



# Business Process Improvement of Hospital Administration and Design of Standard Operating Procedures by Using the DMAIC Method

(Case Study: SMEC Eye Hospital)

Jelita Plastcynthia Sari, Mushonnifun Faiz Sugihartanto<sup>(✉)</sup>, and Imam Baihaqi

Department of Business Management, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

mushonnifun@its.ac.id

**Abstract.** A business process is a sequence of interrelated activities to produce a product or service. At the same time, business process management has the goal of improving business processes without having to use new technology that is useful for providing better results for customers, following the vision and mission of the SMEC Eye Hospital, which is to become the leading eye health service centre in Indonesia and provide needs-oriented services and patient satisfaction. Furthermore, with the Covid-19 pandemic, hospitals need to improve their administrative processes to comply with existing guidelines and better protect health workers and patients. In order to improve business processes, the DMAIC approach from Six Sigma is considered a systematic, measurable method, and the purpose of this research, namely, to provide suggestions for improvement of business processes at SMEC Eye Hospital through the DMAIC method and the results of these improvements will be documented into standard operating procedures. This research is qualitative research with a case study approach, where the author will obtain data and conduct an in-depth analysis using interviews with the Quality Control and Patient Safety side and observations at the SMEC Eye Hospital. There were ten problems identified through the business process mapping of general patients and BPJS, which was carried out at the Define stage. Then, at the Measure stage, the author conducts a risk analysis using FMEA, resulting in 3 problems with the highest risk value. Then at the Analyze stage, the root cause of the problem was identified, which was then used as a reference for the author to make six improvement proposals at the Improve stage, and three proposed improvements were selected as priorities. Finally, at the Control stage, the authors develop standard operating procedures based on the proposed improvements useful for monitoring service performance at the SMEC Eye Hospital.

**Keywords:** Hospital · DMAIC · Six Sigma · Business Process · Standard Operating Procedures

## 1 Introduction

The business process is an activity series that is useful as a sequence of activities and plays a role in better understanding the interrelationships of activity [1]. Moreover, business process management (BPM) aims to improve the business process without implementing new technology. Much research shows that BPM will fix the process [2]. In order to improve the business process, BPM gains recommendations from customers through surveys [1]. This case can be found in SMEC Eye Hospital as the object of this research.

SMEC Eye Hospital is one of Indonesia's hospitals focused on eye health services, established in 2006. It has the vision to become the best and the most modern and professional eye health centre in Indonesia, to be able to compete with similar institutions in other countries. This hospital already has several branches spread out in several cities in Indonesia, such as Medan, South Jakarta, Malang, Samarinda, and others [3].

Hospitals are one of the many essential aspects of people's lives and play a role in spearheading development and public health services [4]. Another critical role of the hospital is the implementation of nursing services. Hospitals must be able to provide professional nursing services following the demands of service users and through the application of advances in science and technology, under established standards, applicable moral and ethical values. In addition, the services provided by the hospital must be carried out following what is stated in the standard operating procedure (SOP) [5].

Standard operating procedures are guidelines used to ensure that all operational activities run consistently, effectively and efficiently [6]. Another opinion is that SOP is a work procedure with a fixed or unchanging nature stipulated in a written document [7]. SOP itself is part of business processes. As time goes by, there are times when it is necessary to update the applicable standard operating procedures because it adapts to conditions that occur in the community.

The administrative process that occurs at the hospital starts from registration according to the patient's needs, where the patient fills out a registration form divided into two, namely general or insurance. Then, the patient will be directed according to the existing procedure. After that, the patient will receive action from health workers. Finally, the patient will be directed to the cashier to complete payment for hospital services and or pay for drugs prescribed by health workers [8]. This procedure will vary according to the needs of each patient. For example, some patients only do health check-ups, patients planning to have surgery, and patients who suffer from particular disorders and require treatment. The administrative processes that the author wants to improve include 1) administration for outpatients, 2) administration for surgical patients, 3) administration for doctor visit patients, 4) administration for patients using BPJS, and 5) administration for general patients.

Based on the problems being experienced by the hospital in its current condition, this research was conducted to improve business processes in the SMEC Eye Hospital. Improving business processes effectively requires three things, namely planning, control, and improvement [9], which is in line with the concept of the Six Sigma method.

In recent years, Six Sigma has become a systematic and scalable methodology to improve process capability according to the required demand [9]. One approach in the Six Sigma method that can be used in business process improvement is DMAIC, an

acronym for the steps in carrying out the method, namely Define, Measure, Analysis, Improve, and control, which can be used to improve current processes [10].

