

# Implementation of Lean Healthcare for Waste Elimination at Darmayu Ponorogo Hospital

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## Abstract

The performance of a company is determined by the quality of the services produced. Services are considered to have quality when the products meet the consumer's desires. It is important for the companies to know what consumers want and need to improve the service quality. One of them is the quality of health services which is one of the important things for patients. The service process at Darmayu Hospital received criticism from the patients. The study was conducted in an outpatient internal medicine clinic since there were many complaints from the patients. The aim of this study was the duration of each service process on an outpatient basis. The purposes of this study were to identify waste from patient service systems on out-patient care with a lean approach using value stream mapping to reduce waste that occurs, to identify the root causes of waste problems with a fishbone diagram, to identify the 10 waste and to design the improvement proposals with participatory ergonomics. The results of the study obtained concluded that the value-added activity was 26,28% or less than 30% which meant that there was still waste on service activities. From the results of the spread questionnaires of 10 waste, there was 1 critical waste that was waste of waiting or waiting time for the doctor's examination. The root cause of waste problems was analyzed using the fishbone diagrams so that the root cause of the problem in terms of humans, methods, environment, and materials /information could be obtained. From the analysis of fishbone diagram results then the proposed improvements were given with the concept of kaizen.

## Keywords

Quality of service, Lean, VSM, Waste, kaizen.

## 1. Introduction

The industry must be able to withstand the increasingly intense market competition to improve its performance (Dombrowski et al, 2016). The performance of a company will determine the quality of goods and services produced. Goods and services that are considered to have quality are the goods and services whose products meet the desire of the consumers. Therefore, it is important for an organization or company to know the wants and needs of the consumers because it will affect the satisfaction of the consumers (Ato'illah, 2017).

The increasing economic condition of the community causes them to begin to realize that health is important because the community will not be able to live decently if the health needs are not met properly (Mongkaren, 2013). There are various types of service sectors, one of which is the services engaged in health for example hospitals. The hospital is one of the health facilities to strive for health improvement (Putri & Susanto, 2017). The competition for hospitals is now getting tighter with the increasing number of hospitals in the area. Not only the competition in the area, but also the competition in the hospital industry is occurring in a national scale because of the number of overseas hospitals that become the competitors in Indonesia (Yolla Adellia, 2014).

With the increasing numbers of competitors, it is a necessity for hospitals to always provide health services according to hospital service standards. With the competition that exists, the hospital must strive to improve and maintain the quality of health services which is oriented to the achievement of customer satisfaction because in the hospital service industry the quality of service is very well noted (Putri & Susanto, 2017). In addition, hospitals are required to be able to apply the concept of effectiveness and efficiency in each line in order to create services with good quality, the high patient safety guarantees which are equivalent to the right expenditure. In a service process, there are contributing factors. One of the main factors of service is the duration or length of service that causes dissatisfaction with the service and makes the consumers feel saturated. The factors must always be evaluated as a step to continuously improve the quality of service, whether it needs to be improved or not (Singgih, 2012).

One of the private hospitals that continues to evaluate to improve the quality of services in the Ponorogo area is Darmayu Ponorogo Hospital. Darmayu Hospital is one of the private hospitals in the Ponorogo area. The average number of daily outpatients is 333. From 333 patients daily, they can be divided into 15 specialist polyclinics. Specialists' polyclinic for internal medicine on average per day has 40 patients. Based on this number, there is always a queue every day that causes the long waiting time and affects the satisfaction of the patient's services. The waiting times become one of the concerns of this hospital to be minimized so that the patients' satisfaction can be maintained properly without getting a reprimand from the government.

