

APPLICATION OF SIX SIGMA TO ANALYZE COMPLAINTS OF PATIENTS AT KING FAISAL SPECIALIST HOSPITAL

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CONTENTS

Table of content	vi
List of Figure.....	vii
List of Tables	viii
Abstract	ix
Chapter 1: Introduction	1
Chapter 2: Literature Review	6
2.1 The importance of service quality and quality management.....	7
2.2 Six-Sigma	8
2.3 Quality tools used in Six-Sigma.....	14
Chapter 3: Methodology	17
Chapter 4: Results	29
Chapter 5: Conclusion.....	31
References	33
Appendix A: Letter to the Head of Patient Affairs Office in KFSH	44
Appendix B: Approval Letter for Applying the Project in the Hospital	46
Appendix C: Data Report.....	48
List of abbreviation.....	50

LIST OF FIGURES

Figure 2-1.: The DMAIC process.....	13
Figure 3-1.: CTQ tree diagram	18
Figure 3-2.: Pareto chart.....	23
Figure 3-3.: Initial complaints rate happening befor improvment	24
Figure 3-4.: Cause-and-effect diagram.....	25
Figure 3-3.: Complaints rate of 2024	28

LIST OF TABLES

Table 2-1 DMAIC activities.	14
Table 3-1 Project Charter.....	20
Table 3-2 Top 9 types of issues and number of events.....	21
Table 3-3 Categories of data.	22
Table 3-4 CTQ Specification.	23
Table 3-5 Issue process – current and expected states.....	24
Table 3-6 Suggested Recommendation for Received Treatment Services.....	27

ABSTRACT

APPLICATION OF SIX-SIGMA TO ANALYZE COMPLAINTS OF PATIENTS AT KING FAISAL SPECIALIST HOSPITAL

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The study purpose was to reduce the number of patient complaints about services quality within KFSH non-manufacturing business in Saudi Arabia by applying Six Sigma DMAIC methodology. The five phases of DMAIC approach explained the quality tools and techniques used as well as key steps that led to problem-solving and sustainable improvement for the current services process performance and led to investigate type of issue, root causes of the complaint problem, and provide a recommendation to eliminate these complaints. Common nine patient complaints from 2023 to 2024 for the project undertaken by the head of patient affairs office are investigated through submitted document that showed the number of complaint events. Patient complaints analysis is critical for patient satisfaction as complaints produce customer dissatisfaction and KFSH cannot achieve a competitive advantage among other healthcare organizations, thus probable business loss. With this study, A description of how the tools and techniques of DMAIC methodology were employed in the different phases and how the improvement actions were implemented. This project methodology hoped to be useful to other healthcare institutions that are facing the same issues and intend to reduce errors in service processes as well, reduce patient complaints, and improve medical services.

Keyword: Six Sigma; DMAIC methodology; quality management; service; Healthcare; process improvement; complaints; root cause; Parito Analysis; Saudi Arabia

Chapter 1

Introduction

Introduction

Medical services are an important facility in healthcare institutions. Patients' complaints about the services of the hospital are a main indicator for the healthcare quality assessment, because services with quality have a stronger effect on customer satisfaction, organizations performance and profits. The importance of quality of services is to avoid poor quality cost (Mehta, 2004). However, most of medical services institutions still do not use the basic quality tools or do not have a high- level management support, which impact the process performance or the quality of service of the institutions, thus increasing in the number of patient complaints, for example, Medical Services Center at King Faisal Specialist Hospital (KFSH), in Riyadh city, Saudi Arabia, which is the case study of the project. The medical services center received various complaints from the patients about the quality of services. First, due to the long time to solve the problem. Second, due to personal skill of the worker and low information provided. Third, due to the table of time, forms keeping, received treatment, and medical equipment related. The problem of complaints of the patients became significant at the hospital, and had a great impact on work satisfaction, services effectiveness, low hospital reputation, low overall income because of poor quality cost that increase expenses of working for medical service center. Because poor quality management can reduce patients' satisfaction and prevent the hospital to achieve a competitive advantage among other health care institutions, it is important that patient complaints problem is understood so that processes of services of medical services center are operating efficiently. This project will use quality management techniques; particularly, Six-Sigma DMAIC methodology to eliminate the patient

complaints problem about the services, and to improve the service quality in Medical Service Center at KFSH by using quality tools such as Pareto chart and fishbone diagram to identify and measure the root cause of the type of issue in the service and to analyze the main cause in detail. Then, giving a recommendation about how to improve the service processes to reduce these complaints, to meet patients' satisfaction, and to drive KFSH to achieve a competitive advantage among other health care institutions. The data had been submitted in document by the head of patient affair office from 2023 and 2024. The submitted document (Appendix C) showed the total number of patient complaints and the types of the complaint that were grouped in 9 categories and were used as source of data for Pareto chart, which also known as the 80/20 rule to identify and measure the common type of issue in service problem that have high number of complaint events. After identifying the root cause of the problem by using Pareto charts, fishbone diagram can then be used to identify and eliminate sub-causes of the main cause of patient complaints problem. Once problem causes are determined in the Analyze phase, the project will find, evaluate through testing, and select creative new improvement recommendations. After improvement phase, a solid audit plan with proper change service management methods will be established to monitor and control service issues that cause the complaints of patients. In planning this study, the project presumed that management will be interested in improving the quality of services standards in the medical services center at King Faisal Specialist Hospital and will be interested in reducing complaints number, generating hospital revenue, and obtaining patient satisfaction of requirements, so they will provide accurate information for the purpose of this project. The benefits of Six-Sigma and its application are limited in this project because of time constraints that cannot solve all

types of errors about service, and just focus on the major type that causes a high number of complaints to improve it. In addition, the application of the project is limited to the medical services center in KFSH which is a healthcare services institution. Consequently, the results may not be applicable to other departments or other hospitals, especially those dealing in different services or located in different countries. The project DMAIC activities starts on January, 2024 to October, 2024. In conclusion, this research proposed to analyze why the number of patients complaints is increased. Is applying Six-Sigma leading to reduce patient complaints? Will Six-sigma DMAIC methodology enable the Medical Services Center at KFSH to improve its patient satisfaction and meet their expectations by reducing the issues and thus producing better services? Will the Six-Sigma quality tools such as Pareto chart and Fishbone diagram that are used in the project effective to find out the root causes of the type of error in the Medical Service Center at King Faisal Specialist Hospital, Riyadh city, Saudi Arabia. To answer the previous questions, the project will use Six-Sigma DMAIC methodology and certain quality tools on the case study to investigate whether the methodology is effective in reducing the number of complaints of the patients about the services in the Medical Service Center at KFSH, or not effective.

Study Issue:

Health services is one of the most important service field, so its development and attention to it are among the things that we cannot afford to lose sight of in order to obtain quality care services. Patient has to wait more than an hour before meeting a doctor at clinic, according to a recent opinion poll by the King Faisal specialized hospital' Health affairs department, Riyadh city, Saudi Arabia.