Using the Six Sigma method with the DMAIC approach, this research helps the SMEC Eye Hospital fix the existing administrative business processes to comply with the Technical Guidelines for Hospital Services During the Adaptation of New Habits. In addition, with the new administrative process at the hospital, it is hoped that it can better protect both health workers and patients and their families in the hospital area. Therefore, this study will develop business processes and SOPs using the DMAIC approach from Six Sigma.

## 2 Literature Review

### 2.1 Business Process Management

Business process management is a science that looks at how a job is done in a company or organisation to ensure consistent results and benefit from improvements/changes/innovations made [11]. In addition, business processes can also be interpreted as a combination of a series of activities carried out by a company and organisation in order to achieve the desired goals [12]. The process will involve three elements [11], including:

1. Actors, which include HR, organisation, and software used
2. Physical objects such as equipment, materials, products and paper documents
3. Information objects, such as electronic documents and electronic records.

As shown in the Fig. 1, there are six stages owned by business process management, followed by a description of each stage.

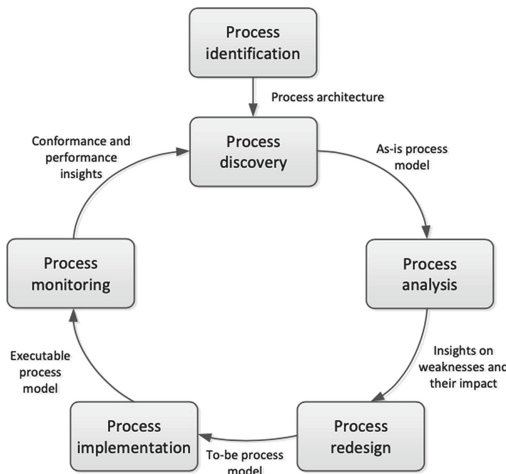


Fig. 1. Business Process Management Steps [11]

### 1. Process Identification

The first thing to do is to identify the problems that are currently happening in a company to determine whether the existing business process framework needs to be updated or improved, which provides an overview of the entire process and its relationship. This framework is then used to choose which process the company or organisation will carry out

### 2. Process Discovery

In this process, the business process framework that has been determined is modelled. This can be done using a process flowchart.

### 3. Process Analysis

In this phase, the business process framework that has been designed will be analysed, and several problems or risks will emerge. Existing problems or risks will be prioritised based on their potential impact and the estimated effort required to resolve them.

### 4. Process Redesign

This phase aims to identify changes to the process that will help to address previously identified problems. Then changes will be made to the existing process so that the problems that occur in the process can be reduced and the desired goals can be achieved.

### 5. Process Implementation

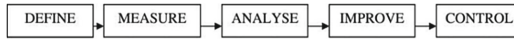
In this phase, the process design that has been improved in the previous phase will enter the implementation phase. This can be in the form of two aspects, namely changes to the organisation or company, including changes in the way the fundamental elements are included in the process and process automation that involves the IT system to carry out the process design that has been formed.

### 6. Process Monitoring

After the design of the improvement process is implemented by the company, then supervision is carried out to see whether the performance of the process is following the company's goals. If it is deemed not appropriate, corrective action or changes will be made.

## 2.2 Six Sigma

Six Sigma is an organised and systematic method of strategic process improvement and development of new products and services that relies on statistical methods and scientific methods to reduce customer-defined defect rates [13]. Six Sigma method has been applied not only to the manufacturing industry but has also been adapted to other organisations such as construction, supply chain management, accounting, raw material supply, non-profit organisations, as well as the service industry, including health services, banking, education and aviation [14]. This follows the object of research conducted by researchers, namely the health service sector.



**Fig. 2.** Step of DMAIC [9]

Six Sigma applies a structured approach to managing improvement activities represented by Define-Measure-Analyze-Improve-Control (DMAIC) for process improvement [13]. The following is a picture of the stages of DMAIC (Fig. 2).

The first stage in implementing the DMAIC approach is Define. At this stage, the authors identify problems in a process that require solutions and have a clear understanding of output and evidence from the supervision carried out by the management [15]. From several tools and techniques that can be used at this stage, the authors use process mapping to describe business processes.

The second stage is Measure. At this stage, the authors collect data or information about problems from the company, customers, and suppliers and find out where the problem is [16]. Of the several techniques and tools that can be used at this stage, the authors choose to use FMEA in measuring the risk of problems that occur in the administrative business process of the SMEC Eye Hospital.

Third, the “Analyse” process is conducted to find out the cause of the current problems. This is done by analysing the causes of problems and sources of variation, determining variations, and prioritising opportunities that can be improved in the future [17]. Root Cause Analysis and Fishbone Diagram are chosen to analyse the risk that might impact the SMEC Eye Hospital performance, and it finds out the source of the risk to reduce the possibility of happening.

