12-2015

Minimizing Error Rate in the Updation of Physicians' Profile

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by

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A Starred Paper

Submitted to the Graduate Faculty of

St. Cloud State University

in Partial Fulfillment of the Requirements

for the Degree of

Master of Engineering Management

November, 2015

Starred Paper Committee:
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Abstract

The Provider Update Management is the project undertaken by *i*Space Global Services Company. MultiPlan is the leading provider of independent national Payer and Provider Organizations (PPO) networks and related cost management services. It was founded in 1980 as a New York hospital network. With more than half a million healthcare providers under contract, an estimated 40 million consumers access the network products. About 65 million claims are processed through the network each year. The Company desired to understand the process of updating the Provider data without any errors committed by the users. The company believes that the SIX SIGMA methodology is the most useful methodology to understand the root cause and take the improvement steps to sustain the Benchmark in Quality. This study focuses on achieving internal and external quality targets by minimizing error incidence in the updating process of physicians' data through systematic deployment of Six Sigma DMAIC methodology resulting in substantial improvement of the process quality.

Acknowledgements

During the course of this project work, I received help and support from many people and it is a matter of great pleasure to express my profound gratitude to them all individually.

I express my sincere thanks and gratitude to **Dr. Ben Baliga**, Director, Master of Engineering Management program, St. Cloud State University, Minnesota for granting me the permission to carry out my project work.

I am obliged and grateful to **Mr. Ramesh Maddukuri**, Vice President, iSpace Global Services, for encouraging and providing the concept to work on this project work.

I sincerely express my gratitude to **Prof. A L N Murthy**, Indian Statistical Institute, for his guidance and inspiration throughout my work.

—Somanadha Kasyap Addepalli

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Chapter I

INTRODUCTION

Introduction

*i*Health Technologies (*i*HT) Company is a healthcare analytics company that derives meaningful insight and delivers effective solutions to help clients optimize performance. *i*HT is a leader in payment integrity solutions and leverages business intelligence, technology, and operational excellence to improve the effectiveness of healthcare. The company's value to the clients are basically in the areas of reducing medical costs, reducing administrative costs and improving operating effectiveness along with compliance.

*i*HT delivers high performance for its clients and creates new levels of operational precision in the healthcare industry. Over 75 leading healthcare organizations partner with *i*HT. The clients include insurance related plans (Blue Cross Blue Shield plans, commercial, and government) and other healthcare entities.

*i*HT helps its clients succeed by developing new and innovative solutions, leveraging on its extensive clinical experience and medical cost, billing, and payment expertise with effective technology. The ***i***HT client satisfaction results consistently show high ratings and highly satisfied clients.

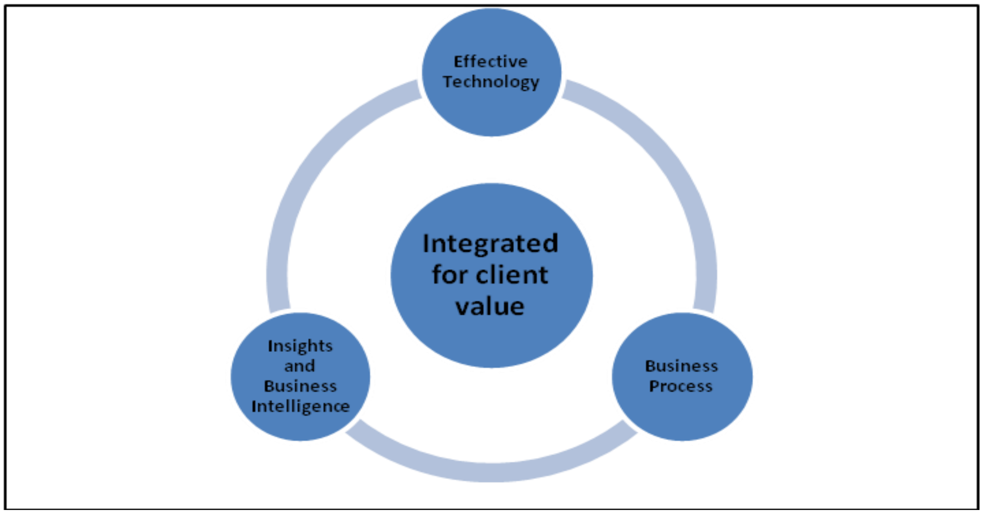

Figure 1. *iHT Business Value and Policy*

MultiPlan is the leading provider of independent national Payer and Provider Organizations (PPO) networks and related cost management services. It was founded in 1980 as a New York hospital network. With more than half a million healthcare providers under contract, an estimated 40 million consumers access the network products. About 65 million claims are processed through the network each year. MultiPlan delivers primary PPO network access under the Private Health Care Systems (PHCS) Network and Health EOS by MultiPlan brands. PHCS Network offers access in all 50 states to over 500,000 healthcare professionals and more than 3,700 hospitals. Primary PPOs access, nationwide or regionally, through the PHCS Networks. Extended PPO access with PHCS Healthy Directions, opening up access to the rest of the country for plan designs that call for the use of a local HMO, POS or PPO. The MultiPlan Network is a national complementary PPO network. Just as the name implies, the MultiPlan Network adds to the coverage of a primary PPO or HMO/POS/EPO by giving health plan participants an additional choice of providers at a discounted rate. When participants seek care outside their primary network, they typically pay a higher coinsurance rate, but share in the savings achieved by the network discount. Some 4,300 acute-care hospitals, 103,000 ancillary facilities, and 550,000 practitioners participate from all states.

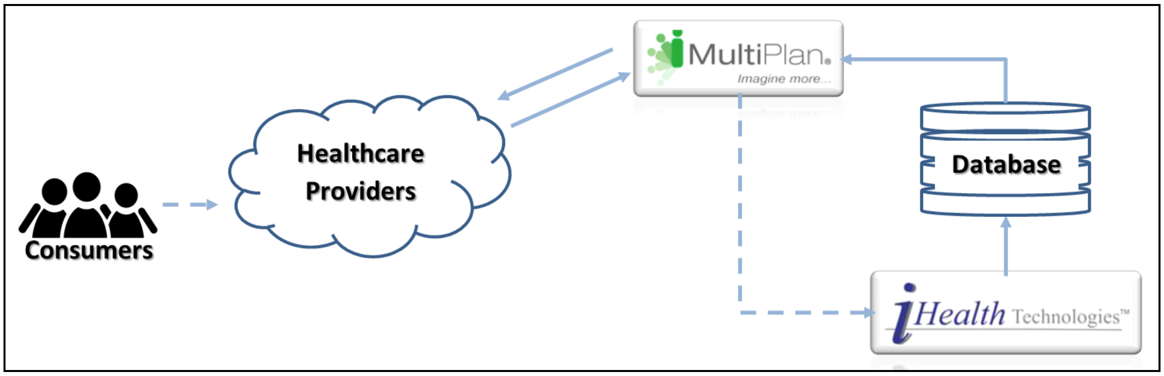

Figure 2. *MultiPlan and Provider Network*

Provider Update Management is a process of updating the providers data, submitted with a request and set of Business Rules according to the provider's request.

Problem Statement

Failure to achieve the internal and external quality metric targets (SLAs of 99%) due to high incidence of errors in the process of updating the Physicians data.

Nature and Significance of the Problem

As explained above, the MultiPlan is the leading provider of independent national Payer and Provider Organizations (PPO) networks and related cost management services. Any incidence of errors in the Physicians' database would result in wrong selection of the provider by the client resulting in huge coinsurance costs as well as in the inappropriate treatment (Sarkar, 2013). In view these implications, the ***i*** Health Technologies (*i*HT) have been specified targets for quality metrics as a part of Service Level Agreement (SLA). Internally, the I Space Global

Services, which is the healthcare analytics company of *i*HT, has defined these metrics in terms of internal as well as external quality metrics with the necessary targets to meet SLAs.