This amount of waiting time affects utilization of healthcare services and causes stress for both patient and doctor. According to (Boudreaux & O'Hea, 2004) Long patient waiting times contribute to poor access to care, interrupted hospital work patterns, and patient dissatisfaction.

The importance of studying:

The importance of this study comes from the significance of patient safety which represents a worldwide issue and an important area of research. conducting such a study regarding this topic is expected to have high positive reflections and significance that can be summarized as in the following:

- This research contributes to bringing this topic to the realm of scientific research due to its importance in the field of administration and health alike.
- Reducing the number of complaints of patients in the medical services center at KFSH leads to high Patient satisfaction which is a performance indicator that measures the extent to which the patient is content and satisfied with the level of care provided by health-care institutions and providers.

- The researcher hopes that this study will help public hospitals in improving their health services and increase patients' satisfaction with the health services they receive in these hospitals.

Study goal:

The main goal is:

- Improve the current services process performance.

Sub goals:

- Revealing the impact of Six-sigma DMAIC methodology to reduce the number of complaints about waiting time and increase patient satisfaction.
- Identify the major factors that cause for long time waiting.
- Suggested Recommendations to solve each factor

Study questions:

The main question of this research is: "Is applying Six-Sigma leading to improve services performance? **This main question is subdivided into the following sub-questions:**

1. Will Six-sigma DMAIC methodology enable the Medical Services Center at KFSH to improve its patient satisfaction and meet their expectations by reducing the issues and thus producing better services?
2. Will the Six-Sigma quality tools such as Pareto chart and Fishbone diagram that are used in the project effective to find out the root causes of the type of error in

the Medical Service Center at King Faisal Specialist Hospital, Riyadh city, Saudi Arabia.

Chapter 2

Literature review

Literature Review

Many theories and studies have been proposed to explain how importance of quality and quality management, and how Six-Sigma improves service quality by reducing the errors and increasing customers satisfaction. Although the literature covers a wide variety of such theories and studies, this review will focus on three main parts which emerge repeatedly throughout the literature reviewed.

2.1. The first part is: the importance of service quality, quality management in services organizations.

2.2. Second part is: Six-Sigma.

- Six-Sigma theories.

- The ability of Six-Sigma in improve quality of service, and customers satisfaction (patients; service beneficiaries) through the reduction of errors in non-manufacturing business, specifically in health care services.
- Limitation and difficulties and Six-Sigma implementation.
- DMAIC methodology.

2.3. Third part is: the effectiveness of quality tools which are used in Six-Sigma such as Pareto chart and fishbone diagram in identifying and analyzing the root cause of the problem.

2.1 The importance of service quality, quality management in services organizations.

(Kandampully, Mok, & Sparks, (2001); Seth, Deshmukh, & Vrat, (2005), talked about service quality management as an important area on which many managers and researchers focus. Service quality is influenced by customer satisfaction, work sincerity, organization performance, and profits. Also, Caruana, (2002) study mentioned the relation between service quality and customer satisfaction by the definition of quality service which is a comparison results between the customers' expectations and the manner perception which service was provided in.

Mehta, (2004) in his book, said that the importance of quality is to avoid costs of poor quality because the poor-quality costs of certain service are the same of 30% of operating expenses average in manufacturing. Also, he mentioned that according to Burst and Gryna,

(2002) 25 to 40% increase in working expenses which poor quality costs cause for service organizations.

American Society for Quality defines quality as a free of any defects on product or services, or product or service properties that meet customers' need. Also, Ross, (1999) collects the meanings of quality in her book according to authors such Joseph Juran who defined the quality as "fitness for use", Philip Crosby who said, "quality is conformance to requirements." And Sam Walton who said, "quality is to give the customer what they want." Then, she clarifies that the importance of quality not only lowers poor quality cost, but also uses as growth driver, and profitability. Also, she explains the meaning of total quality management (TQM) as an incorporation of all processes inside the organization to achieve continuous improvement of the services and products quality, and it can be applied in both manufacturing and non-manufacturing business to higher revenue, lower cost, achieve competitive advantage and customers satisfaction.

Marta, Jose, & Carlos, (2015) find by reviewing numerous studies that quality management can make greater profits, reduce the cost, improve organizational elements such as competitiveness or processes, increase workers' productivity and employee satisfaction such as better working environment and training, and customers satisfaction such as reduction in complaints.

Nonthaleerak & Hendry, (2006) show that quality management (QM) is an important management strategy in the business world to achieve competitive advantage. QM classified into traditional initiative such as Statistical Quality Control (SQC), Zero Defects and Total Quality Management (TQM), and recent initiative such as Six-Sigma which had been adopted

by many manufacturing and non-manufacturing organizations across the world and gave a great improvement result to many companies in contrast with traditional initiative.

2.2. Six-Sigma:

Six-Sigma (SS) is considered as organizational strategy to increase their revenue and satisfy their customers by certain statistical tools which lead to elevate the income by making the services with excellent quality according to (Park, 2003).

Truscotts, (2003) defines Six-Sigma as an administration system seeks to achieve strong leadership with enhancing employees to share in problem solving or suggestion in the organization.

Pande & Holpp, (2002) Said that Six-Sigma focus on establishing organization internal work base to measure and provide ways and process map by work team who executes project by project through head administration support and special training programs to form certain idea for the whole staff in the organization.

Revere and Black (2003) suggest that the chosen projects should be focused on having a significant and positive impact on customers and should be selected based on company errors related not to achieving customer's expectations.

Several papers have been reported that Motorola introduced Six-Sigma in 1986 because of the problem of many complaints from customers about the products warranty period. After applying Six-Sigma at Motorola, the company became able to reduce the level rate of defects and achieved less than 3.4 parts of defect per million within 5 years, in addition, the implementation success helped in increasing productivity, service quality and customer

satisfaction, also, in reducing poor quality costs associated with operation (Antony, 2006; Mehrjerdi, 2011; Pande, Neuman, & Cavanagh, 2000; Kumar, 2006).

Other papers illustrate that because of the benefits of Six-Sigma implementation which was only used in industry, it has been extended to services area in purpose to reduce the variability and process errors (Mehrjerdi, 2011; Pandey, 2007; Kwak & Anbari 2006).

Sander & Hild, (2000) said that Six-Sigma methodology is used to improve business processes, and it can be adjusted according to the institution's strategy. And Kumar, Jiju, Frenie, & Mada, (2006) study shows that SS methodology can improve the quality of services by reducing the variation and analyzing the root cause based on statistical and scientific method.

One of the major active non-manufacturing that has been adopted Six-Sigma is health care services. The following papers illustrate the ability of Six Sigma in improving healthcare service quality and revenue by reducing the errors:

According to Buck, RN, & MSN, (2001) the paper shows that Six-Sigma reduced the Errors in medication and laboratory and patient safety was improved by thereby.