The fourth is the improvement stage. In this step, the activities carried out are improving processes to reduce variations, increasing new alternatives, and carrying out the plans that have been prepared [17].

The last stage of the DMAIC approach controls. Process control can be carried out by developing corrective actions to maintain existing performance, developing new standards or procedures, planning process control, and assigning responsibility for existing processes [16].

### 2.3 Process Mapping

Process mapping is an activity to identify important stages in a routine visual workflow [18]. Process mapping can be done by designing flowcharts. Flowcharts are one of the oldest and most popular tools used to design business processes [11]. A flow chart is a graphic that is drawn or designed with symbols to show the process by which an activity occurs [12]. At the same time, flowcharting is a method for designing a new process using simple symbols and descriptions to show the entire sequence of activities [19].

### 2.4 FMEA (Failure Mode Effect Analysis)

FMEA, or failure mode and impact analysis, is a technique used to increase the reliability and safety of activity by finding out the potential failures that may occur in the activity [20]. Each possible failure value will be calculated using three parameters, namely,

Severity (S) to assess the severity of a risk, Occurrence (O) to assess how likely the risk is to occur and Detection (D) to assess how easy the risk is to be detected [21]. The combination of these three parameters is known as the Risk Priority Number (RPN), which is mathematically formulated as follows:

$$\text{RPN} = \text{S} \times \text{O} \times \text{D}$$

## 2.5 Pareto Diagram

Pareto diagrams can be useful for conducting analyses that require researchers to identify what risks are being faced by a company and how large the scale of these risks are in a period [22]. The Pareto analysis calculates the amount of risk that occurs and the costs that the company must bear due to these risks. As for Pareto's law, 80% of the problems that occur come from 20% of the causes of the problem [23]. This chart is a bar graph showing risk based on the highest risk located on the far left and the lowest risk on the far right.

## 2.6 Fishbone Diagram

Fishbone diagrams, also known as cause-and-effect diagrams, can be used to identify existing risks and find the causes of the risks [24]. The process undertaken to create this fishbone diagram is brainstorming. The factors found will be grouped into several categories to facilitate the identification of risk causes in a more organised manner [11]. There are six categorical elements in the fishbone diagram, namely machine, method, material, man, measurement, and milieu.

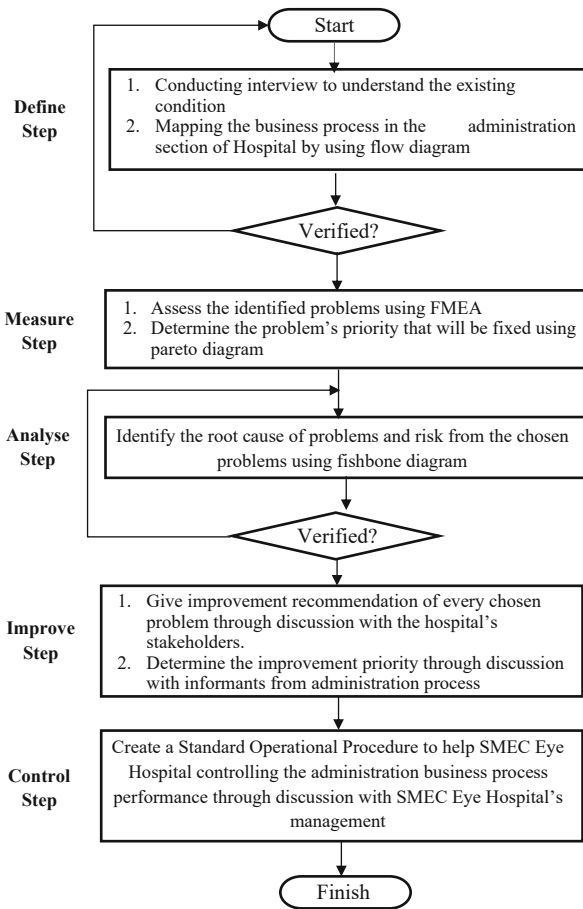
## 2.7 Standard Operating Procedures

Standard Operating Procedures (SOP) is a work procedure with a fixed or unchanging nature determined in the form of a written document [7]. Another definition stated that those standard operating procedures are planning standards that describe the steps to be taken under certain conditions [25].

# 3 Methodology

This research used a qualitative approach and applied the Six Sigma Method with the DMAIC (Define-Measure-Analyze-Improve-Control) approach, where the author explores the conditions that take place at the SMEC Eye Hospital. Then, the risk or problem was identified to be the foundation for creating standard operating procedures.