The average daily service for the polyclinic of internal medicine is 40 patients with diabetes mellitus patients wanting to get the treatment is 70% of the total number of patients. Each service process provided by this hospital is certainly inseparable from the patients' complaints. The complaint stated by the patients is that they have to wait in a long queue at each service process. The estimated service from the patients' arrival to the completion of the service of taking the drug in the pharmacy section could take 3 hours to wait for the service process. The problems that cause the queues are the waiting time for administrative activities, the waiting time for the examination process by medical and the doctors who are late to come. In addition, there are still some ineffective activities such as the long re-input process of patient data due to name spelling errors or the long loading of billing systems and also the transportation of registration employees to send medical records files. The long duration of the waiting process is one of the matters affecting the customers' satisfaction. If the waiting time in the service is too long, it will cause the level of service satisfaction of the hospital to be decreasing. All of these problems are wastes that do not give the added value (non-value added). To reduce waste, improvement is needed from each existing service process and the realization that the end goal is to provide better health care to patients (Zidel, 2006).

Lean concept has been applied to eliminate waste and to increase the value-added of products both goods and services in order to provide value to customers (Gaspersz, 2011). Meanwhile, according to Intifada & Wityanto (2012), Value Stream Mapping (VSM) can be used to describe the flow of value in the company that contains an overview of the information flow and physical flow of the company's system. Currently, Lean methodology has been applied to improve operations in many different disciplines, including healthcare (Mancosu, et al., 2018). Lean for services is a business improvement methodology that maximizes shareholder value by achieving the fastest rate of improvement in customer satisfaction, cost, quality, process speed, and capital investment (Terry, 2003).

Continuous improvement of service quality is part of the Total Quality Management (TQM) of hospitals that need to be developed to survive and to be more competitive. TQM is a way to a continuous performance improvement at every level of operation or process, in every functional area of an organization. Continuous Improvement terminology is inseparable from the Concept of Kaizen in Japan which means continuous improvement. The concept of continuous improvement is formed based on the order and stages of activities related to the work in the form of goods or services (Gaspersz, 2001).

In this study, lean service is conducted as an effort to identify and reduce waste in the process of outpatient services. The tool used to identify the 10 wastes in the outpatient service process is Value Stream Mapping (VSM) and to provide proposed improvements to the critical wastes to improve better services. In addition, from the results of the waste identification questionnaires, the critical waste then is made the improvements with the application of the concept of kaizen is one of the proposed improvements.

### **1.1 Objectives**

To identify the waste in the process of outpatient services of the polyclinic of internal medicine in Darmayu Hospital by using Value Stream Mapping to reduce waste occurring. To make improvements in order to reduce wastes in the process of outpatient services of the polyclinic of internal medicine in Darmayu Hospital.

## **2. Literature Review**

Currently, studies related to waste have been widely done by previous researchers until now. In this study, the review of several previous research that is still related to the research was done. Lean has been shown to provide better chances for health care systems (Akdang, et al., 2018). According to Kovacevic et al (2016), lean is one of the management approaches focusing on identification and elimination of waste and continuous improvement. The lean concept is evaluated by improving the production process as well as the redesigned business and preparation to be offered to customers about what they want for quality improvement.

Lean consists of a set of tools in identifying and eliminating waste with VSM, 5S, SMED, and standardized work that focuses on aspects of the manufacturing process to eliminate waste, improve quality, reduce time and cost. Among these tools, VSM gets more attention for using process improvement with a systematic approach (Maalouf & Zaduminska, 2019). The Value Stream Mapping (VSM) method is widely used in the efforts to reduce waste (Contreras, 2018; Devani & Sari, 2018; Apriliani, et al, 2017; Nancy, et al, 2014). Research conducted by Azizah et al. (2017), Putri & Susanto (2017) and Boronat et al. (2018) on lean healthcare uses the Value Stream Mapping (VSM) approach.

Further research according to Noviani (2017) shows a reduction in non-value-added activity from 90% to 78.30% and an increase for value-added activities which was initially 10% to 21.70%. In addition, in the reduction of waiting time by 4.5 hours with the accuracy percentage increased by 50% after the implementation of lean (Lot et al. 2018). Lean deployment results in the pharmaceutical section of U.S. hospitals also showed a 54.5% decrease in queue times, 32.4% at order entry times, 76.9% in waiting times, and 67.7% in transit time with the use of digital scanning technology (Ker, et al., 2014).