In addition, Thomerson & Douglas, (2001) study shows that the Commonwealth Health Corporation (CHC) was the first medical institution adopt Six-Sigma approach, the service radiology amount was increased around 33% and the cost per radiology procedure was increased around 21.5 % and the CHC saved around \$1.2 million.

Also, Revere, Black, & Huq, (2004) demonstrates that Six-Sigma show improvement in patient satisfaction in virtue health organization and reduction in the length of stay for its congestive heart failure patients. Also, the study mentions that studies include healthcare in

U.S. services industries has average level of sigma between 2.0 and 2.5 because Six-Sigma has not been widely applied to patient care.

Moreover, Liberatore, (2013) explains that SS techniques have been applied to 88 hospitals healthcare institutions. 16% were in Netherlands, United Kingdom, Italy, South Korea, India, Finland, Taiwan and Thailand. Also, the study shows the applications of SS were initially at inpatient areas such as admission, medical administration, discharge, operating room, and intensive care. Then, the findings after reviewed several studies show that SS addressed some errors and was applicable in other areas such as reducing medication, other errors and process, and wait times.

Many papers have been reported that the application of six-sigma is limited in services in comparison of manufacturing. For example, Frustule, Dr. Bansod, & Swati, (2012) literature review criticized Six-Sigma as does not offer new thing and it is simply repackaging traditional QM practices.

Antony, (2006) said that Six-Sigma can be applied in the service sector, but it is still moderately limited because of several constraints, and the paper presents the ability areas in which where Six-Sigma could be exploited in service functions the paper also illustrates most common performance of six sigma metrics commonly used by service organization. Also, Chakrabarty & Tan, (2006) mentioned that the six-sigma can be applied in hospitality and call centers, and it is still not widely used in services. Its application is mainly limited to specific service organization such as health care, banks. Then, the study concludes that since services are not uniform, it is better to applying the Six-Sigma tools and methodologies after understanding the process.

Despite this limitation, applying Six Sigma in services of medical center makes improvements in performance. In addition, this methodology can be applied even in processes with low performance (Abreu, Sousa, Member, IAENG, & Lopes, 2012).

However, some papers investigate difficulties and the negative side of applying Six Sigma. For example, McAdam & Lafferty, (2004) found that there was low success in non-manufacturing areas according to process perspective, and according to people perspective, they found lack of empowerment which the organizations needs to evaluate before applying Six-Sigma.

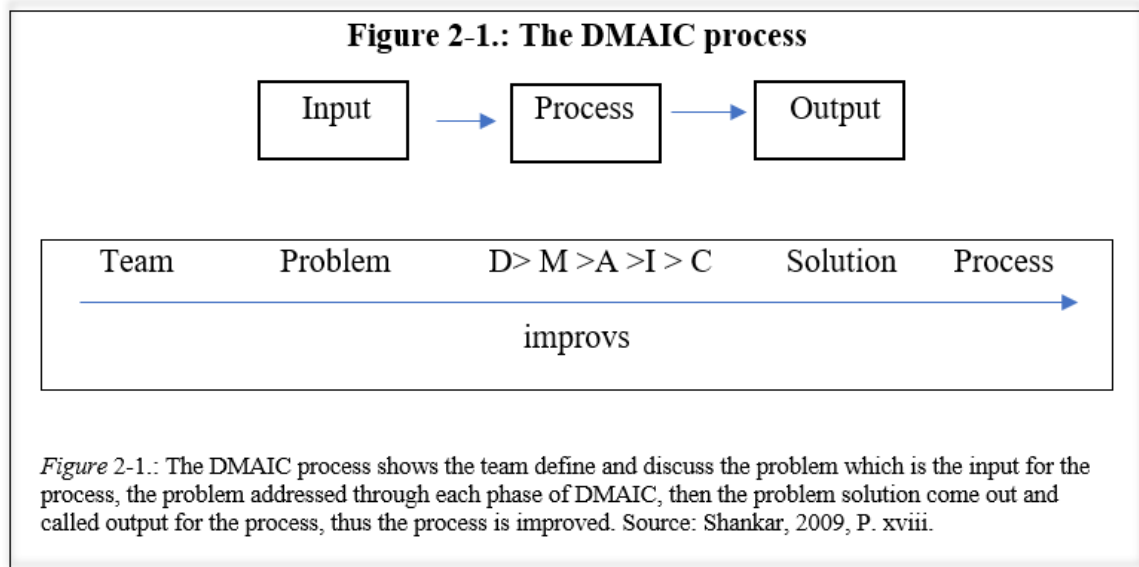
Another study explains that root cause analysis in the analysis phase of business problems can be affected by lack of data, then Six-Sigma would not be effective on improvement action. (Gnibus, 2000).

In addition, some authors reveal controversial studies and criticize Six Sigma , for example, Dalglish, (2003) who point out that there was an excessive emphasis on using quality techniques rather than focusing on improvement efforts, which make SS Impact negatively on organization, And Catherwood, (2002) who said six sigma is not the universal answer to all business errors and organizations must realize that, also SS should not be the most important management strategy which manufacturing and non-manufacturing feel a sense of urgency to understand and implement.

The future of Six-Sigma has been reported by Kwak & Anbari, (2006) the paper illustrates according to several authors who agreed that the primary focus should not be on pinpointing and counting defects, but it should be on improving overall management performance. Researchers and practitioners are trying to merge Six-Sigma method with other new management practices methods to attract many organizations which might have not

started or completely applied the Six-Sigma method. The merging and comparing principles and characteristics of SS with TQM.

One of the most familiar Six-Sigma sub-methodologies is DMAIC approach. Shankar, (2009) called DMAIC as process improvement methodology, which its input is the problem, the output is the solution to the problem, and the process between the input and the output composed of Define, Measure, Analyze, Improve, and Control (Figure 2-1.).



Furterer, (2009) list the activities that can be executed inside each phase of the DMAIC problem-solving approach (Table 2-1.).

Table 2-1.

DMAIC Activities for Each Phase

Define	Measure	Analyze	Improve	Control
Identify the scope and the problem	Measure the current performing and the size of the problem	Analyze the root causes to isolate the problem	Improve the process by selecting solution	Monitor and audit the process to ensure the goals are met
Project and team selection	Determine the available data and its source	Determine causes and effect relationships	Address the root cause with an improvement	Determined results measurement and change running
Determine the stakeholders	Make data gathering plan	Develop process data capability and confirm vital few	Make brainstorm	Create process control plan
Identify the customer (VOC)	Define in detail VOC	Test the hypotheses about root cause of the problem	Prioritizing the solution depending on patient requirements	Develop future plans
Set the project's mission, aims, and timeframe for completion	Validate measurement system such as product feature, process parameters	Determinant of performance	Gaining an approval to implement and applying	
Create the project plan	Determinant of performance		Execution and training	

Note. VOC= Voice of Customers. Source: Furterer, 2009. P. 14.

