

DMAIC Methodology in Medical Transcription

Prof.P.M. Nandakumar, Dr.H.S. Anitha and Bhanu Prathap Singh

Abstract--- *In developing countries, service industry production values exceed those of manufacturing industry, and the number of those employed in the service industry makes up more than half of the total labour force. When it comes to Total Quality Management (TQM) in service industry, the most fundamental component is Service Quality (SQ), since the basis of service lies in physical equipment and personnel interaction. Service processes tend to produce operational wastages due to various reasons, which can be reduced by identifying and eliminating those using Six Sigma methodologies. Six Sigma is a powerful system. Basically it is measuring of quality that longs for perfection (3.4 defects on 1,000,000 transactions). In the proposed work, DMAIC (Define, Measure, Analyze, Improve and Control) can be used to reduce wastages in Medical Transcription. Core issues, pain areas or processes related to Medical Transcription wastages are identified. This study reports how DMAIC can be applied for reduction of DPMO (Defects per Million Opportunities) by identifying factors CTQ (Critical to Quality) in Medical Transcription (MT).*

Keywords--- *Six Sigma, DMAIC, Quality, CTQ, Medical Transcription*

I. INTRODUCTION

IN today's ever-changing market environment, organizations want to reach goals of meeting customer's demand as well as improving the competitiveness. Purely relying on Total Quality Management (TQM) and 'Re-engineering' is very difficult, and thus Six Sigma has emerged as an effective management approach. Six Sigma is a statistically-based quality improvement program, helps to improve business processes by cutting waste, reducing the costs associated with poor quality, and by improving the levels of efficiency and effectiveness of the related processes (Hoerl & Snee, 2002¹).

Six Sigma is the business philosophy with statistical background, used by manufacturing organizations, to avoid defects in the processes so that the quality level of the output reaches near to zero of defectives.

Sigma, (σ) is the Greek symbol for the statistical measurement of dispersion called standard deviation. It is the best measurement of process variability, because the smaller the deviation value, the less variability in the process. According to Six-Sigma philosophy, processes rarely stay centered. The centre tends to shift above and below the target, by a value of 1.5 sigma. The 3.4 defects per million opportunities (DPMO) value is the area under the normal curve beyond $6 - 1.5 = 4.5$ sigma (Snee, 2000²).

Six Sigma is a management tool for pursuing high quality of product and service, focusing on process improvement through a series of well-defined projects and a complete training program. It also uses profits and financial benefits as a performance measure to evaluate the related projects, and accomplishes its goals by utilizing an extensive set of statistical and advanced mathematical tools, and a well-defined methodology that produces significant results quickly. To succeed in this methodology, an organization should be willing and able to engage in a fundamental transformation of its culture (Mahesh et al, 2005³). Today, Six Sigma activities have helped a lot of world-class enterprises, such as Motorola, Texas Instruments, IBM, AlliedSignal, 3M, and General Electric, to achieve significant performance improvements (e.g. Goel & Chen, 2008⁴; Fuller, 2000⁵; Sanders & Hild, 2000⁶; Zu et al, 2010⁷).

Prof.P.M. Nandakumar, Assistant Professor, Department of Management Studies & Research Centre, SIT, Tumkur,
pnmnandakumar@gmail.com

Dr.H.S. Anitha, Professor, DOS in Commerce, Davangere University, Davangere.

Bhanu Prathap Singh, MD, Sigma Master Black Belt, Bangalore

PAPER ID: IEM2B5

Since the processes are having similarities in manufacturing and service, the concept got its applicability in service sector also. Service sectors being a vulnerable sector, for service to human, the zero defect approach will be the most suitable one, and the way towards the same being six sigma, making Six Sigma success becomes extremely important. To those who work as Six Sigma practitioners in the organizations, Six Sigma has become a way of life. Quality of care has become a focal point in service sectors. Service sector systems continue to produce care that varies in quality. This leads to customer dissatisfaction as well as inefficient processes and output. As stated by Hongbo Wang (2009⁸), Six Sigma can be applied service sectors like, construction, health, telecom sector and other industries. This paper attempts to know how Six Sigma concepts can be applied in Medical Transcription.