Data for this research was gained from the interview and direct observation in SMEC Eye Hospital. Several criteria were defined for workers that was interviewed, such as they should work for at least three years, understand the service system and business process in the hospital, and understand the facility maintenance service in SMEC Eye Hospital. The research flow diagram is shown in Fig. 3:



**Fig. 3.** Research Diagram

## 4 Results

In this part, the results of DMAIC methods implementation with the Six Sigma Approach is explained, and the improvement recommendation also described.

### 4.1 The Existing Conditions of Hospital

In general, the business process of SMEC Eye’s hospital consists of registration, medical treatment, cashier and pharmacy, and education and information (Fig. 4).

### 4.2 Business Process Mapping

In this section, several business processes are illustrated in the flowchart by using the cross-functional flowchart. The information was gained from the interview process with SMEC Eye’s Hospital Medan staff.



**Fig. 4.** Business Process Cycle SMEC Eye Hospital

#### **4.2.1 Process for New General Patients**

Figure 5 illustrates the administrative process of new patients in SMEC Eye's Hospital Medan.

#### **4.2.2 Process for Registered General Patients**

Figure 6 illustrates the administrative process of patients who had been registered before in SMEC Eye's Hospital Medan.

#### **4.2.3 Process for General Patients of Local Surgery**

Figure 7 illustrates the administrative process of patients who need surgery and decide to receive it directly and categorised as local anaesthesia.

#### **4.2.4 Process for Surgery General Patients**

Figure 8 illustrates the administrative process for general patients who need surgery.



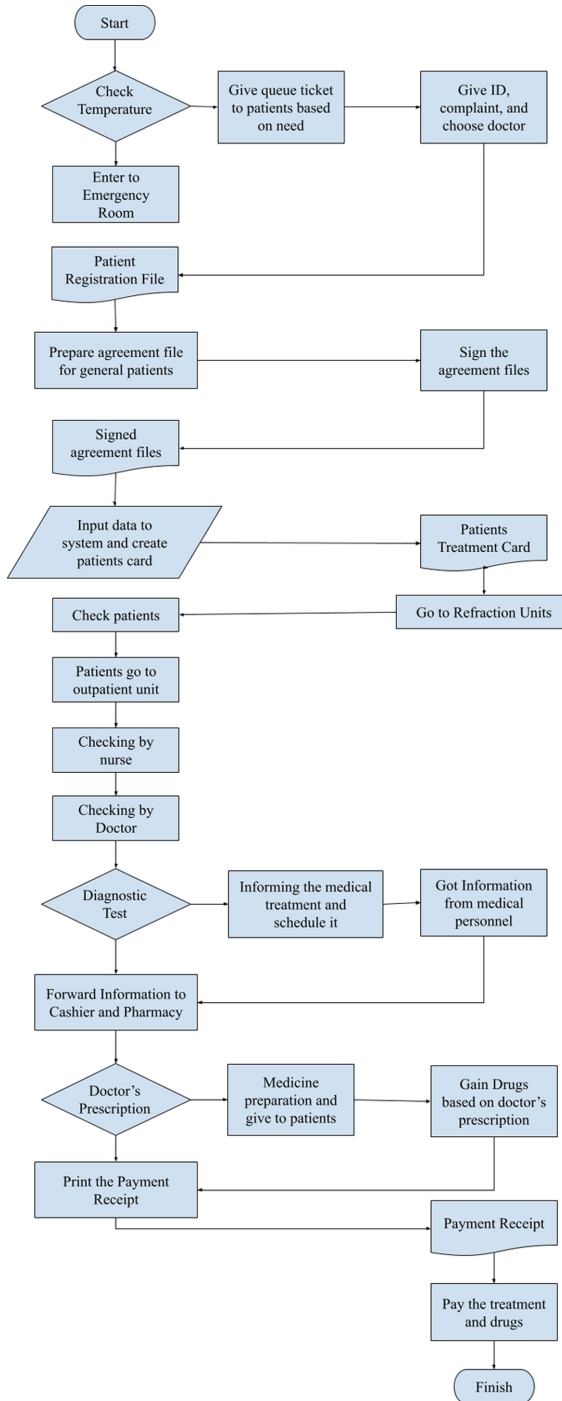
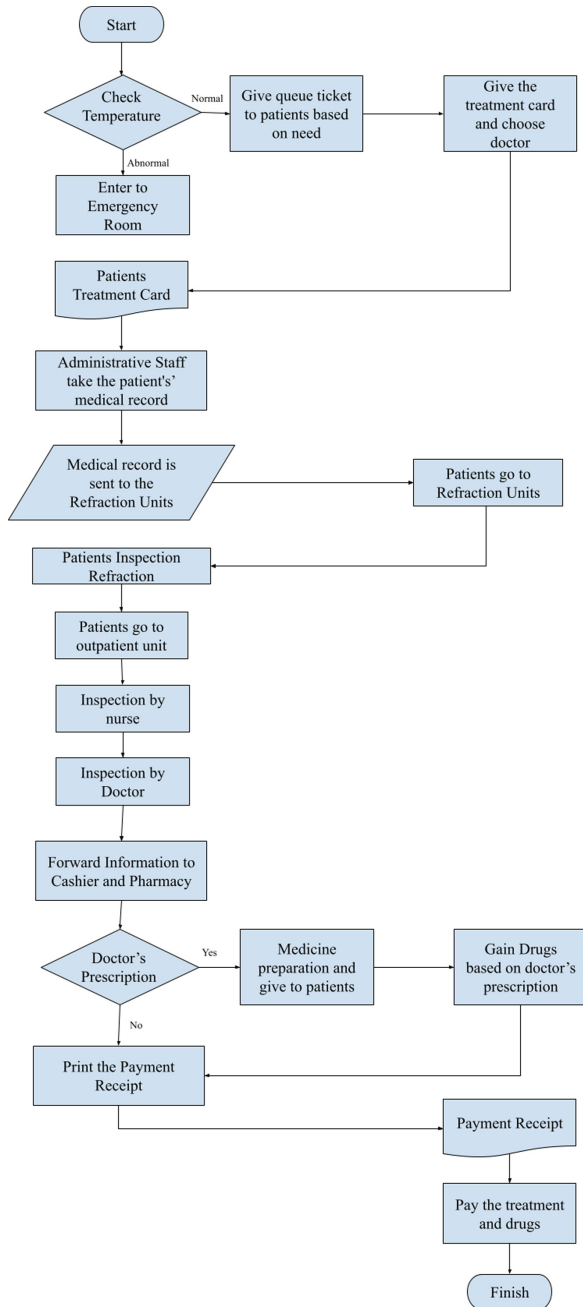