Several papers discuss each phase of DMAIC in detail. For example, Snee, (2004) who discusses the tools and concepts which are part of the Six-Sigma method for process improvement and focus on explaining each phase of DMAIC. Also, the paper shows that the errors were reduced by 65%.

Also, Rasis, Gitlow, & Edward, (2002a), (2003b) show in their paper material for DMAIC that helps in self-learning training and helps the readers by involving guidance on the tools application to learn how to perform small-scale Six Sigma project. Also, the paper illustrates the need for training material and suggests that there are many ways to develop researches for further training materials to cover a wider range of applications and larger scale projects.

Ray, Das, & Bhattacharya, (2018) said that a successful selection and corrective actions implementation can reduce the number of occurrence and the root causes severity, thus the process performance become improved. That can be achieved by Six Sigma DMAIC methodology which can be applied to any process, to improve the performance of process, where the process root causes problems are not known.

Studies like (Abreu et al., (2012); Chakrabarty & Tan (2006); Ramly et al., (2012)), used Six-Sigma DMAIC methodology and show improvement in services process by reducing the errors.

2.3 The effectiveness of quality tools Six-Sigma

Antony, (2006) paper reviewed that there are significant benefits through the application of basic tools of six sigma such as Pareto analysis, root cause analysis or cause-and-effect analysis, etc. for many service organizations. Also, the paper looks at the most commonly used tools and techniques of six sigma within the service organizations.

Ross, (2014) in his book, point out that the goal of using quality tool such as Pareto chart is to ensure the effective manner of allocate the limited resources in healthcare organizations, and the idea of Pareto chart suggest the improvement should start with high-

frequency event, then assess the effort that will be needed and the performance that will be achieved when the improvement of performance projects is undertaken.

Mears, (2009) defines a Pareto chart as a graphical tool used to distinguish the most important errors by describing a large event into small parts. And Vasconcellos, (2003), explains that Pareto technique is used for quality improvement of both products and services, where problems are solved separately.

Rastogi, (2010) said in his book about cause-and-effect diagram, also called a fishbone diagram, and it is a graphical technique that identify the root causes of a major errors. And Charantimath, (2003) in the brainstorming process Fishbone technique can be used, where possible factors categorize the key problem causes which are organized within four majors

Although the literature shows these three main parts in a variety of contexts, this paper will primarily focus on their application to Six-Sigma DMAIC methodology. For the conclusion healthcare quality assessment can be achieved by the concept of service quality, quality management, and Six-Sigma with effective quality tools used in DMAIC methodology of Six-Sigma.

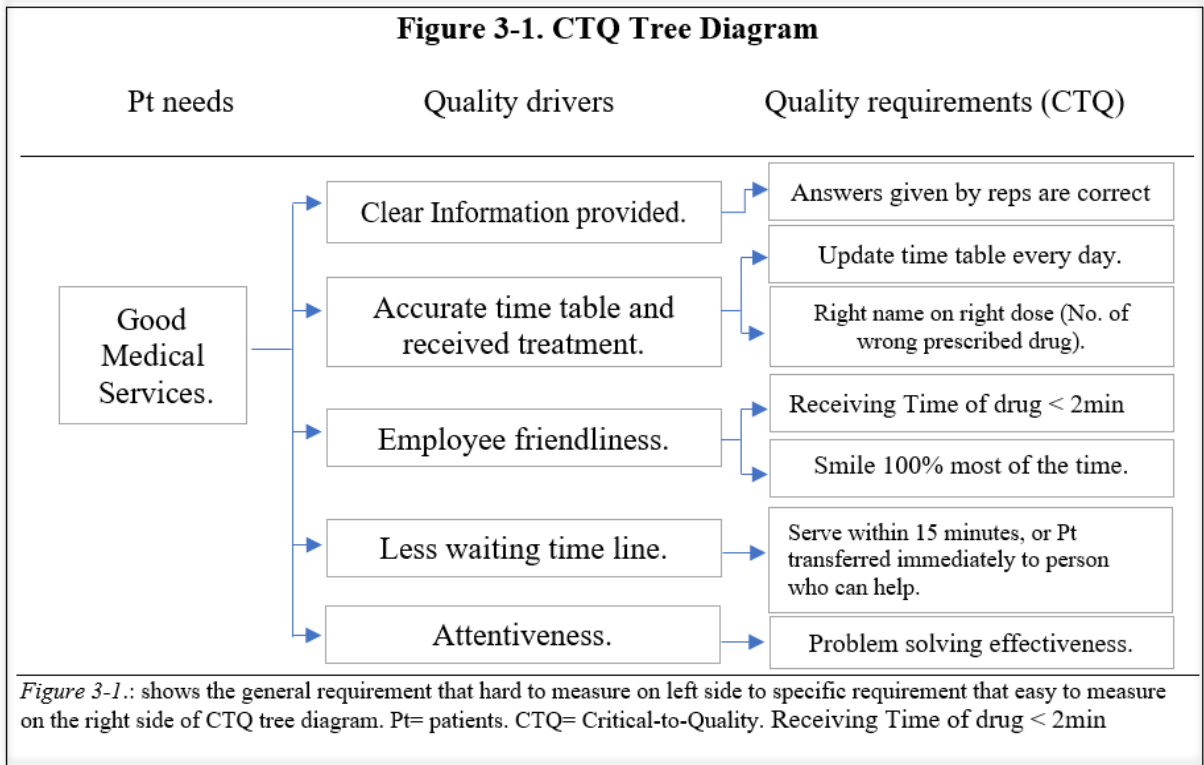
Chapter 3

Methodology

Material and Methods

The project was carried out between January 2024 and October 2024 and has used Six-Sigma DMAIC methodology Define-Measure-Analyze-Improve-Control to reduce service issues, thus reduce the number of complaints of patients about the quality of service in medical services center at King Faisal Specialist Hospital, Riyadh city, Saudi Arabia.

Also, the project seeks success in Six-Sigma process by identifying the voice of the customer (VOC); Customer is the patient (Pt) in the hospital. The importance of VOC in this research study is to capture the patients' needs by gathering patient data from the health affairs department and converting it into measurable critical-to-quality (CTQ) elements to satisfy their needs (Figure 3-1.). The study obtained the patient complaints data by the head of patient affair office through submitted document (Appendix C).