II. DMAIC-SIX SIGMA MODEL OF IMPROVEMENT

Six Sigma is more than numbers. That is a method and practice that provides tools for businesses necessary for accomplishing results from their processes and products. The main concept of Six Sigma is DMAIC (Define-Measure-Analyze-Improve-Control), method for analyses and improvement of business processes or operational process (Vojislav Stoiljkovic, et. al. July 2010⁹). DMAIC itself has five stages: To Define opportunities, To Measure performances, To Analyze opportunity, To Improve performances and To Control performances.

DMAIC is based on original Plan Do Check Act cycle (PDCA) (Vojislav Stoiljkovic, et. al. July 2010⁹). However, DMAIC is used for application of both efforts improvement of processes and design/redesign for an existing process and Define, Measure, Analyse, Design, Verify (DMADV) is used for creating a new product or process (Mădălina Brutu 2010¹⁰). As DMADV is used to design a process, product or service, the design options to select one that best meets customer needs, Design the detailed processes and Verify the design performance. This systematic design methodology can build processes that will reliably meet customer expectations.

III. LITERATURE REVIEW OF SIX SIGMA IN SERVICE SECTOR

Six Sigma was envisioned to be a quality improvement program that reduces process variation to the point where there are only 3.4 unacceptable defects per million process applications through the use of DMAIC and DMADV improvement strategies coupled with the deployment of a structured set of quality tools (Kumar et al., 2008¹¹).

More importantly, Six Sigma as a powerful management strategy has evolved from being exclusively about the original goal of a target of less than four failures or defects or errors per million opportunities, to encompass a broad range of approaches for incorporating quality into products and services from the early design and development stages and throughout their "life times" (Hensley & Dobie, 2005¹², and Cheng, 2008¹³).

Six Sigma is able to re-shape the flawed process with the purpose of reducing the resulting variations to a minimum level. The type of methodology is different according to the business process that the company intends to re-shape with DMAIC and DMADV methodologies.

In the beginning Six Sigma was popular in manufacturing industries and later it is started to implement in service industries also. As pointed out by authors such as Bank (2000¹⁴), Banuelas & Antony (2002¹⁵), Antony (2007¹⁶), Taner et al. (2007¹⁷) and Antony (2008¹⁸), there are a few expected benefits from implementing Six Sigma in the banking sector, such as: reduce customers' complaints, reduce internal call backs and so on.

In the same line, Antony (2006¹⁹) listed some of the benefits obtained by the financial institutions as a result of Six Sigma implementation such as those obtained by Citibank Group and J P Morgan Chase (Global Investment Banking). These are: reduced internal call backs by 80 percent, external call backs by 85 percent and credit processing time by 50 percent and etc.

Accordingly, Dinell (2003²⁰) indicated that Bank of America, Citibank have extensive in-house Six Sigma training and implementation programs. In the same line, Tracy (2003²¹) indicated that Six Sigma is a well established approach that seeks to help bankers at Bank of America to identify invisible-problems and errors within the bank so that they can identify the gaps the bank has.

Chakrabarty and Tan (2007²²) have investigated lots of articles concerning Six Sigma in services and filtered their results on 40 articles on the same topic. They strongly believed that Six Sigma is a recent improvement initiative that is felt to be difficult to implement in services because service's processes cannot be amended easily. Moreover, they highlighted the Critical Success Factors (CSF) of Six Sigma implementation in both manufacturing as well as in services sectors such as: top management commitment, education and training, cultural change, customer focus, clear performance metrics, attaching the success of financial benefits, and organized understanding of work process.