Table 1

Quality Metrics and Performance Targets

Metrics	**Current**	**Goal**	**Improvement Target**
Internal Quality	93%	99%	6%
External Quality	98%	99%	1%

Objectives of the Project

1. To undertake the root cause analysis through systematic process study for the failures to achieve internal and external quality metrics in physicians' data updating process.
2. To identify and implement remedial measures for achieving consistency in meeting quality targets SLAs by establishing a suitable process control system.

Project Questions/Hypotheses

This study addressed the following questions by adopting a systematic approach:

1. Does the user performance vary among users impacting the quality metrics?
2. How a specific stage in the process mapped is a major contributor for high error incidence?
3. Does the process have the requisite capability to meet the SLAs w.r.t internal as well as external quality targets?

Limitations of the Project

One of the limitations observed initially was in preliminary data collection process. As the updating process has already been executed before examining the quality of the record through audit process, secondary data had to be used for understanding the baseline performance. However, the improvements and control for sustaining the improvements have been observed directly on the process at execution stage itself and the results are validated through quality audit data.

As the number of users is high, random sampling has been adopted to decide on the user for collecting the audit quality data which is statistically valid as complete validation on entire user population will be cost and time prohibitive.

Summary

In this chapter, a detailed understanding of the problem background and quantitatively stating the problem statement has been highlighted. Further, the nature and significance of the problem, the objectives of this project study along with the limitations of the project has also been discussed. The questions have been framed in the form of the postulation of Hypotheses that were subsequently addressed during the course of project execution and validated have been specified.

Chapter II

BACKGROUND AND REVIEW OF LITERATURE

Introduction

The literature review primarily consists of the preliminary work in identification necessary tools that will be useful on the topic of Quality improvement and Six Sigma DMAIC methodologies. In this project, a systematic approach using Six Sigma DMAIC methodology (Chaudhuri, 2007) has been used where the use of various qualitative and quantitative problem solving tools becomes imminent for data capturing, analysis, improving and sustaining the benefits of improvement. In this chapter the concepts, tools and methodologies used in the project have been described.

Literature Related to the Problem

Quality is the buzzword these days and everybody talks about it, the politicians from public platforms, the company executives from business, and of course, the common man on the street. Nevertheless, few understand the true meaning of the word quality and fewer still are able and willing to put quality in its true perspective in the changing context of the liberalization and globalization, where the national boundaries for freer trade and commerce are slowly, but surely, breaking down.

Quality problems are reflected today in wide variation in use of health care services, the underuse and overuse of some services, and misuse of others. Improving the quality of health care and reducing medical errors are priorities for the Agency for Healthcare Research and Quality (AHRQ).

Every day, millions of Americans receive high-quality health care that helps to maintain or restore their health and ability to function. However, far too many do not. Quality problems are reflected in a wide variation in the use of health care services including an unacceptable level of errors.

Literature Related to the Methodology

Process Mapping

A process is a series of steps designed to produce products and/or services. A process is often diagrammed with a flow chart depicting inputs, a path that material or information flows, and outputs (Chaudhuri, 2007). A business system is the asset of processes which makes every resource to contribute in for business outcomes.

Process mapping is a type of flowchart depicting the steps in a process and identifying the responsibility of each step and key measures and a process flow diagram the flow of materials through a process, including any network or repair operations etc.

Box Plot

In descriptive statistics, a Box Plot is a convenient way of graphically depicting groups of numerical data through their quartiles. Box Plots may also have lines extending vertically from the boxes (whiskers) indicating variability outside the upper and lower quartiles, hence the terms box-and-whisker plot and box-and-whisker diagram (Lem, Onghena, Verschaffel, & Van Dooren, 2013). Outliers are plotted as individual points with a symbol appearing as per the magnitude away from the box and whiskers. The Box Plot usually depicts the five-point summary namely; the minimum, first quartile (Q_1), Median (Q_2), third quartile (Q_3) and the maximum along with outliers if any present in the data set.

Probability Plots

The probability plot is a graphical technique used for assessing whether or not a data set follows a given (expected) distribution such as the normal or Weibull (Montgomery, 2012). The data are plotted against a theoretical distribution in such a way that the points should form approximately a straight line. Departures from this straight line indicate departures from the specified distribution.

Johnson Transformation

The Johnson transformation function is selected from three families of functions in the Johnson system. Because the functions cover a wide variety of distributions by changing the parameters, Minitab usually finds an acceptable transformation. The family of transformation Minitab selects is called the Best Transformation Type (Ryan, 2006). The Johnson transformations are useful when the data follows a non-normal distribution and to check whether a suitable transformation from among Johnson family transformations will make the data behave like Normal (Montgomery, 2012).

Process Capability

A process is a unique combination of tools, materials, methods, and people engaged in producing a measurable output; for example a manufacturing line for machine parts. All processes have inherent statistical variability which can be evaluated by statistical methods.

The process capability is a measurable property of a process to the specification, expressed as a process capability index (e.g., Cp or Cpk) or as a process performance index (e.g., Pp or Ppk). The output of this measurement is usually illustrated by a histogram and calculations that predict how many parts will be produced out of specification (OOS).

The process capability refers to the uniformity or consistency of the process (Munro, Maio, Nawaz, Ramu, & Zrymiak, 2007). Obviously, the variability of critical to quality characteristics in the process is a measure of the uniformity of the output. There are two ways to think of variability.

1. The natural or inherent variability in a CTQ at a specified time.
2. The variability in a critical to quality characteristics over time.

As process capability analysis is the formal study to estimate process capability. The estimates of the process capability may be in the form of a probability distribution having a specified shape, mean and standard deviation. Alternatively, we may express process capability as a percentage outside of specifications; however specifications are not necessary to process capability analysis. A process capability study usually measures the variability in functional parameters or critical to quality characteristics of the product, not the process itself. When the analyst directly observes the process and can control or monitor the data-collections activity and knowing the time sequence of data, inference can be made about the stability of process over time.

Process capability analysis is a vital part of an overall quality or process improvement program (Montgomery, 2012). Among the major uses of data from a process capability analysis are the followings:

- Predicting how well the process will hold tolerance.
- Assisting product developers/designers in selecting or modifying a process.
- Assisting in establishing an interval between sampling for process monitoring.
- Specifying performance requirements for new equipment

- Selection between competitors (for supply chain management)
- Reducing the variability in a process.

Thus, process capability analysis is a technique that has application in many segments of the product/process cycle, including products and process design. Three primary techniques are used in process capability analysis.

- Histogram
- Probability plots
- Control charts and for specific situations using Analysis of Variance (ANOVA).

For this study purpose, it is proposed to use the probability plots and I-MR charts to study the process capability of internal and external quality.

Process Capability Indices

C_p, C_{pk}, P_p, P_{pk} are the various capability indices have been developed in an attempt to quantify process capability in a single number.

C_p = Tolerance zone / 6σ, where tolerance zone = USL-LSL

$C_{pk} = \mathrm{Min}(Z_u, Z_l)/3$, where $\min(Z_u, Z_l)$ is defined as the smallest Z value.

Historically, a C_{pk} value of one or larger was considered capable. This would be equivalent to stating that the natural process limits lie inside the specification limits. Most recently, quality requirements have become stringent and many customers require C_{pk} value of 1.33, 1.66 or 2.00. This is equal to +/- 4σ, +/-5σ, +/ - 6σ to be inside the specification. Most authors currently define a 6σ process as one with σ </=1/12 (Specification) with the process average not drifting more than 1.5 σ overtime. Therefore the present violating each specification limit is based on values from the Z table corresponding to 4.5σ (Munro et al., 2007).

Process Capability Analysis

There are typically two calculations done to identify how capable a process is. This is done so that we can determine if the possibility of improvement exists for the process in question. These two calculations are called C_p (Potential Capability index) and C_{pk} (Achieved Capability index). Some common interpretation of C_p and C_{pk}:

- In both C_p and C_{pk}, the higher the value the better.
- The C_p; values do not change as the process is being centered to target unless something in the process change.
- C_{pk} is always equals to or smaller than C_p.
- The C_p and C_{pk} values will be equal if the process is perfectly centered.
- In a process with one-sided specifications, either C_{pU} upper limit or C_{pL} lower limit is calculated.
- Higher the C_{pk} observed from a small sample may not be of much use as the confidence interval for C_{pk} will be very wide due to small sample size.