The next research according to Devani & Sari (2018) which is about to find the root cause of waste identified with Process Cycle Efficiency (PCE), Interrelationship Diagram, and Process Decision Program Chart (PDPC). The results were analyzed using 5WHY.

Azizah et al. (2017) conducted a research to find root causes of waste problems by using the Fishbone Diagram. Further research conducted by Putri & Susanto (2017) identifies the root cause of the problem with 5 why. The proposed improvements to reduce the root cause of waste by implementing the 5S method. Research according to Contreras (2018) stated that to analyze the root causes of waste can use kaizen, 5S, and DMAIC. Research conducted by Lot et al. (2018) stated that reducing waiting times was done by changing scheduling patterns, creating flow charts and Kanban visuals.

## **3. Methods**

### **3.1 Patient Service Process Cycle Time**

The data collection process for outpatient services is based on cycle time for each process activity. The cycle time for each process occurs in an outpatient service activities poly medicine. In determining the time of the patient service cycle, the researcher observed the number of patient arrivals by observing the time between arrivals and the time of outpatient activities.

### **3.2 Creating Current Service Value Stream Mapping (CSVSM)**

In the creation of Current Service Value Stream Mapping (CSVSM) researchers conducted an analysis of the process of outpatient services in the polyclinic of internal medicine. The author mapped the entire process of

outpatient services. This was done in order to see the flow of the patient service process and also to see the waste occurring in the process. Creating a value stream can make it easier for the researcher to identify the type of waste occurring because in value stream mapping there is information that can indicate the waste. The information that can be seen such as the cycle time or working time of one activity, the time available to perform an activity, the number of operators, as well as the total time of the overall outpatient service process that occurs. Here are the steps in creating VSM.

1. Creating a whole flow map of hospital services including patient registration and information that forms a current state map.
2. Understanding the process of patient service.
3. Finding problems or waste that occurs can be in many ways.

### 3.3 Calculating Process Cycle Efficiency (PCE)

For process cycle efficiency (PCE) calculations use the following equation (Marlyana,2011):

$$\text{Process Cycle Efficiency} = \frac{\text{Value added}}{\text{Number of lead times}} \times 100\%$$

If the result of Process Cycle Efficiency (PCE) is greater, it can be said that the process runs more efficiently.

### 3.4 Identifying the Causes of Wastes (Fishbone Diagram)

The selected waste is then identified its root cause by using tools namely Fishbone Diagram. Fishbone Diagrams to look for causal factors that are grouped into several categories. These categories included man, material, method, measurement, and environment.

### 3.5 Designing the Proposed Improvements

Providing proposed improvements based on waste occurred in the process of service of the polyclinic of internal medicine that has been analyzed about its root cause of the problem using the fishbone diagrams. The next method to be used for proposed improvements is kaizen.

## 4. Data Collection

The data collection methods used in this study were direct observation and literature studies. The data used in this study can be classified into two parts, they were:

1. Primary Data is when the data collector receives the data directly from the data source (Sugiyono, 2008). The data that directly related to the processing of data in this study was the data on the process of outpatient services in hospitals. This data will be input into the waste reduction process. The following were the data used in the research:
  - 1) Number of operators in each activity involved in the service process.
  - 2) Service time of each activity of each patient service process.
  - 3) Waiting time between activities in the patient service process.
  - 4) Time available to complete the patient service process.
2. Secondary data is when the data collector receives the data indirectly from the data source, for example through a document (Sugiyono, 2008). This data was used as supporting data and was not directly involved in calculations. Here are the data used:
  - 1) General company data.
  - 2) Data on the number of patients served.
  - 3) Working hours on outpatient poly.

Literature reviews were conducted by reading a variety of literature to help with the problem identification process. Literature used such as websites, scientific articles, library books, and research journals on waste on services, fishbone diagrams, and kaizen. In addition, the literature used such as the archives on the accountable company's historical data to explore the information about the methods that can be used to solve problems that occurred.

