccurring errors.

At this point it should be clearly mentioned that so called “quick hits” that improve a process should be implemented immediately after feedback from the champion. Also, Lean Six Sigma professionals should not get hung up on trying to avoid the infamous “Hawthorne Effect.” The purpose of Lean Six Sigma is the decrease of defect rates. If a

Hawthorne Effect (i.e., the measurement system itself) contributes to the reduction in defects that is okay. Care should be taken, however, that the intervention only yields results as long as the "spotlight" is on the problem. This is where the Control phase and the ongoing improvement efforts also known as "kaizen" come into play.

The Six Sigma Calculation

Data was gathered for two consecutive months in order to determine the sigma baseline. The team was conservative in its assumption of defect opportunities and decided that a requisition could have missing or wrong information or not. Thus, the number of defect opportunities was assumed to be one. There is some disagreement among Six Sigma practitioners in regards to the calculation of defect opportunities. The more defect opportunities, the higher the sigma level will be. The main issue at hand was if unnecessary work was performed on a bill because the information on the requisition gathered by the phlebotomists at the PSC was wrong or missing. As a result, the team decided on one defect opportunity per requisition. Out of a total of 746 requisitions, 346 showed a defect that resulted in billing rework. From a Six Sigma point of view this translates into a defect per million opportunities (DPMO) of 463,807 or a sigma level of 1.62. Figure 3 shows the calculation of the number of units reviewed, the number of defects, the defect opportunities (one per requisition), and the DPMO. The sigma score calculation assumes that the data is discrete (right vs. wrong). A more complex method could have been used, but the company was more interested in the financial implications of the current defect rate.

Figure 3: Sigma Calculation Using the Attribute Data Method

Calculating Process Sigma: Method 1

1. Determine number of defect opportunities per unit	**O** =	1
2. Determine number of units processed	**N** =	746
3. Determine total number of defects made (include defects made and later fixed)	**D** =	346
4. Calculate Defects Per Opportunity	**DPO** = $\frac{D}{N \times O}$ =	0.46381
5. Calculate Yield	**Yield** = (1 – DPO) x 100 =	53.619%

DPMO = 463807

The Financial Implication

The financial implications were calculated based on two premises:

1. The direct impact of lost revenue to the bottom line, and
2. The cost it takes to do the rework in order to gather the missing information not captured at the PSC.

In this case, the increased accounts receivables were not included in the actual savings as they are soft savings that are more difficult to measure and interpret.

A review of the billing errors yielded that 82.8% of all errors resulted in a billing-related issue. It was estimated that four FTEs were needed to resolve at least part of the billing problems caused by the lack of data verification. Also, for each of the requisitions that had missing information or information that was not verified at the PSC, the group determined if the money was recovered or if the requisition had to be written off. The group determined that a total of 12.5% of all requisitions with billing-related errors had to be written off.

While the list price of the reviewed requisitions had an average of $290, the more conservative Medicare reimbursement of $35 per requisition was taken as the baseline for write-off. Of the total random sample of 746 requisitions, 12.5% had to be written off. While the numbers looked relatively small in the sample, the annualized figure showed a serious shortfall in revenue due to lack of critical information at the first point of verification. A review of the last year's figures showed that about 60,000 requisitions were generated by the PSCs. With 60,000 requisitions at a value of $35 and 12.5% of all requisitions written off, the impact to the company was $262,500 in lost revenues. In addition, four clerical FTEs were needed to recover the information that was eventually billed, resulting in an additional cost to the organization of approximately $70,000. (This number was derived from the HRIS system.) Thus, the annualized cost of the non-verification of critical information at the PSCs was estimated to be $332,500.