Six Sigma Methodology

Six Sigma is a structured and disciplined process designed to deliver perfect service on a consistent basis. It aims at improving the bottom line by finding and eliminating the causes of mistakes and defects in business process (Chaudhuri, 2007).

Usually six sigma is associated with process capability of $C_{pk}>1.5$, which are considered as world class performance. Sigma is a statistical term that refers to the standard deviation of a process about its mean. Six sigma is a term generally used to indicate that a process.

- Philosophy: The philosophy perspective view all work as a process that can be defined, measured, analyzed, improved, controlled. The process requires input and produces outputs. This is generally expressed as the y=f(x) concept.
- Set of tools: Six Sigma as a set of tools includes all the qualitative and quantitative technique used by the six sigma experts to drive process improvement. A few such tools include Process Mapping, SPC, MSA, failure mode and effect analysis, and DOE.
- Methodology: This view of six sigma recognizes the underlying and rigorous approach known as DMAIC. It defines the step six sigma practitioners is expected to follow, starting with identifying the problem and ending with the implementation of a long lasting solution.

DMAIC Model

The DMAIC model (Munro et al., 2007) stands for define, measure, analyze, improve, and control and is very similar to Plan, Do, Study and Act (PDSA) or Plan, Do, Check and Act (PDCA) model of Karou Ishikawa popularized by W E Deming. A key factor in each step is for management to allow the time and resources to accomplish each of the phases to strive for continual improvement. This is one driving force which makes the six sigma methodology different from other quality improvement programs. The five steps of the DMAIC as pertinent to this project are shown in Table 2.

Table 2

DMAIC Model

Five Phases
Define: Defining the problem statement and collect the past data.
Measure: Data will be collected and calculated to compare the output of each stage and to measure how much is the problem.
Analyze: Calculate and analyze the manpower involvement, client expectations at each stage and will determine if there is any deviation from SLA's at each level.
Improve: Team will implement the process of training the associates by giving new updates on a regular basis and compare the output against the agreed SLA's.
Control: Continuous team sessions regarding the updates in process and monitor the level of error percentage.

Summary

This chapter explains various concepts of quality and the methodologies for improvement that were needed to be adopted for analysis, drawing inferences and initiating improvement actions on the processes along with the rationale to be used for some metrics and indices as a part of the project work. These concepts form a sound basis to decide on the study design, sampling for data capturing, defining and computing quality metrics which are described in the following chapter.

Chapter III

METHODOLOGY

Introduction

It is a well-known fact for successful execution of any project/study, a defined plan is essential and failure to plan invariably results in planned failure of the study. Therefore, this chapter highlights the aspects pertaining to this study the design adopted, quality metrics used together with the calculations involved, sampling for data collection, analysis plan and methodologies involved and ultimately the timelines adopted for the study.

The Design of the Study

A study design is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the study purpose with economy in procedure." Consideration regarding what, when, where, how much and by what means concerning an inquiry or study has been taken.

The nature of the current study is Observational as well as Quantitative in nature type. The aim of the study is knowledge seeking and study of Quality improvement, so that the process capability of Process can be evaluated and improved.

This study has been initiated in I space Global Services, Hyderabad, India and has been carried out with the active involvement and their support. The Critical to Quality (CTQ) characteristics taken in consideration for the study are as follows.

Data Metrics

The study team has understood that Internal Quality percentage is very low and there should be an improvement step taken for the users in order to improve the Quality internally and externally as well. Quality metrics have been calculated based on the Past Data Analysis are given as follows.

Table 3

Process Performance Metrics

Metrics	Current	Goal	Improvement
Internal Quality	93%	99%	6%
External Quality	98%	99%	1%

It was understood that there is merely an improvement scope in Internal Quality rather than External Quality which eventually will lead to improvement in external quality metric. So the team has decided to focus on analyzing and finding the root cause in achieving the Internal Quality.

CTQ Definition

Table 4

Defining CTQ

Problem	CTQ	Defect	Measure	Kano Status
"Not able to reach Internal Quality Targets"	Achieving Quality in updating physicians data	User errors are >0	Average Quality is 93% out of 99%	Must be (Basic)

Sample Design

Simple random sampling of the records has been adopted, as every item in population has equal chance of selection and there by the sample estimates clearly reflect the population behavior in terms of the parameters.

Data Collection

It is planned in the study to adopt initially secondary data collection method through observation, as the data have been already processed and analyzed. At the end of process (QC Sheets), data needs to be collected. It is to be observed and collected from QC sheet (i.e., the collection of internal and external quality reports done for the users who ever worked in processing). Data is collected in a planned excel sheet format, scrutinized, and time taken for completion of each updation report has been inspected and converted into minutes for analysis.

Selection of Sample and Sample Size

This is carried out in a corporate environment and for better understanding of the process behavior is to collect data from process itself, as soon as the Quality reports are generated. As mentioned in the purpose of the project, the main aim of the project is to reduce internal errors and then automatically external errors can be reduced. Thus, in the team of 60 members, all the data was considered as past data to calculate the average quality percentage. Pareto Analysis was carried out to identify the priority users who ever being major contributors for errors as well as the identification of vital few fields in the reports where incidence of errors is high. The final goal of the project is to observe the improvement at least in the prioritized users, check whether the user quality tools are able to implement in the process of improvement and finally prepare a Control plan for further implementation.

Method of Calculation

The quality of the users calculated at record level. Each record is differentiated with a unique Cred_id (A unique identification in software application to update the Provider's / Physician's Data). It does not matter how many fields got the errors in a cred_id, the quality percentage calculated for the user at the record level.

For example, if a user received error in 1 record out of 20 records audited, then the audit quality percentage for the user can be given as follows:

=Records without errors/number of records audited*100

=19/20*100

=95% of quality percentage is achieved by the user.

Data Analysis Plan

The planned data is to be collected by preparing an excel format from the process at each level i.e., inward, collection of quality reports of all the executives who ever worked for the process.

For this study, the structured DMAIC methodology is adopted as time, resource (constraints) and various organizational limitations are existing across the project.

DMAIC Methodology for the Study

Define: The variability in the overall process (quality is not achievable) and understand the areas for improvement in the process.

Measure: Collection of data on excel format for analysis and identification of outliers or abnormal entries using Box Plot, computation descriptive measures of display and assessing the baseline performance.

Analyze: Appropriate statistical tools have been used to understand the behaviour of the data for process stability and with a view to identify the users and causes contributing to the high incidence of errors. The analytical tools used for data analysis are IMR chart to find out assignable causes, probability plot and process capability analysis.

Improve: Root cause analysis (through brain storming), validation, identification remedial measures, suggestions and recommendations for improvement.

Control: Developing control plan for process to sustain the improvement and monitoring the process for any assignable causes on daily basis with appropriate measurements. It is planned through this study to understand the bottlenecks for process improvement through systematic DMAIC approach and carrying out the RCA for identifying the contributing factors with suitable remedial measures to realize improvements envisaged.

Timeline

Table 5

Timeline for Various Project Phases

Activity	Target Date	Actual Date	Remarks
Project Idea Formulation and Research	February, 2015	13th February, 2015	
Project Proposal Write-up	March, 2015	26th March, 2015	
Define	April, 2015	14th April, 2015	
Measure	May, 2015	11th May, 2015	
Analyze	June, 2015	17th July, 2015	Identification and validation of root causes on the process in real time has resulted in over shooting the time line by a fortnight.
Improve	July, 2015	13th August, 2015	
Control	July/August, 2015	27th August, 2015	

Summary

In this chapter, a detailed description of the aspects pertaining to this study on the design adopted, quality metrics used together with the calculations involved, sampling design for data collection, analysis plan and methodologies involved and ultimately the timelines adopted for the study was presented. Execution of the study as per the methodology laid out and systematic data presentation, analysis with appropriate inferences on analysis has been described in detail in the following chapter on Data Presentation and Analysis.