## 5. Results and Discussion

This section will explain the results and discussions.

### 5.1 Service Process Cycle Time

The result of the service process stages was based on the cycle time of each process activity. Observations at the time of the process were taken by sampling 30 patients using a stopwatch. After the sample time data is obtained, then the calculation of the cycle time of each service process was done by calculating the average time of each service process. The cycle times of each process can be seen in Table 1.

Table 1. Cycle time process of poly outpatient services internal diseases

Process	Activity	Time (s)
Patient Registration	Patients Arrival	7.2
	Patients register in admissions	28.43
	Patients wait in the queue for registration	211.64
	Admission data input	58.47
	Admissions hand over queue numbers to patients	5.73
Nurse review	Patients hand over queue numbers to the nurse	5
	Patients wait in line for a doctor's examination	3878.87
	A nurse calls the patients to an examination room	5.37
	Nurse inputs the patient's data into the system	62.13
	Nurses perform hypertension checks on patients	77.07
Doctor's examination	Doctor's examination of the patient	761.47
	Doctor makes prescription	222
Provision of outpatient pharmaceutical drugs	Patients heading to outpatient pharmacy	31
	Submit a prescription to the pharmacy admissions department	4.71
	Admission checks medicines, prints prescriptions, and hands prescriptions to pharmacists	163.88
	Pharmacist prepares medicine	314.03
Payment of medicine at the cashier	The patients submit a note to be paid	3.43
	Patients wait in line for payment	956.53
	The patients make a drug payment	125.33
Drug taking in pharmaceuticals	The patients submit the paid note	4.28
	Patients wait in line for medication	487.07
	Handing over the drug to the patient	149.86

Here is the number of operators and the available time in each process of outpatient services in the polyclinic of internal medicine.

Table 2. Number of operators and workstation available time

No	Workstations	Number of Operators	Available Time (s)
1	Patient Registration	2	75600
2	Nurse Studies	2	25200
3	Doctor's Examination	1	25200
4	Pharmacy	3	25200
5	Drug Payments	2	75600

The total lead time and cycle time in each outpatient service process of internal medicine polyclinic can be seen in Table 3.

Table 3. Total time

No	Information	Amount of time (s)
1	Total <i>lead time</i>	7560,07
2	Total <i>cycle time</i>	1987,76

### 5.2 Current Service Value Stream Mapping (CSVSM) Creation

In mapping the entire process of outpatient services of internal medicine polyclinic, the service stream mapping (CSVSM) was created to see the whole process and to see the total lead time for the entire service process includes cycle time, value-added, non-value added. In addition, the creation of service stream mapping (CSVSM) is also expected to represent the greatest waste that occurs in the process of outpatient services of the internal medicine polyclinic. Figure 1 shows the service value stream mapping (CSVSM) of the outpatient service process of the internal medicine polyclinic.