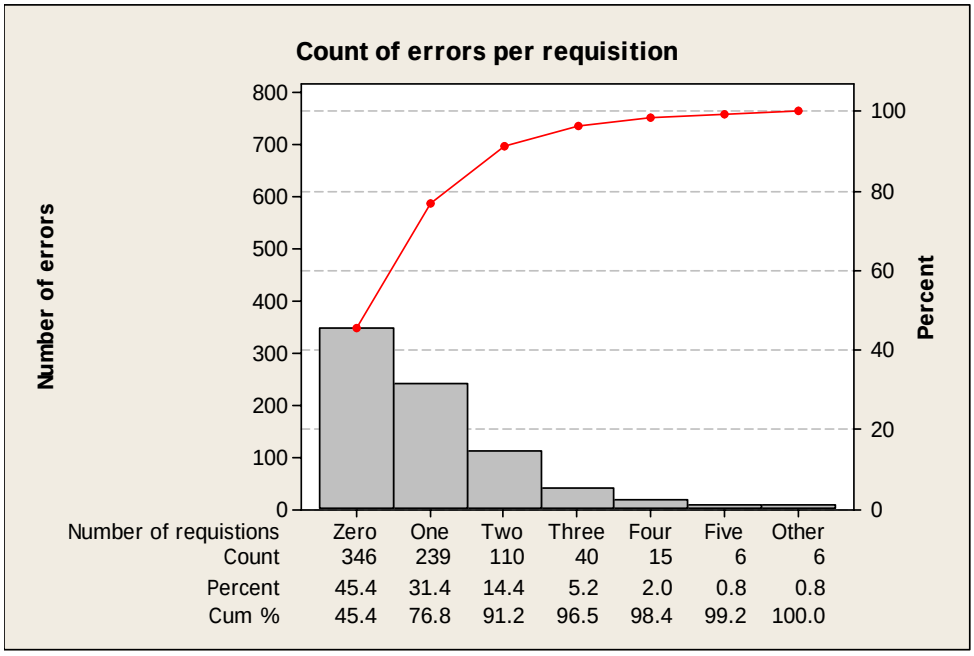
The sigma and DPMO scores did not fully show the financial impact of the current practices at the PSCs. However, it has become a rule of thumb that green belt projects should improve a sigma score by 25% while a black belt project should improve the sigma score by 50%. This rule of thumb is used when it is difficult to track the exact savings or revenues in the form of EBIT (earnings before income and taxes). If EBIT can be clearly calculated, the rule of thumb is that green belt projects result in savings or revenues of about $50,000 while black belt projects should result in savings or revenues of about $250,000. The CEO and the Six Sigma team decided that this project should yield a decrease in non-billable revenues of 25% from its baseline. In the case of test turnaround, a goal of a 25% reduction in reduced sigma score may be more appropriate because the actual financial savings are more difficult to quantify.

Analyze Phase

In the next step, the team analyzed the frequency of errors. Figure 4 shows that the majority of the requisitions had between 0 to 2 errors; the maximum number of errors per

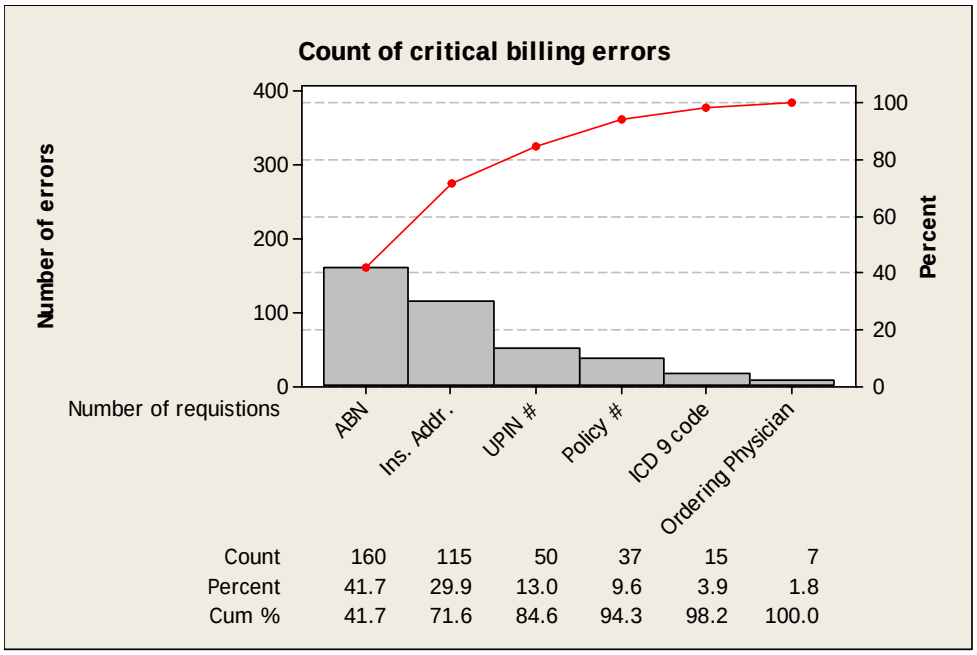
requisition was seven. 55% of all requisitions had at least one error. 83% of all errors on the requisition potentially resulted in a billing issue.

Figure 4: Counts of Errors



The next frequency table shows the key errors that the group honed in on in order to determine why, when, how, and where they occur. These six errors are the ones that had the most impact on the Billing Department.