A. Define phase:

KFSH where the case study took place seeks high standards of service quality and is a reference hospital in the health care institutions. The frequent patient complaints problem selected to be tackled through this project with emphasis on the use of Six-Sigma method is to increase in competitiveness and quality and to reduce issues in the service quality, which clearly comprise both an impact on the patient's expectations and important savings for the institution studied. In the patient affair office where the top nine patient complaints and issues for 2023 to 2024 were recorded and submitted in document. The complaints were about information provided, timetable, received treatment, forms missing, solving time, medical equipment related, personnel skill, waiting line time, other. With the understanding of the Six-Sigma project, benefits are expected namely the reduction of number of patient complaints, reduction of number of medical services issues, and improvement of patient satisfaction and quality of the service. Define phase is focusing on defining the problem that needs addressed solution and ended with clear perception of scope and management support evidence to ensure the commitment from stakeholders involved. The problem faced by this healthcare institution was that the number of complaints of patients was 2,743 complaints during 2023 to 2024. It was decided to reduce the number of patients complains that were recorded in the hospital (Y) by 20%. This problem caused several types of losses to the hospital, for example, time, efforts, capital as well as it creates patients' dissatisfaction, which negatively affects the organization's image, thus selected a Six-Sigma DMAIC methodology to improve the medical services process by analyzing the patient complaints to reduce the service issues. At the end of the define phase, the project identified patients' requirements, and captured the information in project Charter (Table 3-1).

Table 3-1.

Project Charter

Project Title	Analysis and reduction of complaints of patients				
Project leader	Khalid Alaiban				
Business Case			Problem Statement		
Vast number of complaints of Pt about the medical services due to service issues. This problem causes several types of losses to the company, i.e. time, efforts, capital as well as it creates patients' dissatisfaction, which negatively affects the organization's image, thus selected a Six-Sigma project to reduce the medical services issues by analyzing the number of patient complaints.			The number of complaints of patients about the quality of service in medical services center have gone up every year for the last 4 years.		
Project Scope			Goal Statement		
Start date: January, 2024 End date: October 2024 In scope: Upgrading of major medical service with more efficient service. Out scope: Analyze the categories of patient complaints to reduce complaint frequency.			The main goal is reducing the number of complaints of patients by reducing the issues in medical services center at KFSH and gaining patients satisfaction.		
Business Benefits			Voice of Customer		
Reduction of the number of patient complaints. Improvement of patient satisfaction. Improvement in the medical services quality. Increase in medical services productivity.			Services quality.		
Team Members			Project Milestone		
<i>Name</i>	<i>Role</i>	<i>commitment</i>	<i>Phase</i>	<i>Start</i>	<i>End</i>
Khalid Alaiban	Leader	High	Define	Jan 22 th	Mar 9 th
Saud Altamimi	Sponsor	medium	Measure	Mar 10 th	Jun 23 th
			Analyze	Jul 24 th	Aug 9 th
			Improve	Aug 10 th	Sep 23 th
			Control	Sep 24 th	Oct 25 th

Table 3-1- Summary of the project.

B. Measure phase:

This research consisted of reducing the number of patient complaints about quality of service in medical services centers. Particularly, in this project the measure phase means the definition and selection of effective metrics to clarify the major type of issue which needed to be reduced. The project is using two metrics to compare the before and after states of the King Faisal Specialist Hospital non-manufacturing organization when conducting the Six Sigma's projects. After defining the total number of patient complaints, Sigma level of the major issue that has high number of complaints in the medical services center is calculated. The project starts from January, 2024, and its duration takes 300 days, which ends on to October, 2024. The project bases the study on gathered data from submitted document in patient affair office. The problem can be seen in (Table 3-2.) of the top 9 types of issue that have frequent number of events.

Table 3-2.
Top 9 Types of Issue with Number of Events

Type of issue	Number of complaint events
Information provided	137
Timetable	81
Received treatment	989
Forms missing	79
Solving time	450
Medical equipment related	280
Personnel skill	54
Waiting line time	647
Other	26

Table 3-2. Pareto table data in easy understandable information; complaints categories by types.

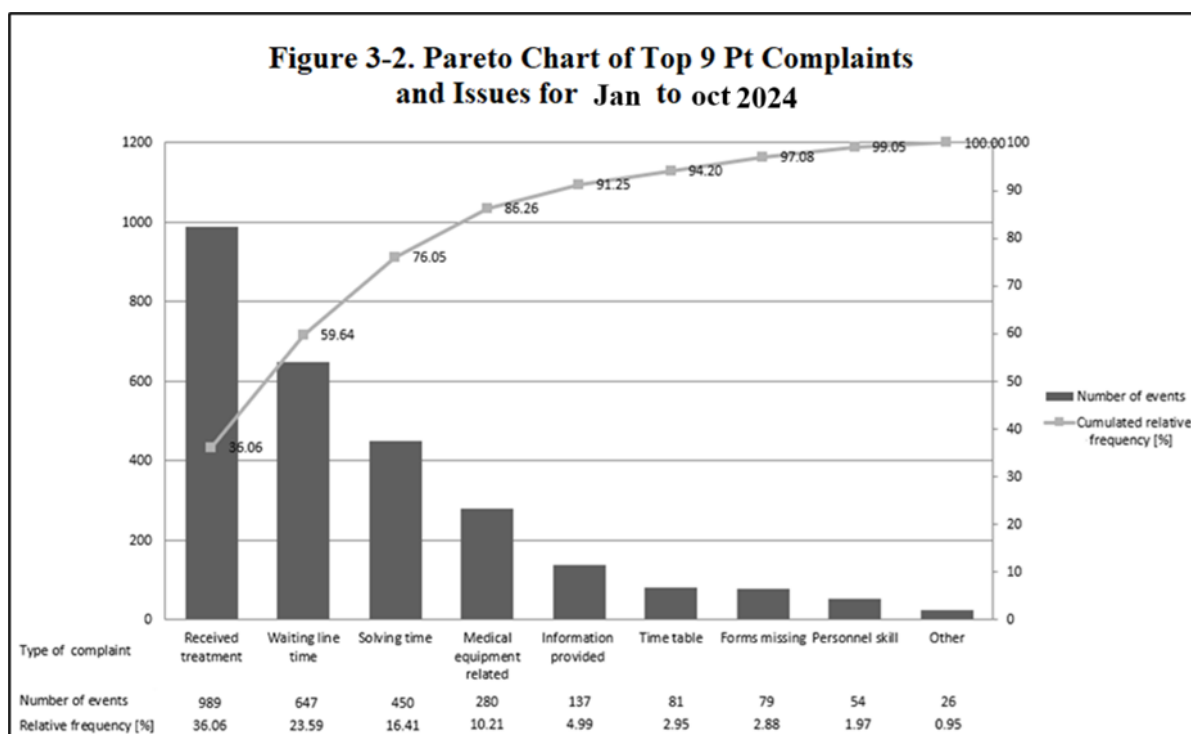
The issue with Table 3-2. is it does not readily answer the question of what type of issue should be focused on. As a next step, a Pareto analysis carries out to identify the utmost occurring type of issue and prioritize the most critical problem which is required to be tackled (Table 3-3. Types of issue with data distribution).