In this view, Hensley and Dobie (2005¹²) addressed in their study on "Assessing readiness for Six Sigma in service setting" the difficulties in using Six Sigma in services, such as difficulties in gathering data, difficulties in measuring customer satisfaction, and difficulties in quantifying and measuring data of sub processes. Other difficulties include: data collection is not automated like in manufacturing, cultural change, organizational infrastructure, linking Six Sigma to business strategy and linking Six Sigma to customers. Those difficulties are in line with the limitations expressed by Coronado and Antony (2002²³), Rajamanoharan and Collier (2006²⁴), and Chakrabarty and Tan (2007²²).

The other service sector like Fitness club (Kuei-Mei Cheng 2010²⁵), Legal Practitioners (W.M. Hirwani et al. 2011²⁶), Higher education (Prabhakar and Kaushik 2010²⁷), Hospital (R. Rao 2011²⁸), Telecom Sector (Manish Bhargava et al. 2010²⁹) and so on has been applied Six Sigma for process improvements.

From the above literature review, Six Sigma can be implemented effectively and efficiently through two key methodologies, i.e., DMAIC and DMADV, both of which were inspired by Deming's (Cheng, 2008³⁰). In the same view, researchers such as Antony (2006¹⁹), Ladani et al. (2006³¹), Antony et al. (2007³²), Chakrabarty & Tan (2007²²), and Antony (2008¹⁸) are in favor of applying the DMAIC methodology as the best way to implement Six Sigma in both manufacturing and service sectors, and this includes the five phases (DMAIC or DMADV).

IV. DEVELOPMENT OF MEDICAL TRANSCRIPTION

Evolution of transcription dates back to the 1960s. The method was designed to assist in the manufacturing process. The first transcription that was developed in this process was MRP, which is the acronym for Manufacturing Resource Planning, in 1975. This was followed by another advanced version namely MRP2. But none of them yielded the benefit of medical transcription.

The term transcript or "report" as it is more commonly called is used as the name of the document (electronic or physical hard copy) which results from the medical transcription process, normally in reference to the healthcare professional's specific encounter with a patient on a specific date of service. This report is referred to by many as a "medical record".

An individual who performs medical transcription is known as a medical transcriptionist or an MTs. The equipment the MTs uses is called a medical transcriber. A medical transcriptionist is the person responsible for converting the patient's medical records (voice files) into text from recorded dictation. The term transcriber describes the electronic equipment used in performing medical transcription.

Medical transcription can be performed by MTs who are employees in a hospital or who work at home as telecommuting employees for the hospital; by MTs working as telecommuting employees or independent contractors for an outsourced service that performs the work offsite under contract to a hospital, clinic, physician group or other healthcare provider; or by MTs working directly for the providers of service (doctors or their group practices) either onsite or telecommuting as employees or contractors.

In transcribing directly for a doctor or a group of physicians, there are specific formats and report types used, dependent on that doctor's specialty of practice, although history and physical exams or consults are mainly utilized. However, transcription equipment has changed from manual typewriters to electric typewriters to word processors to computers and from plastic disks and magnetic belts to cassettes and endless loops and digital recordings. Today, speech recognition (SR), also known as continuous speech recognition (CSR), is increasingly being used, with medical transcriptionists and or "editors" providing supplemental editorial services, although there are occasional instances where SR fully replaces the Medical Transcription (MT). Natural-language processing takes "automatic" transcription a step further, providing an interpretive function that speech recognition alone does not provide.

Currently, a growing number of medical providers send their dictation by digital voice files, utilizing a method of transcription called speech or voice recognition. Speech recognition is still a nascent technology that loses much in translation. For dictators to utilize the software, they must first train the program to recognize their spoken words. Dictation is read into the database and the program continuously "learns" the spoken words and phrases.

A. *Basic MTs Knowledge, Skills and Abilities*

The basic requirements of a MT are: Knowledge of basic to advanced medical terminology is essential, Knowledge of anatomy and physiology, Knowledge of disease processes, Knowledge of medical style and grammar, Average verbal communication skills, Above-average memory skills, Ability to sort, check, count, and verify numbers with accuracy, Demonstrated skill in the use and operation of basic office equipment/computer, Ability to

follow verbal and written instructions, Records maintenance skills or ability, and Above-average typing skills. (Source: Wikipedia.org.³³).