Figure 5: Frequency of Billing-related Errors



After the initial baseline measurements, the team proceeded to the analysis phase. The analysis of the error distribution by PSC showed that there was no systematic relationship with the location. As a matter of fact, the number of errors per site correlated highly with the total number of requisitions.

In order to determine the root causes of the error rates, the team decided to use a Failure Mode and Effect Analysis (FMEA). The failure mode and effect analysis is a tool that is used to identify the frequency of the occurrence of a defect (occurrence), the relative impact of the defect on the output (severity), and the detectability of the defect (detectability). Based on a 1-10 scale for each of the three ratings, a risk priority number (RPN) is calculated. In addition to this information, the failure mode and effect analysis also shows what potentially causes the defect (root cause analysis) and what actions should be taken if a failure is detected. Each defect can have multiple impacts or root causes. The risk priority number allows the team to determine where the highest risk of a defect is and subsequently what the best intervention will be. The Failure Mode and Effect Analysis is a complex analytical tool that is difficult to present. Therefore, the output of the FMEA is often presented via a simple Pareto chart or a fishbone diagram. In the case of this project, the number of root causes was so high that a fishbone diagram was more effective in keeping track of the various root causes of the error rate. The fishbone diagram decomposes the root causes into six categories:

1. **Measurement:** At the point of the project start, the measurement system was not coordinated with Operations, was unreliable, and there was no standard format of reporting. Most importantly, the defect rate was calculated but no feedback was given to the individual phlebotomists. Also, the data could not be analyzed because the information was not in a format that allowed for trending.

2. **People:** It became clear through the FMEA that turnover was high in the PSCs and that there was no mechanism for training on critical knowledge related to the verification of billing information. Also, many phlebotomists were not aware of the financial impact of missing or wrong information. Finally, the phlebotomists had no back up in Billing for inquiries about billing-related information.

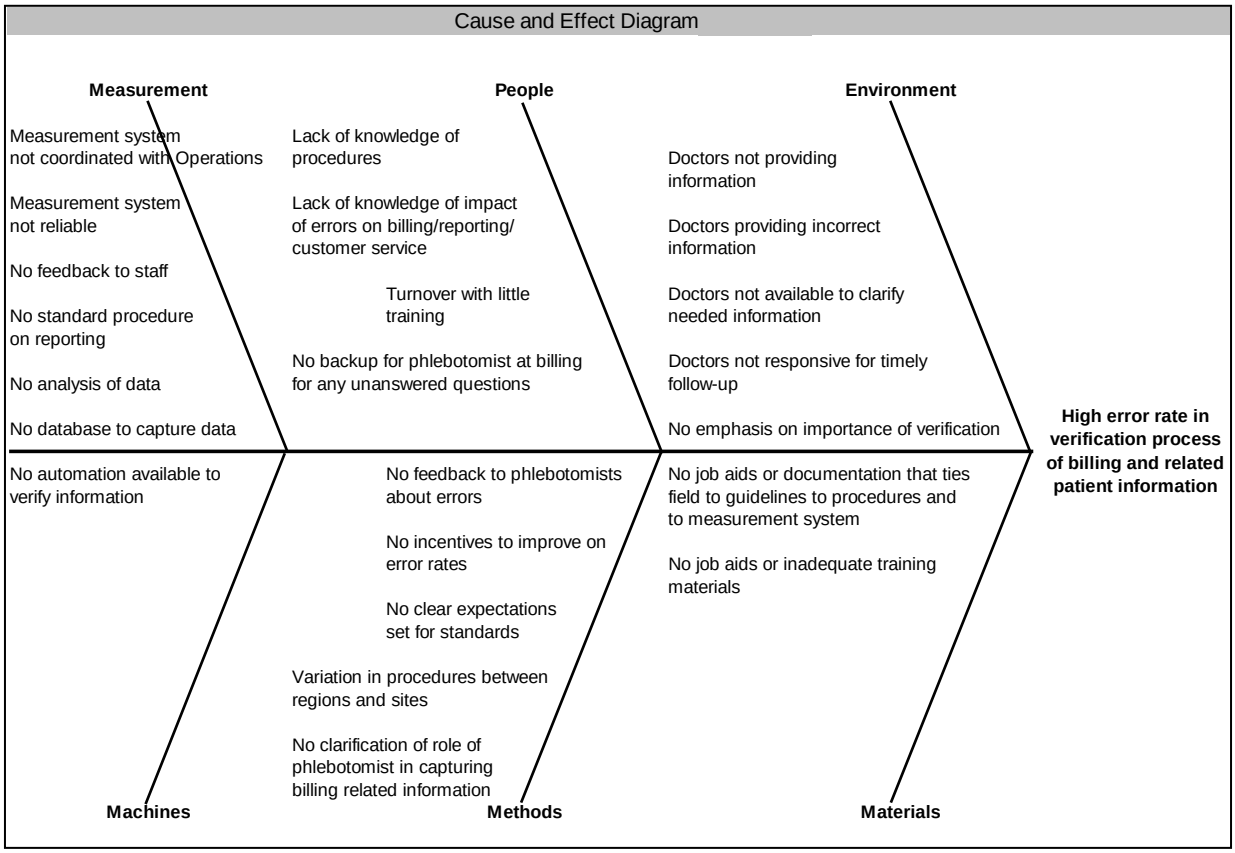
3. **Environment:** The environment is not in the control of the phlebotomists, but it became clear that often doctors did not provide full information and that the communication between the doctors' offices and the phlebotomists was limited.