Table 3-3.
Categories of Data

Type of issue	Absolute frequency	Cumulated absolute frequency	relative frequency [%]	Cumulated relative frequency [%]
Received treatment	989	989	36.06	36.06
Waiting line time	647	1636	23.59	59.64
Solving time	450	2086	16.41	76.05
Medical equipment related	280	2366	10.21	86.26
Information provided	137	2503	4.99	91.25
Time table	81	2584	2.95	94.20
Forms missing	79	2663	2.88	97.08
Personnel skill	54	2717	1.97	99.05
Other	26	2743	0.95	100.00

Table 3-3. Pareto table of top 9 types of issue with number of complaint events (absolute frequency), (cumulated absolute frequency), percentage of number of complaint events (relative frequency) and (cumulated of relative frequency).

Then Table 3-3. of collected data is presented in the form of a Pareto chart which is showed in (Figure 3-2.) The Pareto chart indicates that the highest rate of patient complaints is caused by received treatment service which contributed to over 36.06 percent of the overall number of complaints. Therefore, the project and the hospital decide to initially focus on the reduction of the received treatment complaints.



The figure shows the top 9 patient complaints for Jan 2024 to OCT 2024. The analysis of this diagram shows that received treatment issue has 989 complaints and corresponds to 36.06 % of the complaints and the yield of this service is 63.94 %, and it is related with 20% of the events. Thus, the hospital should focus its attention on this type of issue (few and vital) rather than on the low incidence ones (many and trivial). Through the previous Pareto chart, the project came out with Critical to Quality (CTQ) specification table as depicted in (Table 3-4.) and measures the complaint rate of received treatment issue that affected services quality for January 1st, 2024 to January 31th, 2024 (Figure 3-3.).

Table 3-4
CTQ specification

CTQ (project Y)	Operation definition	Goal
Daily complaints rate* for received treatment issue	Complaints happened and captured from helpdesk of the pharmacy.	Reduce daily complaints rate for the received treatment issue by 20%

*Note: Complaints rate = (Number of complained Pt / Total served Pt) *100.

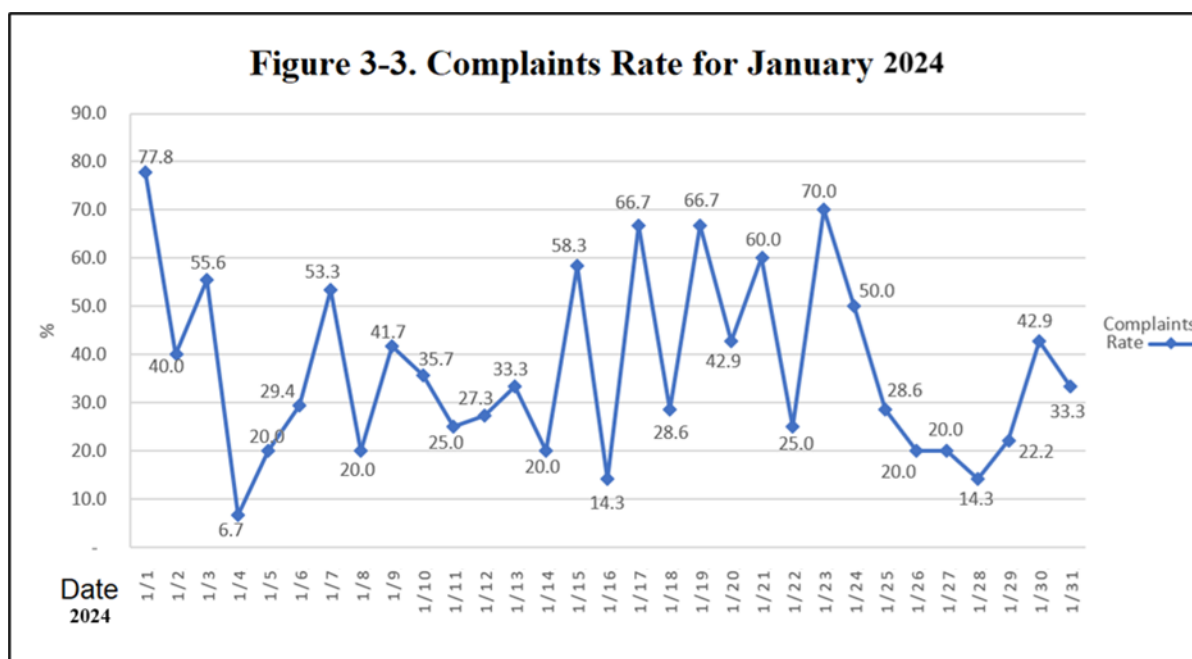


Figure 3-3. The complaints rate for January 1st,2024 to January 31th, 2024 before improvement.

The helpdesk of the pharmacy recorded 300 served Pt for January 2024, and 115 of them complained about the received treatment issue. The complaint rate is then translated into the Sigma levels as 1.8 Sigma. The calculation of the Sigma metrics allows the project and the hospital to have a more detail and operational definition of the current state of the complaints rate well as the Six Sigma's goal in terms of the KFSH medical services quality improvement, and these are shown in (Table 3-5.).

Table 3-5.