Chapter IV

DATA PRESENTATION AND ANALYSIS

Introduction

In this chapter, the details of systematic DMAIC approach as mentioned earlier that was adopted for the project with objective of minimizing the high incidence of errors in physician data updating process for improved customer satisfaction of the Multi plan insurance providers. This chapter describes processes that involved using process description flowchart and the business process mapping made as SIPOC (Chaudhuri, 2007). It highlights the past data that was captured to quantify the problem, baseline performance as sigma level for the identified internal and external quality metrics. Pareto analysis to identify the vital few fields in updating attributing to large chunk of the errors is also presented and the brainstorming session carried out to identify the causes contributing the high incidence of errors in the form of C & E Diagram (Munro et al., 2007) is presented. Finally the remedial measures identified and controls necessary to for sustaining the improvements have been presented.

Process Flow Diagram

It is always a first step to understand the process that is involved to formulate an approach for problem resolution. As mentioned above, the process flow diagram involved in the provider data management concerning the Practitioner/Physician data is presented below.

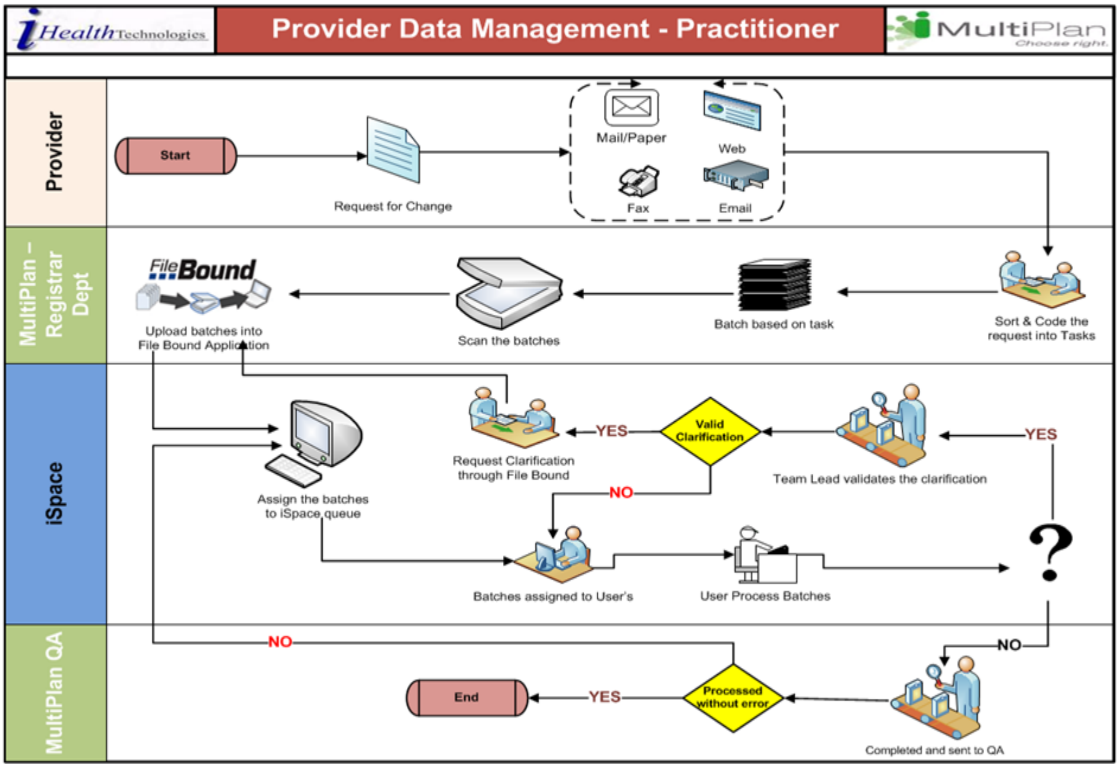

Figure 3. *iHT/MultiPlan Process Flow*

The process flow diagram highlights the significance of the iSpace Global Services role in the incidence of errors in the Physician data updation process. Hence, it was felt necessary to understand the entire business process map involved at iSpace Global Services using the concept of SIPOC. The SIPOC depicts the process of updating the providers data, submitted with a request and set of Business Rules according to the provider's request which is presented below.

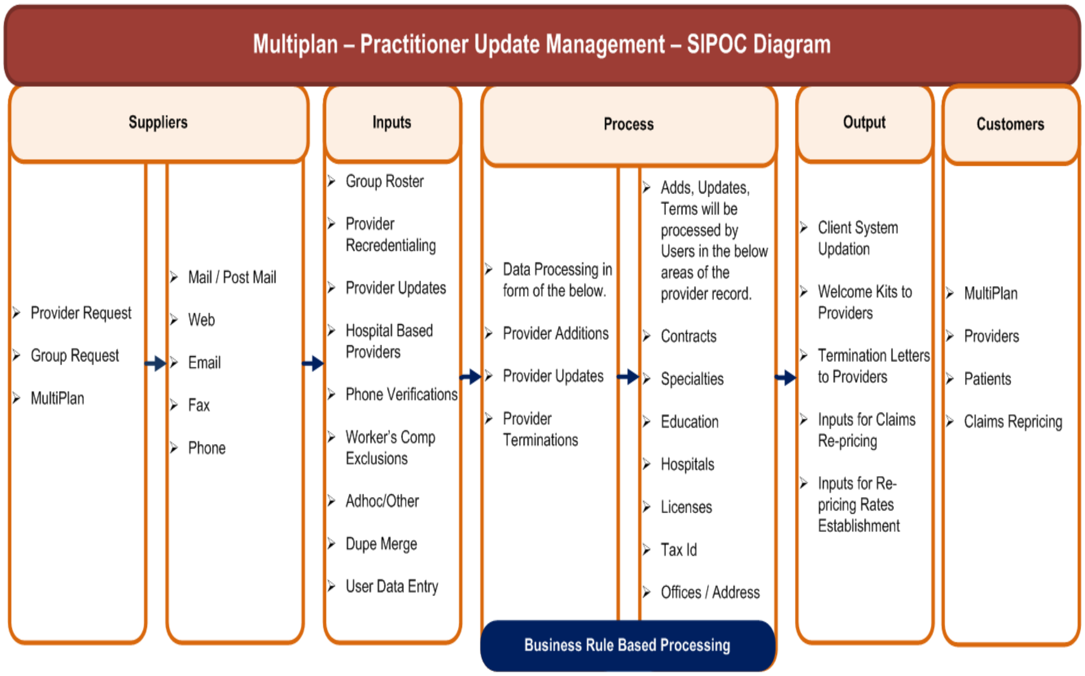

Figure 4. *iHT/MultiPlan SIPOC*

Data Presentation and Analysis

In order to understand the gravity of the problem with regard to incidence of errors in physician data updating process, data has been collected from past records at QA validation check stage and the quality metrics as detailed in earlier chapter have been computed for three months on internal quality and week wise for two months (due to non-receipt of feedback on external quality for May month) on external quality metrics. The summary tables for three months internal quality metrics and week wise for two months data on external quality metrics have been respectively presented in Tables 6 and 7.