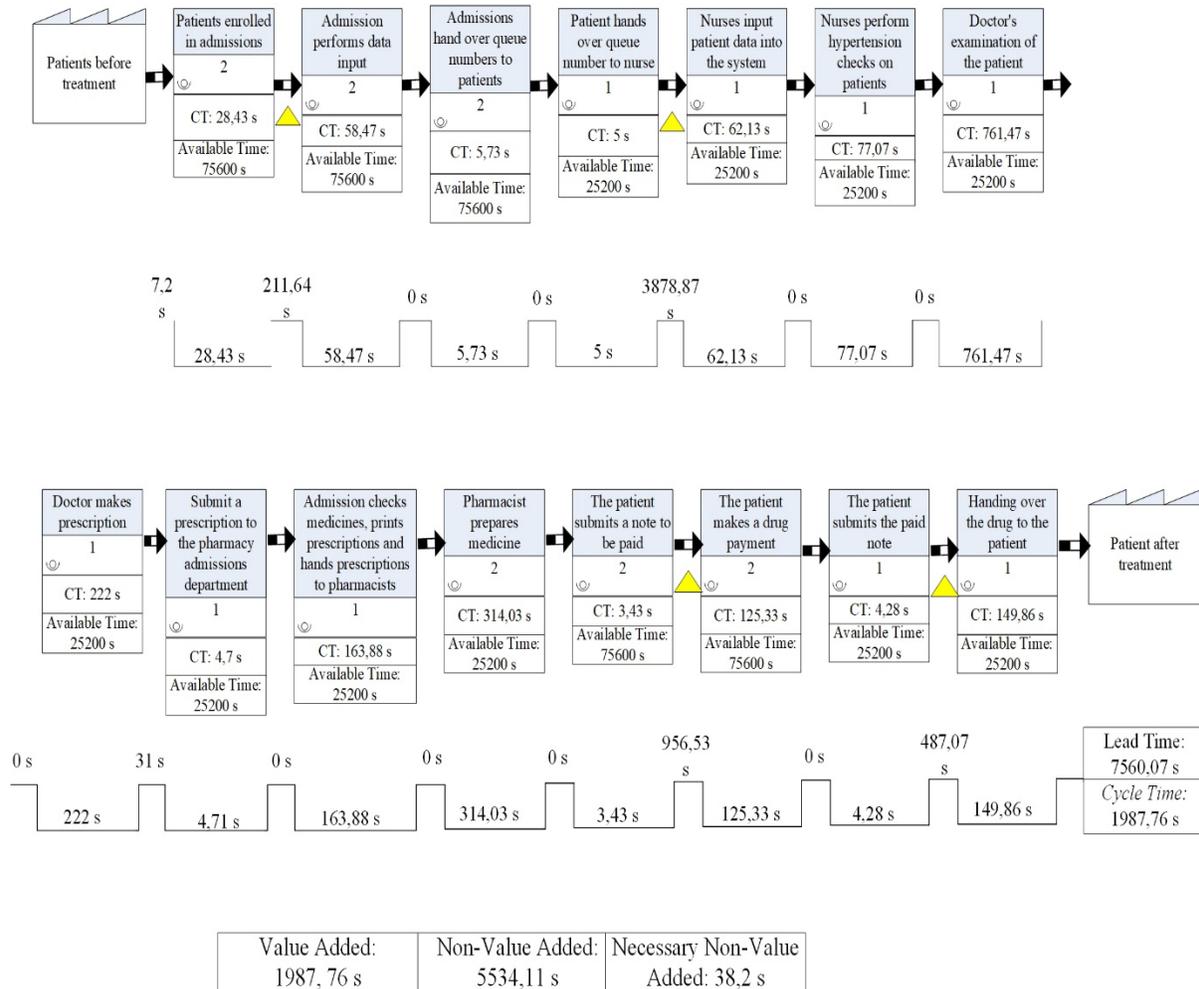


Figure 1. Current service value stream mapping (CSVSM)

The total cycle time for the whole process is 1987,76 seconds. With the creation of value stream mapping, it can also be seen the total lead time (average time for the whole process or from the beginning to the end of a series of processes). The total lead time of the outpatient service process is 7560,07 seconds. By knowing the total cycle time

and total lead time, it can be determined the efficiency of services in the process of internal medicine polyclinic services which includes 3 shifts of work at the registration and payment of drugs and 1 work shift at the work station of nurse studies, doctor examination and pharmacy. The result of the efficiency of the loading and unloading process service is 26,28%.

### 5.3 Identification of Waste Types

In addition to describing the flow of process and process time in each service process, then based on current service value stream mapping, it can be known the waste activity on the process of internal medicine polyclinic service. Identification of waste occurring in the process of outpatient of internal medicine polyclinic services by distributing questionnaires to hospital employees and consumers, in this case, were the patients. Questionnaires were given to employees and patients which directly related to the outpatient service process of internal medicine polyclinic in 20 samples. The purpose of the distribution of questionnaires was to determine the level of frequency of existing waste occurrence during the process service process of internal medicine polyclinic in progress. Table 4 represents 5 analyses of 10 types of wastes that occurred in the process of internal medicine polyclinic services based on the results of direct observation and the creation of Value Stream Mapping.