Issue Process – Current and Expected States

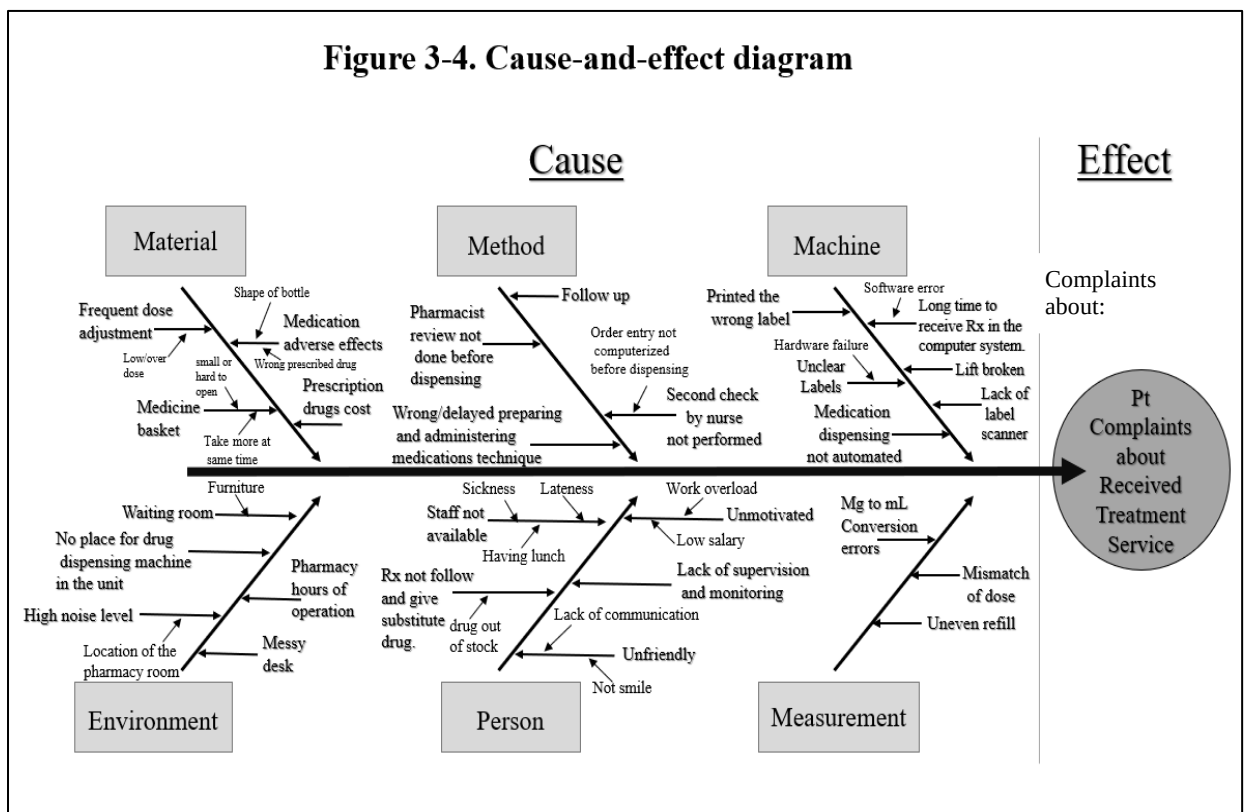
Major type of issue	Number of Major Type of Issues		Sigma Levels	
	C*	E*	C*	E*
Received treatment	115	40	1.8	2.6

Note: C* = Current complaints number. E* = Expected complaints number after finishing Six-Sigma project.

The next phase in the project of Six-Sigma DMAIC methodology is analyzing the root causes of the patient complaints problem as well as applying an appropriate solution.

C. Analyze phase:

This phase in the Six-Sigma DMAIC methodology includes only the analysis of received treatment issue. In this case the non-manufacturing healthcare that introduces the medical services to identify ways to reduce the gap between the current number of complaints and the expected goal. To do this, a data analysis is completed in this phase and followed by an investigation to determine and acquaint the root cause of the problem. The project used brainstorming and discuss with the supervisor of the pharmacy about all possible cause factors that influence on the quality of medical service, and the project then used the cause-and-effect diagrams that also called as Fishbone or Ishikawa diagram to illustrate all the possible causes (Figure 3-4.).



From the cause factors listed, the project identified that there were six major categories that might have an influence on the effect as follows: machine, person, methods, measurement, materials, and environment. After considering all possibilities, and it was found many requested paper about lack of label printer in the room with no response, lack of communication with nurses to check the prescribed drug, many reports about drugs side effect because of drug bottles are similar and elderly Pt who cannot read are confused what drug should be taken first and when, many employee report complaints about high level of noise and slow computer system, and weekly employee assessment showed many observations about staff behaviors such many lateness, unmotivated, and lack of communication with patient within medical services center, so the number of patient complaints is increased. After having assigned the major factors and the possible root causes. The next step is improving phase to eliminate root causes.

D. Improve phase:

The fourth phase of Six-Sigma DMAIC methodology is an improve phase which comes after determining the root cause. Improve phase aims to identify the solutions to reduce and tackle the issue in the quality of medical service that cause high number of patient complaints. From the study brainstorming and observation, literature review, and consultation with management some recommendations with the corresponding causes are provided below to increase the quality percentage in services of medical services center, thus number of patient complaints will be reduced (Table 3-6.).

Table 3-6.

Suggested Recommendations for Received Treatment Services.

Cause type	Causes	Suggested Recommendations
Person	Staff not available	Improve supervision, ensure cover employee
	Unmotivated	Reward employee of the month, paid for overtime work.
	Unfriendly	Improve the skill of the employee. Use good communications skill
Machine	Lack of label printer in the room	Repair damage machine parts. And print by computer printer.
	Long time to receive Rx in computer system.	Apply computer security software, monthly checking on patient records management systems.
Method	Double check by nurse	Provide nurse staffing, works especially for the pharmacy.
Material	Medication adverse effects	Colored drug bottle for Pt who have more than one medication to help them to differentiate between them and instruct the them how to take the drug and when.
Environment	High level of noise	Close the pharmacy waiting area with partition wall and door to insulate the out-side noise.

Table 3-5. Corrective actions plan, note: Rx: medical prescription.

E. Control Phase:

The final and strength of the DMAIC phases is in the Control phase. The main objective of the control phase is to ensure successful improvements of the project's recommendation in the service over time. Then the improved service quality will be control charted (Figure 3-5. Measure complaints rate about received treatment issue after improvement for Oct 1st, 2024 to Oct 31th, 2024). Results will continue to be monitored so that any deviation back to previous results can be observed and solved in a pro-active way, and it should be updated as needed do that the manager is aware of the new arrangement.

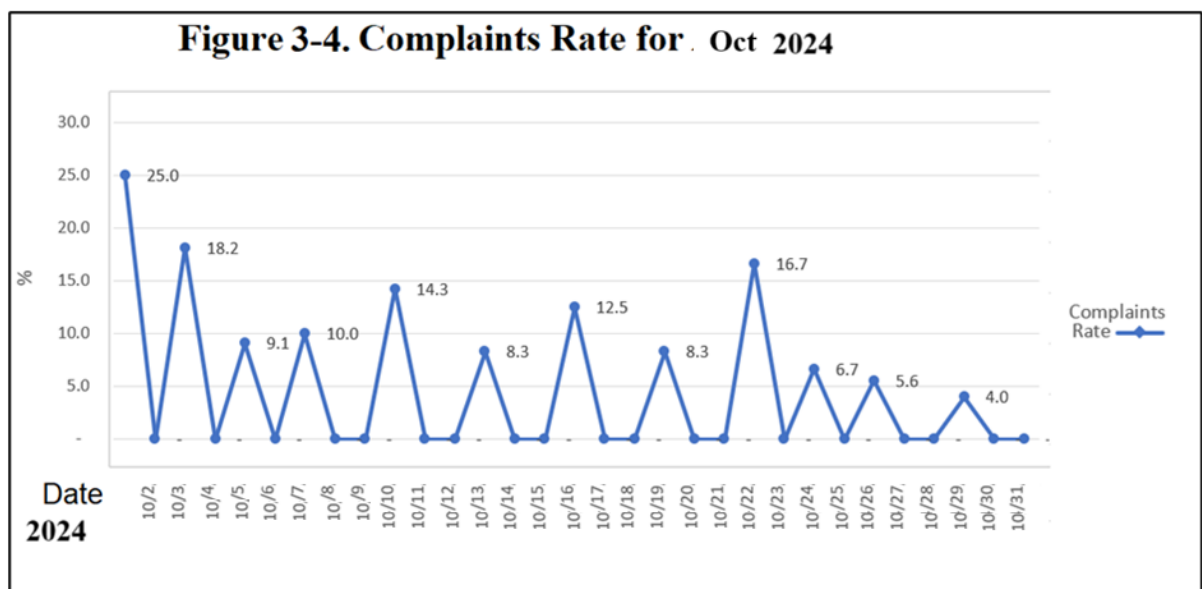


Figure 3-4. The percentage of complaints rate is decreased which means number of complaints about received issue in medical services center is reduced. The helpdesk recorded 300 served Pt with only 39 of them complained