Table 6

Internal Quality Metric Analysis

Month	March	April	May	Overall	Required	Improvement
Internal Quality (IQ)	92.90%	92.94%	93.25%	93.09%	99%	6.00%
Files with Errors	293	303	582	1178	----	----
Files Inspected	4125	4291	8623	17039	----	----
DPMO	71030	70613	67494	69136	10000	59316
Sigma Level	2.968	2.971	2.995	2.983	3.826	0.843

Table 7

External Quality Metric Analysis

Month / Week	1	2	3	4	5	Overall	Required	Improvement
March External Quality (EQ)	98.16%	97.96%	98.31%	97.65%	97.98%	98.01%	99.00%	1.00%
Files with Errors	15	16	13	18	20	82	--	--
Files Inspected	817	786	768	765	989	4125	--	--
DPMO	18360	20356	16927	23529	20222	19879	10000	9879
Sigma Level	3.588	3.546	3.622	3.486	3.55	3.556	3.826	0.27
April External Quality (EQ)	98.04%	97.93%	97.74%	98.29%	---	98.00%	99.00%	1.00%
Files with Errors	21	22	25	18	---	86		
Files Inspected	1072	1062	1104	1053	---	4291		
DPMO	19590	20716	22645	17094	---	20042	10000	10042
Sigma Level	3.562	3.54	3.503	3.618	---	3.554	3.826	0.272

As can be seen from Tables 6 and 7, need arises for significant improvement in internal quality metric and as well as in external quality metric. However, the team felt if steps are initiated to improve the internal quality metric this in turn will improve the external quality metric. So, further study is focused subsequently towards improving the internal quality metric.

Distribution Study and Process Capability Analysis

As mentioned above, data on internal quality metric has been collected for different users during March-May 2015 at QA/QC inspection stage from the records and the quality efficiency % have been initially studied for any outliers present in the data using Box Plot and found two observations are found as outliers in the respective months. These outliers have been omitted for understanding the distribution and as well as for the process capability analysis. The user wise data on quality % computed are given in the Appendix and the statistical analysis carried out are given below.

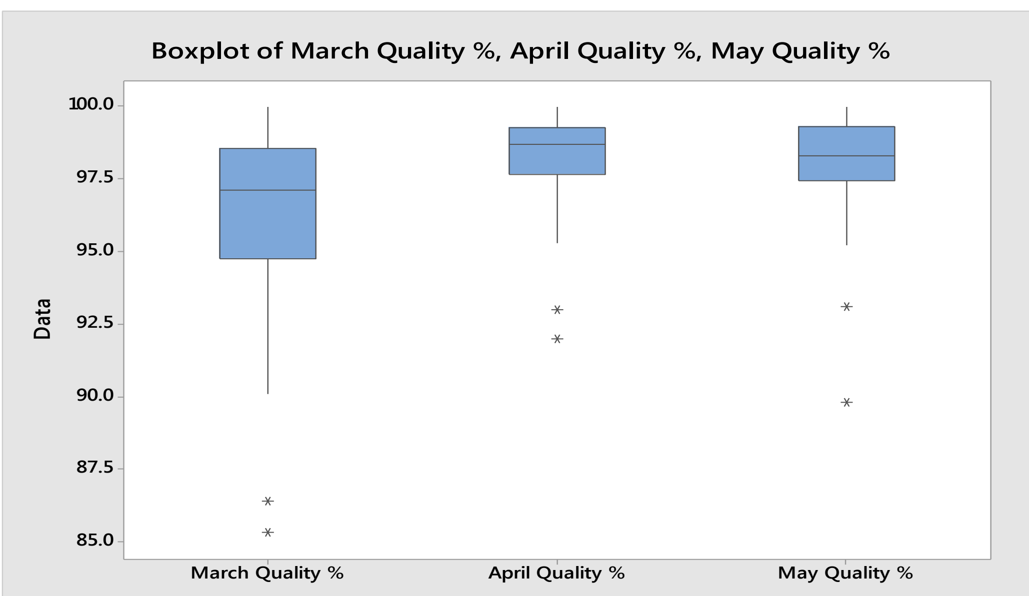

Figure 5. *Box Plot for Quality %*

Removing outliers the Box Plot is again observed and found that data shown consistency with rest of the observations for each of the months thus enabling to study the distribution and as well as the process capability analysis.

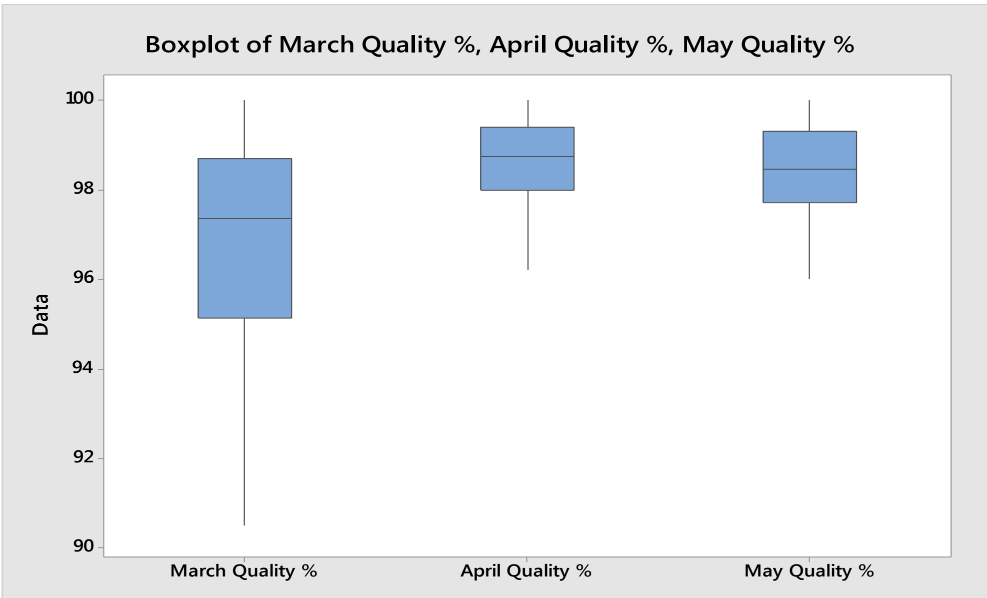

Figure 6. *Box Plot for Quality % After Removing Outliers*

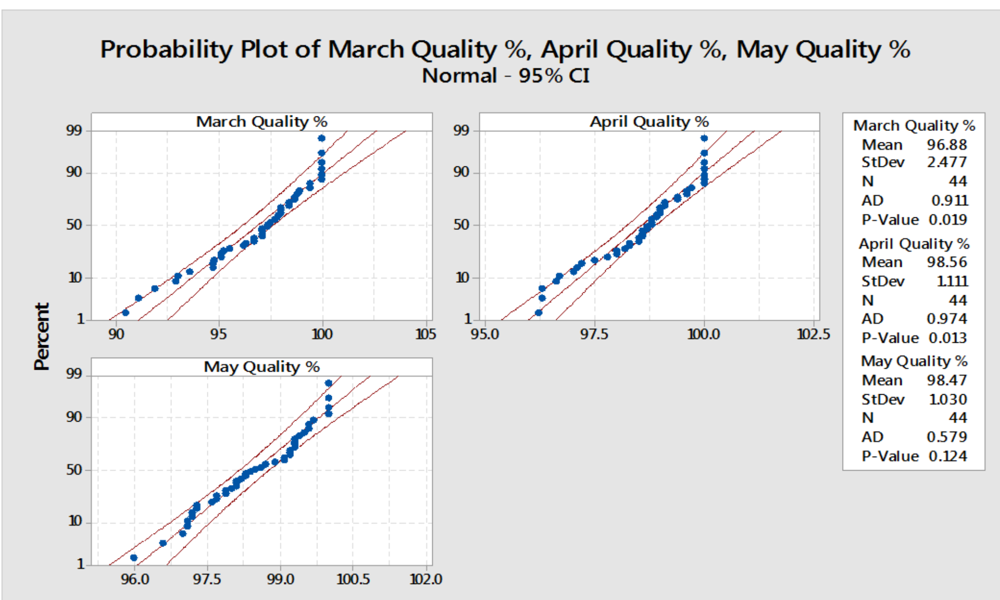

Figure 7. *Probability Plot for Quality %*

The distribution plot for each month suggests that data on quality % does not follow Normal distribution except for the month of May for which the p-value is 0.124. A data transformation is attempted using Johnson transformation for all the months. The transformed data using Johnson transformation is fitting well as Normal distribution for all the months. Process capability analysis has been carried out for each month on the quality % taking the LSL as 99% for the internal quality as specified earlier as a requirement. The process capability analyses month wise are given below.