Table 4. Types of wastes

Type of Waste	Activity
Defects	The mistake at mixing the number of drugs
	Patients were not clear about the explanation of medical personnel both admissions, nurses, and doctors
	Error in spelling the patient's name
	Missing patient data
Duplication	Data entry in recurring the billing of the patient in registration section
	Pharmacy admissions performed repeated prescription verification
Incorrect Inventory	Stacking of drugs that have been formulated
	Admission registration did not immediately send medical records to poly
	Oversupply of drugs
	Many documents were still being processed
Lack of customers Focus	Pharmacy admissions were less focused on patients because of playing mobile phones
	Excessive workload so they did not provide good service
Over Production	Re-explanation to the patient even though instructions were available
	Repeated examinations were performed on patients
Under Communication	Incorrect information about polyclinic opening hours
	Patient listening incorrectly during call to examination room
Motion/Transportation	Admission registration did the job by sitting and standing while serving
	Nurses pace around looking for patient data or medical records which have not been given to polyclinics
	Pharmacists made a movement to reach out and find a cure
	Pharmacists took medicines in warehouses during service
Underutilized Employees	Doctors gave lack education to the patients
	Nurses gave lack attention to patients

Type of Waste	Activity
Variation	Unrestricted consultation time
Waiting/Delay	The doctor had his own practice schedule at home
	Patients waited in line at the registration counter while standing
	The patient waited for the results of supporting examination
	The doctor was late to arrive
	Patients waited for drugs in the pharmacy

From the identification of waste above, in this research waste is divided into ten types of waste. The ten wastes are then grouped into tangible and intangible. For waste that is grouped into tangibles, it consists of defects, incorrect inventory, motion/transportation, lack of customers focus and waiting/delay. For waste that is grouped into intangibles are duplication, overproduction, unclear communication, underutilized employees, and variation.

#### 5.4 Lean Matrix Calculation (Process Cycle Efficiency)

In the application of lean on the system, the first step that must be done is to perform the measurements of lean matrix. Lean matrix measurement provides an overview of the initial conditions before the application of lean and after the application of lean so it can be seen changes in the value of a good matrix. The lean matrix that needs to be measured is the Process Cycle Efficiency (Batubara, 2011). Based on figure 1 about the existing Service Value Stream Mapping, it can be concluded that:

$$\begin{aligned}
 \% \text{ Value Added} &= \frac{1987,76 \text{ s}}{7560,07 \text{ s}} \times 100\% \\
 &= 26,28\% \\
 \% \text{ Non-Value Added} &= \frac{5534,11 \text{ s}}{7560,07 \text{ s}} \times 100\% \\
 &= 73,17\% \\
 \% \text{ Necessary Non-Value Added} &= \frac{38,2 \text{ s}}{7560,07 \text{ s}} \times 100\% \\
 &= 0,51\% \\
 \text{Process Cycle Efficiency} &= \frac{1987,76 \text{ s}}{1987,76 \text{ s} + 5534,11 \text{ s} + 38,2 \text{ s}} \times 100\% \\
 &= 26,28\%
 \end{aligned}$$

Process Cycle Efficiency is a way of measuring to see the efficiency of a process. By using this matrix, it can be known the percentage between the processing time to the overall time performed during the service process. A process is said to be lean if the Process Cycle Efficiency (PCE) shows a value > 30% (Gasperz, 2011). The result of Process Cycle Efficiency for the entire process of internal medicine polyclinic service was 26.28% < 30%, which meant that the process of internal medicine polyclinic services in process was still less efficient and there was waste in the service process.

All non-value-added activities from the activities throughout the Service Value Stream Mapping in the service process chain are waste (Gaspersz & Fontana, 2017). To determine the non-value-added activities based on the complaints given by consumers in this case are the patients. According to data from the service department of internal medicine polyclinic, the patients mostly complained about the long waiting time in the service process. Thus, in this case, the waste is the waiting time or waiting for the service process.