Fig. 5. New Patients Administration Process



**Fig. 6.** Registered General Patients Process

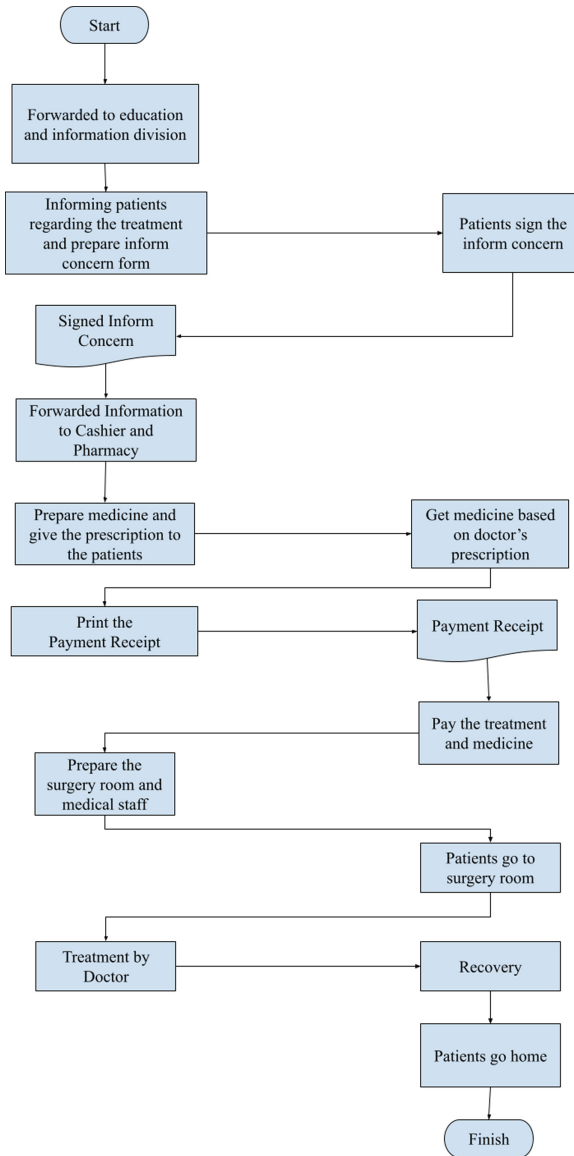


Fig. 7. Local Surgery Patients Administration Process

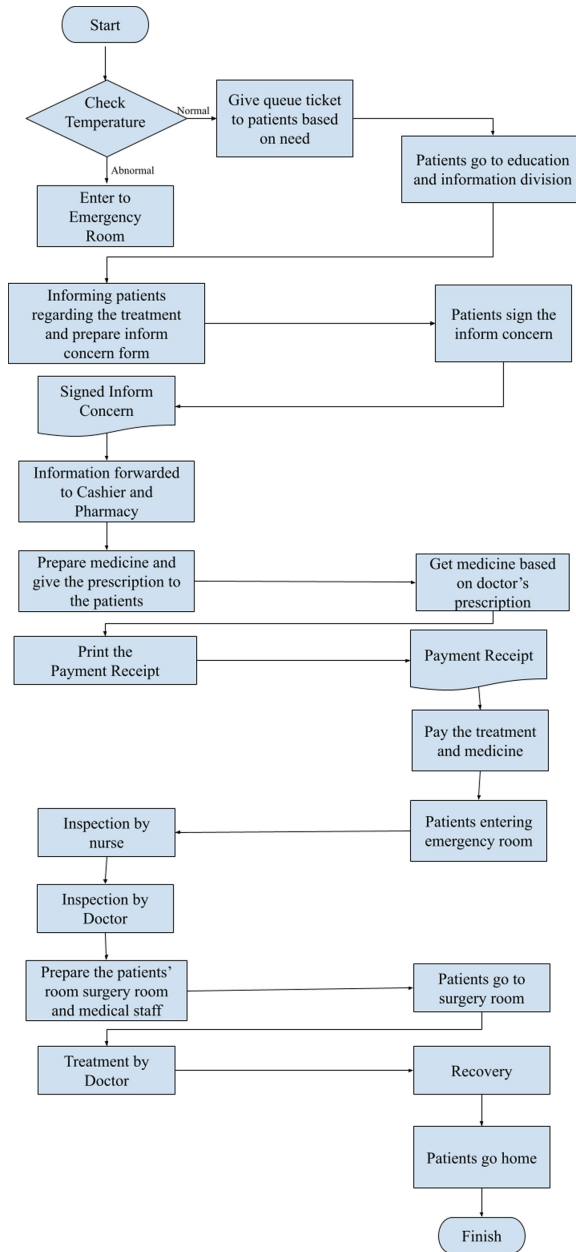


Fig. 8. General Patients Surgery Administration Process

**Table 1.** Risk Assessment Result

No.	Risk	Code	RPN	Cumulative
1.	No definite schedule for control and surgery patients	M6	210	19,07%
2.	Long queue of patients' registration	M1	180	35,42%
3.	Less feedback from patients	M9	180	51,77%
4.	Patients cannot directly get a treatment	M5	144	64,85%
5.	Patients need to wait because the medical record is stil not sent to medical units	M8	108	74,66%
6.	Complaints facilities and service are still not optimum yet	M10	90	82,83%
7.	The sequence of medical record is jumbled	M2	84	90,46%
8.	Recipe Error	M7	48	94,82%
9.	Overwhelmed staff because of the large number of patients	M4	42	98,64%
10.	Patients are not understanding the registration process	M3	15	100%

#### 4.2.5 Other Processes

There are several other processes of administration, such as online reservation of general patients, patients who have insurance from the country (BPJS) and divided into the ones who just recently registered to the hospital, the ones that have been registered before, and the one who want to do the surgery using BPJS insurance.

#### 4.3 Problem and Risk Identification and Risk Assessment

After business process mapping was conducted, the problems in SMEC Eye Hospital are identified. Next, the verification process was conducted to verify that the identified problems are valid. It is verified by using FMEA.

Then, the impact of the problems was identified, also the potential source of problems was found. In order to know the score, a risk assessment was conducted by using RPN, and the result is shown in the Table 1.

Table 1 shows the rank of the risk in the SMEC Eye's Hospital. After the RPN is gained, Pareto diagram is used to determine the risk that will be solved. In the Pareto diagram, it is mentioned that 80% of problems are caused by 20% of the main causes.

From Fig. 9, it can be seen that 20% from 10 identified problems that must be fixed immediately are.

1. Code M6: No definite schedule for control and surgery patients
2. Code M1: Long queue of patients' registration process
3. Code M9: Less feedback from patients

#### 4.4 Root Cause Analysis

The next step in DMAIC with Six Sigma method is Analyse. After knowing the top problems that must be fixed, fishbone diagram is used to know the root cause of the problems.