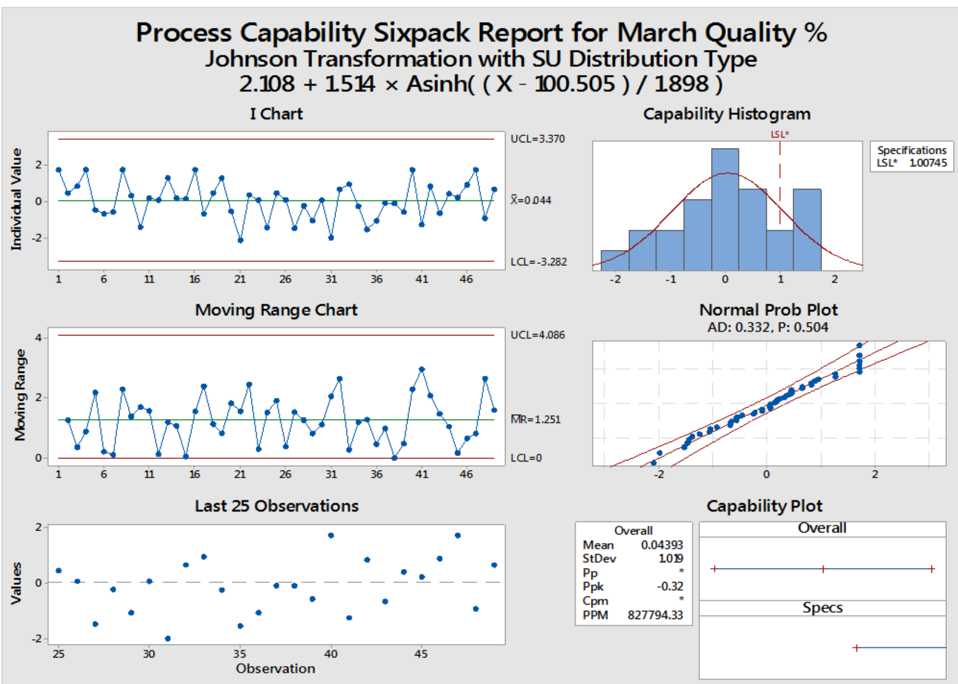

Figure 8. *Process Capability for March Quality %*

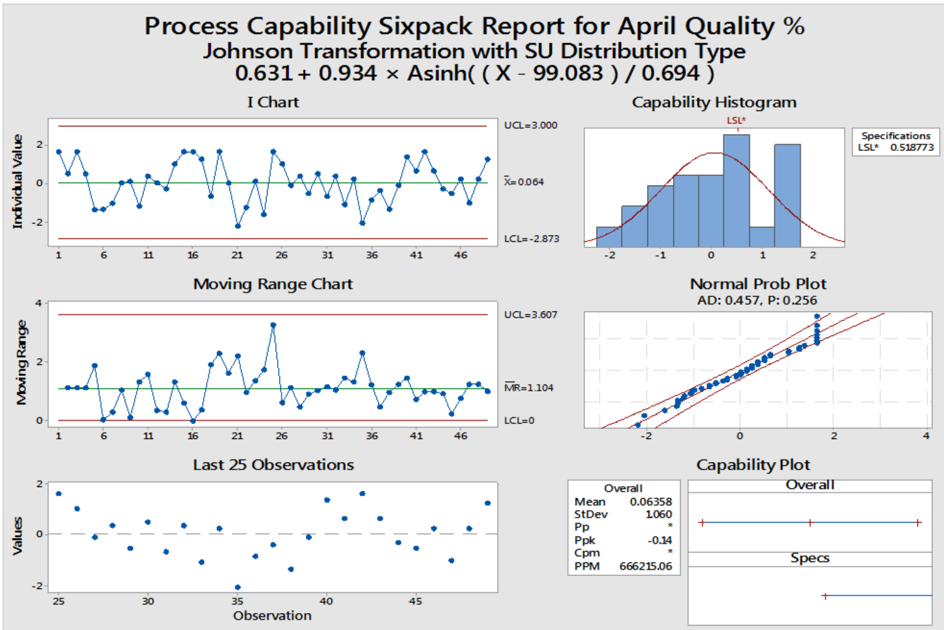

Figure 9. *Process Capability for April Quality %*

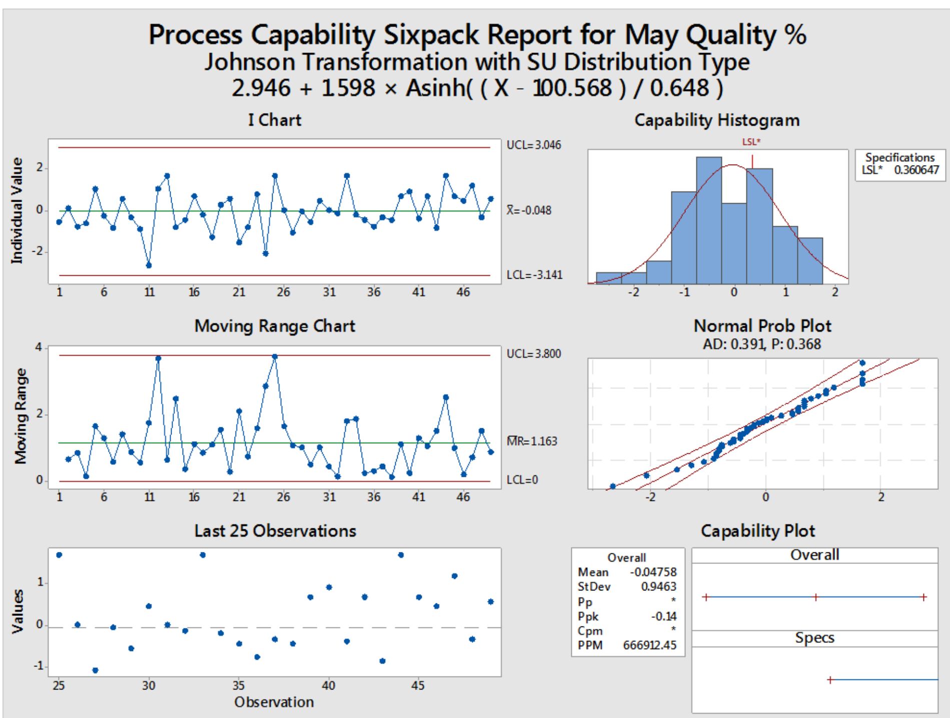

Figure 10. *Process Capability for May Quality %*

It can be observed from the above analysis that the process show consistently a stable process (from I-MR charts) over the months, but the process capability needs to be substantially improved.

In order to improve the internal quality metric and meet the targeted improvement, the team carried out a brain storming exercise to understand the reasons for high incidence of errors in updating process. The result of brain storming has been presented as a Cause and Effect Diagram. Further based on the discussion, reason wise incidence of the errors has been captured for the month of June 2015 and Pareto analysis has been carried out to identify the vital few reasons resulting high incidence of errors. The C & E Diagram and the Pareto Analysis are shown in Figure 11.