4. **Methods:** There were no clear procedures documented that determined what information had to be verified and how the information was to be captured. This resulted in variation between sites and between phlebotomists and often made it difficult for billing personnel to identify the information once the requisition was entered into the billing system and scanned.

5. **Materials:** Related to the lack of standard procedures, the phlebotomists had no job aids or documentation that allowed them to tie the insurance and other guidelines to the correct verification procedure.

6. **Machines:** Finally, there was no automation available to verify the information. The following fishbone diagram shows in summary form the main root causes of the billing-related errors.

Figure 6: Summary of FMEA in the Form of a Fishbone Diagram



Improve Phase

Equipped with this information, the team was now ready to determine critical interventions that reduced the billing-related errors.

As a first step, a document was created that clearly identified the field name and the policy of Medicare/Medicaid or the organization. An additional column contained the impact of an error if the information was not verified. Finally, an error coding scheme for the measurement system was included in the document. Before the project, there was no clear code of error classification. Figure 7 shows the first fields of the procedure documentation.

Figure 7: Extract of a Procedure

Name of Field	Guideline	Impact of Error	Procedure	Error Coding
ABN	Medicare requires obtaining an ABN under 2 conditions: A. Medical Necessity, and B. Frequency. A. Medical Necessity • Medicare has decided that it will only cover tests that meet Medical Necessity guidelines.	Cannot bill Medicare. Lost revenue.	A. Medical Necessity • Check the medical necessity coverage policy by reviewing NCD (National Coverage Determination) book. • Have patient sign a completed ABN form for the particular test(s) not covered. • Attach form to requisition.	1. If test is marked on requisition as Medicare Limited Coverage Policy and no ABN form is attached, mark this as error. 2. If test is a Medicare Wellness Screening test (frequency) and no ABN is attached, mark this as error.

In a second step, refresher training on this document was administered to all existing phlebotomists, and the training was included in every new hire training.

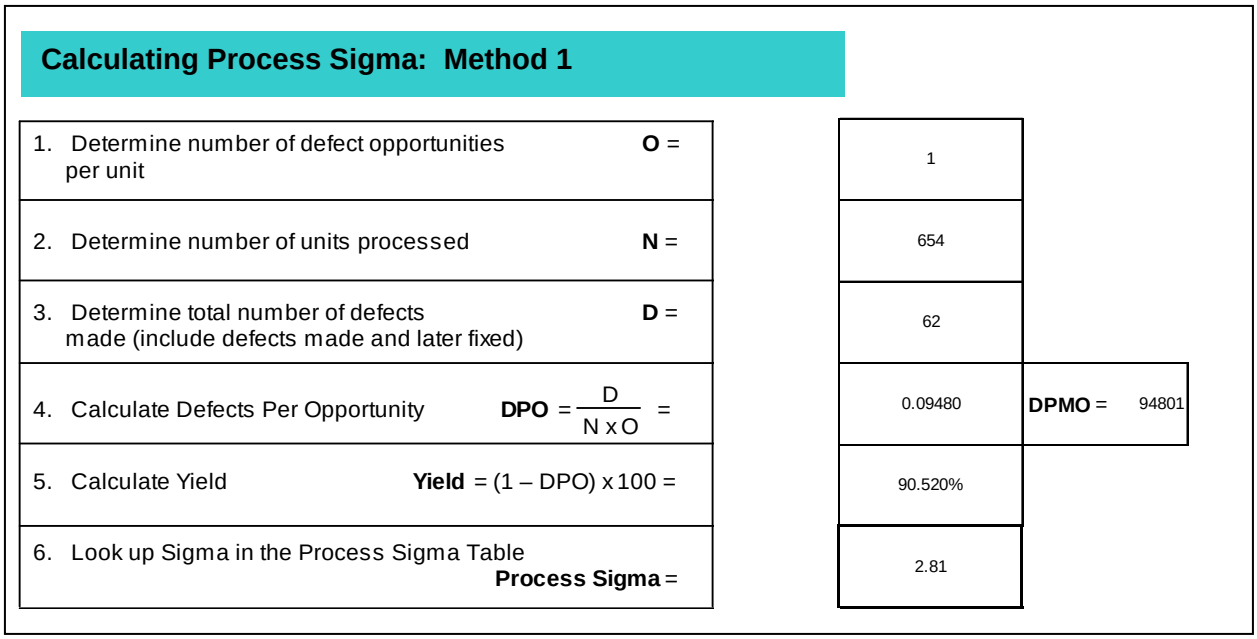
The team created a measurement and reporting procedure including guidelines for analysis and reporting of errors to the individual phlebotomists and the organization. The phlebotomists received feedback on a weekly basis. The Quality Council reviewed the overall performance of each site on a quarterly basis to determine upward or downward trends. This intervention proved to be highly effective as it allowed for immediate feedback and overall trending.