B. Medical Transcription Process

Medical transcription is the conversion of voice files dictated by medical professionals, into electronic data files in a prescribed format. Doctors dictate on a daily basis, their observations and findings on individual patient consultations, into convenient recording devices like handheld cassette recorders or state-of-the-art digital recording devices. The Association for Healthcare Documentation Integrity (AHDI³⁴) has three classifications for medical transcription errors as: Minor Error, Major Error and Critical Error.

C. How Six Sigma Methodology can be Implemented in Medical Transcription?

The fundamental objective of the Six Sigma methodology is the implementation of a Measurement based strategy that focuses on process improvement and variation reduction through the application of Six Sigma improvement projects. This is accomplished through the use of two Six Sigma sub methodologies: DMAIC or DMADV. As the service sectors have one or other similarities in their processes the **Table-1** provides the Six Sigma methodology in Medical Transcription.

D. Application of Six Sigma DMAIC Methodology

Define Phase

Problem is defined in this phase. Several types of defects could occur during medical transcription process are identified. Correct identification and finding the root causes for the defect is difficult due to the involvement of various technical factors like Process Design and Process Flow. The number of defective files during period can be identified, usually in Medical Transcription below 98% of quality level files are treated as a defective files. Quality improvement and reduction of defective files can be identified with the help of Supplier, Input, Process, Output, and Customer (SIPOC) diagram, various stages in the process as shown **figure-1** with reference to (Prabhakar and Kaushik 2010²⁷) modified as per Medical Transcription.

Measure phase:

As per AHDI³⁴ number of Minor Errors, Major Errors and Critical Errors can be identified, the accuracy of each file can be measured. Usually, in medical transcription 65 characteristics makes one line including space. The number of accuracy in words makes productivity of the line. Suppose a document is having 100 lines with 8 total errors of different types, then accuracy is 92%, (100-8), i.e.,

$$\text{Accuracy} = \text{Number of lines} - \text{Number of errors.}$$

$$\text{Defects per opportunity} = \text{DPO} = 0.08$$

In the measure phase, data on rejection rate of word files can be collected over a period. Current level of process performance can be estimated and Defects per Million of opportunity can be calculated and Sigma level can be identified.

$$\text{Defects per Million of opportunity} = \text{DPMO} * 10^6 = 0.08 * 10^6 = 80,000 \text{ or}$$

$$\text{Error per Million of Lines} = \text{EPML} * 10^6 = 0.08 * 10^6 = 80,000$$

The Key Process Input Variables (KPIV) and The Key Process Output Variables (KPOV) is measured in this phase. The various root causes for the defective files can be identified; the causes may be lack of language of medicine (LOM), Reference skill, etc., of medical transcriptionist as a critical success factors (CSF) as shown in cause and effect diagram, **figure-2** (C. W. Yeh, et al. 2011³⁵) modified with respect to Medical Transcription.

Analyze Phase:

The various root causes for the defective files can be identified and estimated by each medical transcriptionist. The frequency of occurrences of the causes can be estimated from each files and also from each Medical transcriptionist. The analyze phase helps to overcome causes for defective files. Hence in this phase occurrence of KPIV are analyzed which were causes for KPOV, as factors influencing for critical to quality (CTQ).

Improve Phase:

Various sources are identified through analysis of historical data as critical success factors (CSF), with the help of Histogram and Pareto Chart, factors that influenced to rejection. Cause and Effect Matrix is a viable tool which provides the maximum amount of information. The KPIV is scored according to their importance while the KPOV is scored in terms of their relationship to key outputs. In the Matrix, a factor of importance for each parameter score is rank ordered and every listed input parameter is correlated to every output parameter. Finally, a total value for each parameter is obtained by multiplying the rating of importance with value given to parameters and adding across for each parameter. The KPIV are listed on the left-hand side while the KPOV are listed on the top right hand side of the diagram. The KPOV may be rank ordered in accordance with the number of points from the Cause and Effect Matrix. The Pareto Diagram is the most influential for KPOV.