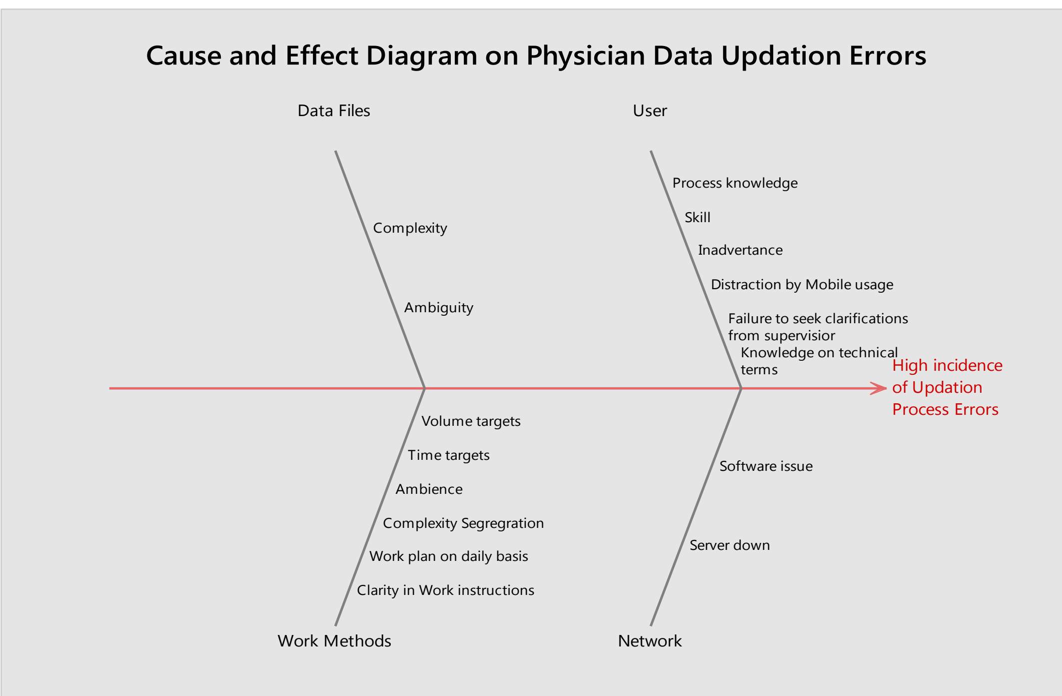

Figure 11. *Cause and Effect Analysis*

Capturing Field Wise Errors in the Month of June

Table 8

Field Wise Errors

Error Field	Error Count	Cumulative Frequency	Percentage
Address	151	151	62%
Specialty	22	173	71%
Other	12	185	76%
TIN	11	196	81%
Contracts	10	206	85%
Notes	9	215	88%
Hospital	8	223	92%
Personal Page	8	231	95%
Provider Name	6	237	98%
Credentialing Dates	2	239	98%
Status	2	241	99%
DOB	1	242	100%
License / DEA	1	243	100%

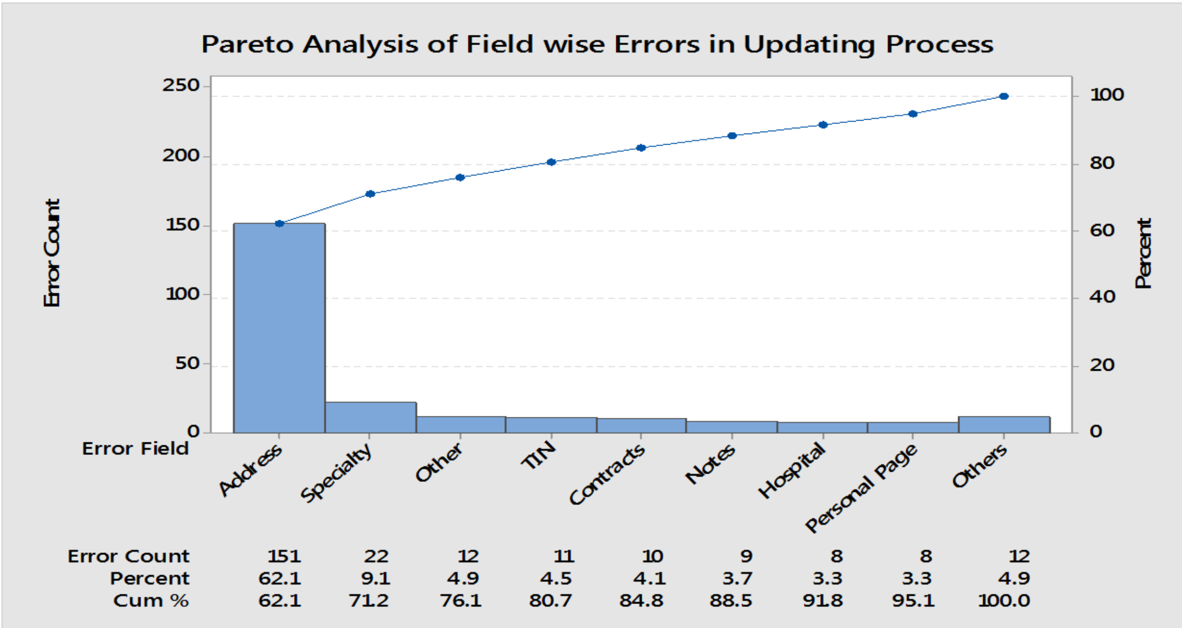

Figure 12. *Pareto Analysis of Field-Wise Errors*

From the Pareto analysis it can be seen that Address field errors are the major contributors for high incidence. The following are the major reasons for the errors along with the address field.

- Address
- Specialty
- Tin
- Contracts
- Notes
- Hospitals

Brain storming on the reasons for address field errors has identified the following as the important causes which need immediate attention for improvement.

The major dominant causes of errors are Addresses field and more errors found in below address fields:

- Phone/ Fax
- Suppress from directory / Handicap Accessible/ Accept New Patients
- Address format
- Wrong zip/city terming and adding correctly
- Less information and more information scenarios

Based on the above, the team has come up with a few suggestions to improve the internal quality:

1. Users need to focus on the above fields and Quality analysts should focus more on these fields and feedback to be provided to the users on the errors after the analysis.
2. Consume more time on reading special handling requests.
3. Must focus on Roster requests, cleanups and should reduce inadvertent as well as negligence errors like Phone / Fax updates, Suppress from directory, Handicap Accessible etc.,

As highlighted in the Pareto analysis, the users as well as quality analysts have been asked to pay special attention to the Address field errors on a continuing basis. The user giving high address field errors have been identified, training was given on updating process and business rules (Wiesenfelder, 2013). Their performance was closely monitored before and after the training. The results showed encouraging and the same are given below.

Table 9

User Wise Address Field Errors in Updating (Before training)

S.No	Users	Errors	Address Errors	Audited	Without Defects	Quality Percentage
1	Ha.pa	21	18	312	280	89.8%
2	La.ba	15	7	263	299	95.2%
3	Pr.me	14	13	334	188	93.1%
4	Mo.ay	10	8	289	331	97.1%
5	Su.ja	9	6	237	303	97.1%
6	Ni.da	9	3	329	254	96.6%
7	Sa.ba	7	7	328	325	97.3%
8	Mat.at	7	4	312	281	97.2%
9	Gn.sh	7	4	263	230	97.0%
10	Sh.gu	6	4	334	322	97.9%

Table 10

User Wise Address Field Errors in Updating (After Training – Week 1)

S.No	Users	Errors	Address Errors	Audited	Without Defects	Quality Percentage
1	Ha.pa	1	0	100	99	99.0%
2	La.ba	1	0	80	79	98.75%
3	Pr.me	2	0	85	83	97.65%
4	Mo.ay	3	0	100	97	97.00%
5	Su.ja	2	0	120	118	98.5%
6	Ni.da	1	0	125	124	99.20%
7	Sa.ba	0	0	72	72	100%
8	Mat.at	0	0	70	70	100%
9	Gn.sh	1	1	80	79	97.0%
10	Sh.gu	0	0	85	0	98.75%

Table 11

User Wise Address Field Errors In Updating (After Training – Week 2)

S.NO	Users	Errors	Address errors	Audited	Without Defects	Quality percentage
1	Ha.pa	2	1	110	108	98.0%
2	La.ba	2	1	95	93	98.0%
3	Pr.me	1	0	80	79	98.75%
4	Mo.ay	1	0	120	119	99.16%
5	Su.ja	3	1	125	122	97.6%
6	Ni.da	0	0	110	110	100%
7	Sa.ba	0	0	85	85	100%
8	Mat.at	1	1	100	99	99.0%
9	Gn.sh	1	0	120	119	99.16%
10	Sh.gu	0	0	130	0	98.75%

It can be observed from the above tables the training to the users is improving the internal quality particularly related to address field. To add statistical significance to the improvement, accuracy before and after training is used for a 2-proportion test (*Montgomery, D. C.*). Following are the results.