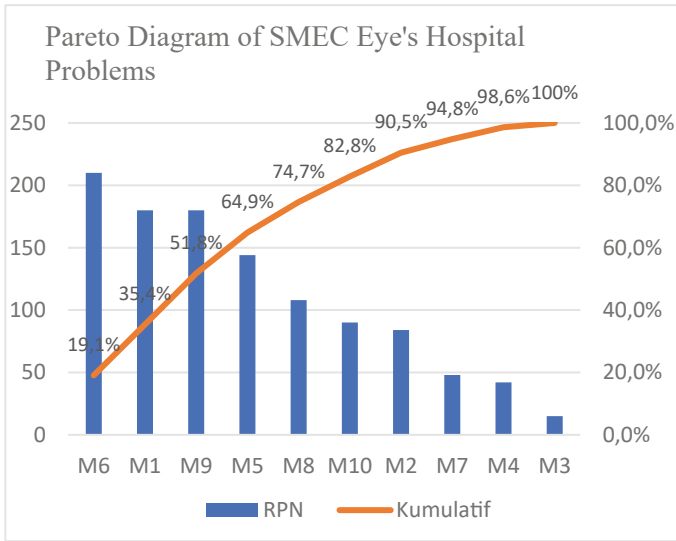


Fig. 9. Pareto Diagram of Problems

4.4.1 Problem Code M6

Based on the fishbone Fig. 10, there are 3 factors caused the problems. First, in method, there is no allocation of schedule based on the patient’s need. This happened because almost all patients, on average, come to the hospital without any reservation. Therefore, except for the patients that want to do surgery treatment, it must be scheduled before.

Second, in Machines. In the website [www.rsmatasmec.com](http://www.rsmatasmec.com), the information regarding doctors’ schedules is hard to find. There is an option there to book an appointment with the doctor. However, after the patients come to the hospital, they will be given a queue ticket based on their arrival sequence.

Third, in Man. The hospital’s medical staff is not giving patients the exact personal schedule, but they just inform the doctor’s scheduled visit.

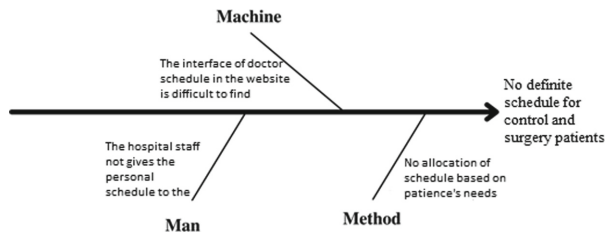


Fig. 10. Fishbone Diagram of Problem M6

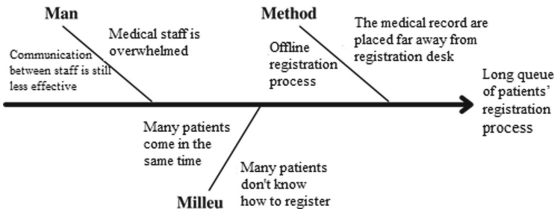


Fig. 11. Fishbone Diagram of Problem M1

4.4.2 Problem Code M1

Based on Fig. 11, there are three root cause categories of problem M1: Method, Milleu, and Man. The first is the methods factor. Currently, the medical record is only available on the paper version. The electronic version is still in development and progress. Thus, it takes much time to find out the medical record and bring it to the registration desk.

The second is milleu factors. Many patients still do not understand the registration process in the hospital, which creates a long registration queue. This happens because there are no posters/figures explaining the hospital's administrative process. Another reason is that the patients come in the same time without scheduling first in the hospital.

Third is the Man factor. The long queue happened because the administration staff were overwhelmed due to the high number of patients, and the coordination between desk staff and medical record staff is still not adequate.

4.4.3 Problem Code M9

Based on Fig. 12, there are three leading causes of the identified risk. First, in man categories, the medical staff is too busy to give a service to other patients. Thus, the feedback form is not given to all patients. Also, there are no officers who focus on taking care of and collecting patient feedback.

The second, is the materials category. A feedback form has not been provided for every patient who has finished receiving treatment at the hospital. A few patients only fill out the feedback form, and it often lost.

Third is Millieu. Generally, patients only submit their complaints verbally to hospital staff and rarely fill out the feedback form provided by the hospital near the entrance or exit. Patients belonging to the elderly also do not understand how to fill out the feedback

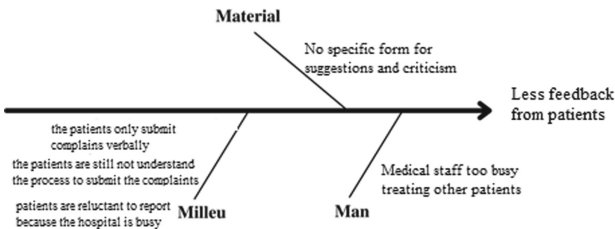


Fig. 12. Fishbone Diagram of Problem M9

form if using the form. Some patients are finally reluctant to give complaints because hospital staff still serve other patients.