In this stage of the Six Sigma Implementation, the results obtained from analysis may be further considered for augmentation. The main objective is to improve the medical transcription process performance. Once the root cause of the problem is understood, the Team can activate to Generate Ideas for Resolving the Technical and MTs Unawareness, Problem by offering important corrections to improve the performance. The corrective actions suggested improving the process performance to medical transcriptionists may be: To enhance the medical language, To develop the correct reference skills, To improve the grammar, To use appropriate capitalization, To minimize typographical errors, To minimize the usage of wrong medical word, To minimize to creative transcription, To minimize pertinent omission and To minimize inappropriate blank.

Control Phase:

The factors critical to quality can be in the improvement process can be in place. The controlling technologies can be thought for continuous improvements. But in this phase design should ensure to solve the problem and secure as a strategies for control. Also, the obtained knowledge in the improvement project can be consulted in other areas to help accelerate improvements of service delivery. The deliverables to control the process may be used are:

1) Control charts for quality improvement, 2) Quality control process charts, 3) Standardization charts for quality, 4) Process metrics defined and implemented in Medical Transcription, 5) Control Plan implemented, and 6) Risk mitigation actions complete and implemented.

V. CONCLUSION

Six Sigma is such a process that brings additional benefits to service industries and help organizations to adopt best practices for service delivery by a quality process which ensure business success. In particular, its business orientation will ensure that service improvement activities are focused on dealing those services that impact the customer. As a result, the impact that it help in increasing the quality in service industries on the business overall will be greater.

As Medical transcription and Six Sigma concept are mutually exclusive, Process optimization, continuous improvement, measuring quality of service and process improvement are to be balanced for maximizing the payback of Medical Transcriptions.

One of the most important limiting factors in this field is difficulty in quantifying and gathering data from service processes, because these organizations don't mention quality data and quality program. Quality of the service must define and measured by defining quality factors and standards. Also quality programs which are focused on particular opportunities must be established strongly. Customer has a main factor in Medical transcription industries, so for proper implementing of Six Sigma in Medical transcription industries, the operational strategies and customer (needs and satisfaction) must be considered. This is one of the differences in the application of DMAIC to a MT project. By considering the limitations of the Medical Transcriptions, if Six Sigma concept is applied successfully there is no doubt improvement in processes and business.

Table 1: Six Sigma Methodology in Medical Transcription

Define	<p>Define the project and customer requirements</p> <ul style="list-style-type: none"> • Decide the project scope and project goals • Plan project deliverables and schedule for DMAIC stages • Form the project team • Prepare a project charter • Identify the process • Document the process using SIPOC diagram • Identify, analyze and prioritize customer requirements
Measure	<p>Study the process and determine the relevant metrics</p> <ul style="list-style-type: none"> • Assess measurement systems for validity and reliability • Design and implement new measurement systems, if needed • Develop a data collection plan • Calculate the process sigma level
Analyze	<p>Analyze data and discover causes of the problem</p> <ul style="list-style-type: none"> • Use collected data to find patterns, trends and variation by using Pareto chart, cause-effect diagram, and other statistical tools
Improve	<p>Investigate possible changes to the process</p> <ul style="list-style-type: none"> • Chalk-out action plans to introduce process changes • Test the new improved methods. • Decide on ways to sustain process changes • Implement changes
Control	<p>Ensure the standardization of suggested changes</p> <ul style="list-style-type: none"> • Address any problems with acceptance and implementation • Verify expected results and • Document effects of changes

Source: Vojislav Stoiljkovic, et. al. (July 2010⁹)