Test and CI for Two Proportions

```
Sample     X     N  Sample p
1       2813  3001  0.937354
2       1064  1075  0.989767

Difference = p (1) - p (2)
Estimate for difference:  -0.0524132
95% upper bound for difference:  -0.0435572
Test for difference = 0 (vs < 0):  Z = -9.73  P-Value = 0.000
```

Since the p-value is less than 0.05, null hypothesis is rejected and alternate hypothesis is accepted i.e. there is significant increase in the accuracy or the quality % of the users after two weeks of training. It has been decided to extend the training to all other user so that the performance on internal quality will improve enabling the updating process meet the target. The control plan (Munro et al., 2007) has been developed to monitor the physician updating process for sustained improvements and for providing the feedback to the users.

Control Plan

Step 1: Observe the data, scrutinize the data and test the normality, understand the CTQ and VOC on quality targets.

Step 2: Users who are contributing more errors should be prioritized using Pareto Analysis.

Step 3: Fields with high incidence of errors need to be prioritized using Pareto Analysis.

Step 4: Perform the process capability and monitor the Cp and Cpk values every month.

Step 5: Use appropriate control chart such as p-chart on defective files to know the assignable causes and to take prevention steps accordingly.

Step 6: Conduct Brain Storming sessions and update sessions on set of business rules and for different root causes.

Step 7: Arrange all the causes in Cause and Effect relation (Fish Bone Diagram) and identify the remedial measures for each cause should it occur.

Step 8: Take the improvement step accordingly.

Step 9: Retrain the users on different causes and conduct the improvement program.

Step 10: Calculate the data which has improved using Process Capability analysis. If there is any improvement, proceed to follow control plan otherwise repeat the steps from Step 1.

Summary

This chapter highlighted the systematic approach that been adopted by right from understanding the problem through process analysis using SIPOC, baseline performance evaluation using the past data and statistically analyzing the data with appropriate methodology such as Box Plots, distribution plots, data transformation for validity of analysis and process capability analysis. Identification of root causes have been done using brain storming, C & E Diagram and Pareto Analysis of the field wise errors. Improvements are validated taking remedial measures such as user training and continuous monitoring using appropriate control charts.

Chapter V

RESULTS, CONCLUSION, AND RECOMMENDATIONS

Introduction

In this chapter, the overall summary of the study along with approach adopted and results obtained through systematic data analysis in minimizing the errors in physician data updating for improved internal and external quality targets has been presented. Further, this chapter highlights the conclusions from the study and the control plan for sustaining the result have been presented with specific recommendation to the operating personnel for user quality improvement.

Results

1. Process study using process map and SIPOC have shown the process at iSpace Global Services will have to be paid attention for improved quality target of internal and external quality metrics.
2. Past data analysis showed that almost 5% improvement in internal quality metric and 1% in external quality metric need to be improved to meet the target of 99% in each.
3. Focus on internal quality and its improvement is essential which in turn improves the external quality as internal process controls improve.
4. Quality performance is not same across the users needing training for the users on skill improvement.
5. Distribution of quality % of user for all the months is not Normal and Johnson transformation is necessary to make the metric distribution as Normal and no other distribution is fitting well and appropriate.

6. Field wise analysis on incidence of errors show address field as most dominant reason for high incidence of errors.
7. Training for the user helped in minimizing the errors, particularly in, address field which is the dominant reason. Data on errors before and after training validates this point.
8. Physician data updating process is highly Operator (User) dominant process and therefore emphasis on feedback, monitoring and establishing process control mechanism become essential.

It is pertinent to reiterate the questions raised in the project journey and the answers found as solutions proposed from the study are summarized below:

Q1. Does the user performance vary among users impacting the quality metrics?

Ans. Analysis of the user wise data has clearly shown the skill of the personnel and thereby their performance is not uniform. Specific training given to low performing users showed statistically significant improvement (p-value 0.000) validating the hypothesis proposed.

Q2. How a specific stage in the process mapped is a major contributor for high error incidence?

Ans. Field wise Pareto analysis of the Physician updating process showed Address field is the major contributor (62%) for high incidence of the errors as hypothesized in the project proposal on identification of major process stage contributing for high error incidence.

Q3. Does the process have the requisite capability to meet the SLAs w.r.t internal as well as external quality targets?

Ans. Process capability analysis showed that the process is not having the requisite capability w.r.t the quality metrics as against the proposed requirement in terms Sigma level as 3.826. However, the systematic study has helped finally to exceed performance specified as SLA w.r.t quality metrics.

Conclusion

High incidence of errors in Physician data updating process and failure to consistently achieve internal and external quality metrics targets has necessitated the *i*Health Technologies to take up a systematic study for improving the updating process. The results after training all the users and improving the overall Quality % are shown in Table 12.

Table 12

Post Improvement Internal Quality %

	Number Audited	**No defects**	**Quality %**
August	6783	6718	99.04%
September	8160	8097	99.23%

Six Sigma methodology using DMAIC approach has been adopted for resolving the issue and bringing the improvements. Various qualitative and analytical tools have been used such as Process Mapping, SIPOC, CTQ definition, Data collection methods, Brain storming, C & E Diagram, Pareto Analysis, Data Transformations and Process Capability Analyses etc. in systematically understanding the process, identifying the root causes for performance deficiency, and remedial measures for control.

Recommendations

A detailed control plan has been developed for sustaining the improvements and discussion were held with process owners for smooth hand over of the controls. Training plays a crucial role as the updating process is highly task performer dominant process and monitoring and feedback to the users become an integral part of control mechanism.

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Appendix

Monthly Quality Percentages User wise			
USER-ID	**March**	**April**	**May**
ab.raz	100	100	97.7
ab.mo	98	99	98.7
an.pa	98.7	100	97.3
ar.gi	100	99	97.6
ar.sy	95.5	96.2	99.6
ar.ke	94.7	96.3	98.2
ay.mo	95.1	97.1	97.1
az.mo	100	98.6	99.2
du.pa	97.7	98.7	98.1
gn.sh	91.1	96.7	97
ha.pat	97.4	98.9	89.8
ha.la	97.1	98.6	99.6
jag.ch	99.4	98.3	100
ja.ka	97.4	99.4	97.2
ch.ku	97.3	100	97.9
kar.dev	100	100	99.3
na.ko	94.7	99.6	98.3
la.kr	98	97.8	96
ma.ka	99.4	100	98.9
ma.sa	95.2	98.6	99.2
la.ba	85.3	92	95.2
mah.mat	97.8	96.6	97.2
ma.on	97.1	98.7	99.4
pr.me	90.7	95.3	93.1
pr.ra	98	100	100
ra.an	97.1	99.4	98.6
ra.don	90.5	98.5	96.6
ra.bo	96.3	98.9	98.5
ra.ma	93	98	97.7
ra.ku	97.1	99	99.1
sai.tu	86.4	97.8	98.6
sa.ra	98.4	98.9	98.4
sa.ky	98.9	97	100
sa.sh	96.2	98.8	98.3

sa.gu	90.1	93	97.9
sa.pa	92.9	97.5	97.3
sa.bo	96.7	98.2	98.1
sa.po	96.7	96.3	97.9
sh.rah	95.1	98.5	99.3
se.ya	100	99.7	99.5
sr.go	91.9	99.1	98
sri.yav	98.7	100	99.3
su.ja	94.8	99.1	97.1
su.bya	97.9	98.3	100
su.ch	97.5	98	99.3
um.ga	98.8	98.8	99.1
us.ji	100	97.2	99.7
ve.go	93.6	98.8	98.1
vi.bh	98.4	99.6	99.2