#### 4.5 Suggestion of Improvement

After analysing the root of the problem using a fishbone diagram and finding the root causes of each risk of the problem, the next stage in the DMAIC method with the Six Sigma approach is the Improve stage. At this stage, some improvements are proposed for each risk that aims to mitigate the occurrence of these problems to improve service performance at SMEC Eye Hospital. The Table 2 is the improvement proposed by the author.

#### 4.6 Assessment Priority of Improvement Suggestion

After recommending some improvement suggestions, it is then assessed to determine which suggestions need to be prioritised. Improvements that are prioritised are easy to implement and have a strong relationship with the root cause. The author adapted this step from the House of Risk principle in phase 2 (two) where this tool is used to assess the priority of implementing the proposed preventive actions to mitigate risks.

**Table 2.** Improvement Suggestions

Problems	Root Causes	Improvement Suggestions
Control and surgery patients do not have a definite schedule	The control patient and the surgery are scheduled at the same time Root Causes: There is no schedule sharing system per patient	Make a scheduled reservation guide according to patient needs
	The doctor's schedule page in the website is hard to find	Arrange doctor's schedule and divided based on patient's needs
	Hospital staff do not provide a per patient schedule	
Long patient registration queue	Medical records are stored away from the registration desk	Develop procedures for online patient registration
	The registration system is still done offline Root Causes: Medical records have not been prepared because there is no advance reservation	
	Patients do not fully understand the registration process	Added option to select treatment schedule for patients
	Patients come at the same time	
Overwhelmed hospital staff		

(continued)



**Table 2.** (continued)

Problems	Root Causes	Improvement Suggestions
	Communication between staff is not effective	
Lack of feedback from patients	Hospital staff are busy serving other patients	Designing a feedback form for hospital
	There is no complaint form given directly to each patient	
	Patients only submit complaints verbally	Develop a complete written feedback procedure
	Do not understand the process of making a complaint Root Causes: there is no guide for filling in feedback	
	Reluctant to report because the hospital is crowded	

From the six suggestion proposal, three suggestions are chosen to be prioritised. There are:

1. Make a scheduled reservation guide according to patient needs
2. Develop procedures for online patient registration
3. Develop a complete written feedback procedure

#### 4.7 Creating Standard Operational Procedures

The final stage in the DMAIC method with the Six Sigma approach is the control stage, where the authors develop standard operating procedures used to monitor the performance of SMEC Eye Hospital services. In preparing standard operating procedures, the author also discussed with the hospital to adjust the hospital's capabilities.

## 5 Conclusion and Suggestions

Based on the research objectives and the DMAIC method with the Six Sigma approach carried out by the author to analyse the business processes of the SMEC Eye Hospital, it can be concluded that:

1. The ongoing business processes at SMEC Eye Hospital have been described using a flowchart. The flowchart described includes the process for new general patients, general control patients, local surgery general patients, general surgery patients, general online patients, new BPJS patients, control BPJS patients, local surgery BPJS patients, and BPJS surgery patients.

2. According to the current business process, there are 10 (ten) risk problems that the author can identify. After that, the risk problems were analysed using FMEA and the risk priorities that need to be resolved first using the Pareto Diagram. As a result, there are 3 (three) risk problems that need to be corrected first, namely: 1) Making a scheduled reservation guide according to patient needs; 2) compiling procedures for patients who register online in full in writing; 2) developing a complete written feedback procedure. Each of the three risks is then analysed for the root of the problem using a fishbone diagram. Then from the root of the existing problems, proposed improvements were in total obtained 6 (six) improvement proposals. Finally, the six improvement proposals are assessed as priority solutions based on the level of difficulty of implementation and the relationship to the root of the problem. In the end, there are 3 (three) priority improvements that need to be completed first, where the three improvements require procedures or guidelines.
3. Standard operating procedures are created with the aim of monitoring improvements made to SMEC Eye Hospital's business processes. Based on the assessment of the improvements that have been made, the authors compiled 3 (three) procedures including 1) treatment reservation procedures, 2) registration procedures for online patients and 3) procedures for providing feedback.

This research has limitations on the point of view because it only uses the SMEC's Eye Hospital's management point of view. Future research should use the customer's point of view to identify the problems in the service performance of the SMEC Eye Hospital and evaluate the services provided.

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