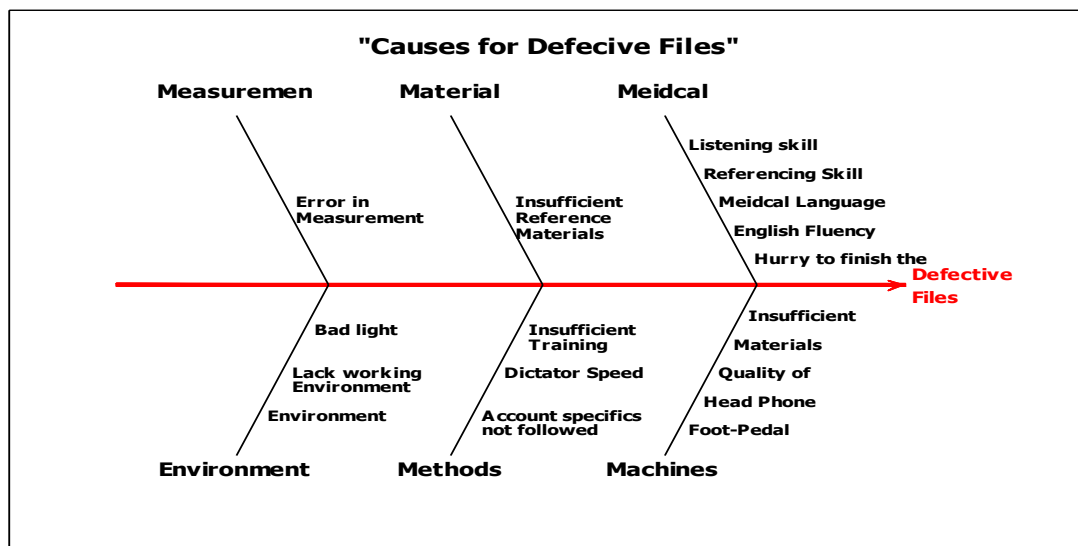
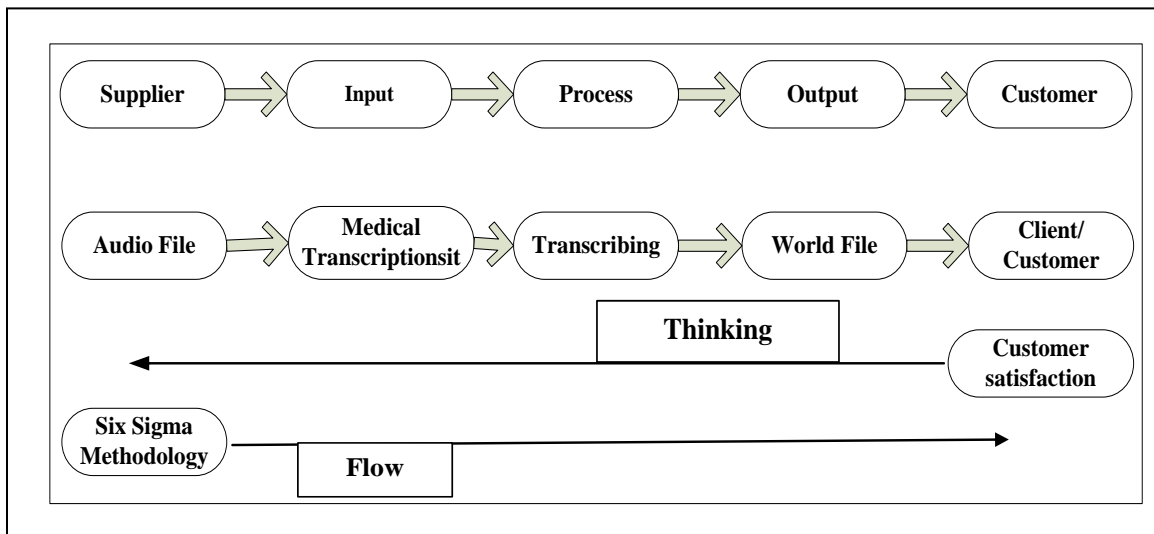


Figure 2: Cause and Effect Diagram in Medical Transcription:

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