Next, an Atlas system was installed into each PSC. This reduced the need for duplicate data entry into the reporting LIS system and the billing system. The IT system also included prompts that alerted the phlebotomist to potential data entry errors.

Control Phase and Financial Benefits

The implementation of the training and awareness program took a total of two months. During this time, the error rates were monitored and a final check for error reduction was completed in the third month after the initialization of the interventions. A total of 654 requisitions were randomly selected. The total number of errors was 62, reducing the error rate to 9.5%. This resulted in a DPMO of 94,801 and a sigma score of 2.81 (Figure 8). This in itself is a vast improvement.

Figure 8: Revised Sigma Score



Most important, however, was the financial gain that resulted in the reduction of billing-related errors. This was the main focus of the project. Errors were reduced primarily as they relate to ABN, insurance address, UPIN, ICD9 code, and date of service errors, i.e., the information that inhibits an outreach program from being reimbursed for its services. Most importantly, the number of non-billable requisitions was reduced to less than 0.5% from its original level of 12.5%! Table 1 shows the dramatic decrease in lost revenues. Granted, there is still room for improvement.

Table 1: Improved Write-off

	Before Intervention	After Intervention
Total Requisitions (annualized)	60,000	60,000
% of Total Requisitions Written Off	12.50%	0.05%
Write-off Amount	$262,500	$10,500

In addition to the improvement in quality score and the better financial position, the number of FTEs that obtained the information once the requisition was in the hand of Billing reduced from four FTEs to one FTE. This resulted in the reallocation of three FTEs to more productive usage.

Conclusion

The project clearly demonstrated to the organization the power of a structured approach to problem-solving such as Lean Six Sigma. Lean Six Sigma can dramatically decrease the error rate and improve the bottom line performance and at the same time improve the productivity of existing resources. In order to be conservative, the financial calculation

did not include additional costs such as outbound calls, prolonged revenues outstanding, etc. The measurement system implemented during the intervention also showed that management is greatly facilitated by effective, timely information that is communicated to the critical channels without putting blame on any of the parties involved in the process. In order to sustain the gains of the project, the measurement system and the process was officially handed over to the parties involved and the measurement system was made part of the ongoing performance review of the point of data verification in the process. It is still in use today.

In summary, the intervention demonstrated to the organization that a combination of lean and Six Sigma is the best approach to improve employee morale; the quality provided to customers, shareholders, and other stakeholders; perceived value; and the bottom line of the organization. As the case study has shown, this particular intervention used more of the Six Sigma rather than the lean tools. It is therefore a testimony to the fact that the healthcare industry benefits best from an effective blend of both methodologies and that it is best served when using the right methodology for the right problem. Each of the two methodologies has their place in the improvement of lab industry-related issues. Unfortunately, it is only lately that the correct matching of the problem solving methodology with a specific problem has come to the attention of healthcare providers. Healthcare still has a long way to go until all tools and methods that we have developed over the past 50 years will be deployed effectively. This case study hopes to have made some contribution to showing that lean in and by itself may not be sufficient to improve all problems of a lab institution and that it requires a pragmatic blend of various problem-solving methods to tackle all the various problems that the laboratory faces.