Chapter 4

Results

Results:

After the implementation of these solutions into medical services center, the results were tested and measured for one month (October 2024). Through these proposed improvements, the project found that number of patient complaints had been successfully reduced to 25% of initial volume of received complaints issue. This result proved that Six Sigma DMAIC methodology had effectively improved the overall service quality by finding the root cause and selecting the best solutions for high received treatment issues that project faced previously. After identifying the true cause of the problem, understanding that continuous auditing needs to carry out from time to time to confirm that any deviations from control targets are identified and corrected before they result in complaints and subsequently negatively affecting improvement effort that took place. The complaints per million opportunities indicator value have decreased from 383,333 (1.8 Sigma) to 130,000 (2.6 Sigma) and the yield % The Sigma level has improved approximately by 0.8 Sigma. The goal of the project – to reduce the number of complaints by 25%. The project seeks to continue implementing Six Sigma DMAIC methodology to other areas of services as well. Through this initiative, it can ensure that it covers all improvement areas needed that are related to received treatment issue volumes that may impact the overall patient satisfaction in future.

Chapter 5

Conclusion

Conclusion:

This study is divided in two parts. The first part reviews about service quality, quality management, Six-Sigma, DMAIC approach with some quality tools, and the application of six-sigma in services. Some literature showed that the application of Six-Sigma is common in manufacturing and is still not wide spread in services. Wherever applied, Six-Sigma is also limited to some certain departments like in health care institution, especially in some laboratories and not in the overall hospital. The second part introduce a current project case study. The project discusses on the improvement carried out to reduce the number of patient complaints using Six Sigma DMAIC methodology in medical services center at KFSH. The five phases of DMAIC approach explained the quality tools and techniques used as well as key steps that led to problem-solving and sustainable improvement for the current services process performance and led to investigate type of issue, root causes of the complaint problem, and provide a recommendation to eliminate these complaints, thus the project finding can be helpful in the wider application of six-sigma. So, the results achieved were improved service quality by reduction of the number of complaints and thus enhancing organization's competitiveness. At the end, the project hoped to be a useful to other healthcare institutions that are facing the same issues and intend to reduce complaints about service quality as well.

Chapter 5

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Chapter 5

Appendix

APPENDIX A:

Letter to the Head of Patient Affairs Office in King Faisal Specialist Hospital

From: Khalid Alaiban < Khalid.alaiban91@gmail.com>
To: Altamimi Saud < Saud.Moh@gmail.com >
Date: Fri, 15 Dec 2023 at 8:38 AM
Subject: Applying a research study on KFSH

Dear Mr. Altamimi

I will be honored if allow me to conduct a study research study at King Faisal Specialist Hospital, Riyadh city, the project title is "Analyze complaints of patients by Six-Sigma methodology." In partial fulfillment of the requirements for the degree Master in the Department of project management, in midocean university.

The project aims to reduce the number of complaints of patients by improving the process of the services which patients complain from. I will use DMAIC methodology (define, measure, analyze, improve, control) which is an approach of Six-Sigma. The targeted sample is the patients, and the data will be collected by filling in the survey, then provide me by e-mail about any submitted complaints form. all answers will be taken into consideration and will be kept strictly confidential and never associated with patients' name, and it will only be used for the purpose of research.

Thank you for your time and consideration. I hope to get approval letter as soon as possible.

Sincerely,

Khalid Alaiban
Riyadh , Alnafal distrect
+966 551170551

APPENDIX B:

Approval Letter for Applying the Project in the Hospital



مستشفى الملك فيصل التخصصي ومركز الأبحاث
King Faisal Specialist Hospital & Research Centre
مؤسسة عامة. Gen. Org.

Approval Report

25 Dec 2023

To Whom It May Concern:

We've approved that Student Researcher Khalid Alaiban will be conducting a research study at King Faisal specialist hospital on "ANALYZE COMPLAINTS OF PATIENTS BY SIX SIGMA METHODOLOGIE". Mr. Khalid Alaiban has informed us of the design of the study as well as the targeted sample.

We support this effort and will provide any assistance necessary for the successful implementation of this study. If you have any questions, please do not hesitate to call. We can be reached at (+966) 554975687

Best regards,

Saud Al-Tamimi

Head Patient Affairs Office

King Faisal Specialist Hospital & Research Centre

Kingdom of Saudi Arabia

Zahrawi Street, Al Maather.

ص.ب: ٤٣٣٥ الرياض ١١٢١١ المملكة العربية السعودية، هاتف: ٤٦٤٧٤٧٤ فاكس: ٤٤١٤٨٣٩

P.O Box: 3354 Riyadh 11211 Kingdom of Saudi Arabia. Tel: 4647474. Fax: 4414839. www.Kfshrc.edu.sa

APPENDIX C:

Data Report



مستشفى الملك فيصل التخصصي ومركز الأبحاث
King Faisal Specialist Hospital & Research Centre
مؤسسة عامة. Gen. Org.

Data Report

Oct, 30 2024

KFSH services complaints : Jan - Oct 2024

2,743 submitted complaints were about:

Information provided	137
Time table	81
Received treatment	989
Forms keeping	79
Solving time	450
Medical equipment related	280
Personnel skill	54
Waiting line time	647
Pre and post operating Room cleaning	7
Walk in service	5
Chargeable services	6
Nursing care	4
Urgent Care Clinic	4

Saud Al-Tamimi

Head Patient Affairs Office
King Faisal Specialist Hospital & Research Centre
Kingdome of Saudi Arabia
Zahrawi Street, Al Maather.

ص.ب: ٤٣٣٥ الرياض ١١٢١١ المملكة العربية السعودية. هاتف: ٤٦٤٧٤٧٤ فاكس: ٤٤١٤٨٣٩

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LIST OF ABBREVIATION

COPQ	Cost of Poor Quality
CTQ	Critical to Quality
DMAIC	Define, Measure, Analyze, Improve, Control
KFSH	King Faisal Specialist Hospital
QM	Quality Management
Rx	Medical Prescription
SQC	Statistical Quality Control
SS	Six-Sigma
TQM	Total Quality Management
VOC	Voice of Customer