#### 5.5 Proposed Improvements

Based on the Current Service Value Stream Mapping (CSVSM) analysis, the researcher concluded that the most dominant waste in the process of outpatient services of internal medicine polyclinic was the waiting time or waiting. Thus, here's an analysis of the fishbone diagram to minimize the waste arising.

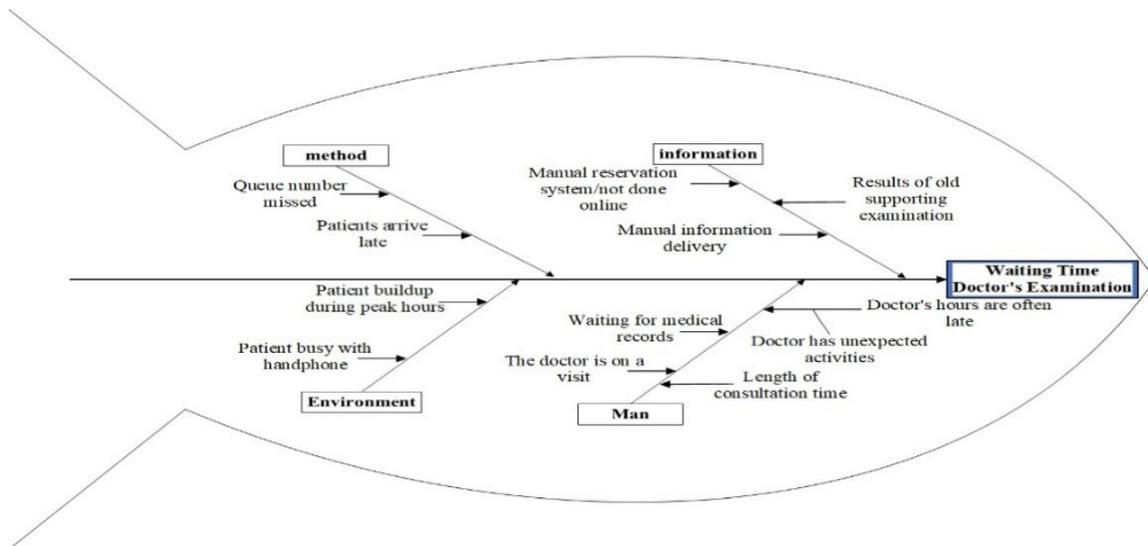


Figure 2. Fishbone Diagram

The explanation of the fishbone diagram for waste waiting that causes the waiting time of the long doctor's examination is as described below.

a. Men

Men factor becomes one of the factors to cause the occurrence of waste waiting. Below are some of the causes of the waste.

1. The doctor's practice hours are often late because the doctor has unexpected activities.
2. The length of patient consultation time.
3. The waiting for medical records.
4. The doctor is visiting inpatients.

b. Environment

Environment factor becomes one of the factors to cause the occurrence of waste waiting. Below are some of the causes of the waste.

1. The accumulation of patients during peak hours.
2. The patients were busy with their mobile phones.

c. Method

The method becomes one of the factors to cause the occurrence of waste waiting. Below are some of the causes of the waste.

1. Queue number missed.
2. The patients were late so the queue had been called.

d. Material (Material/Information)

The material becomes one of the factors to cause the occurrence of waste waiting. Below are some of the causes of the waste.

1. The long wait for supporting examination results.
2. Manual reservation system/no online reservation.
3. Manual information delivery.

### 5.6 Proposed Improvements Through Kaizen Concept

Based on the fishbone diagram above, it can be seen that each waste has different causes. To determine the root of the problem also involved the headroom of the out-patient polyclinic, the nurses of internal medicine polyclinic and the hospital management. To eliminate the waste that occurred in the service process, the improvement needs to be done continuously (kaizen). In the industry, kaizen is done continuously so that the quality is increasingly improved. The waste that was complained by the patients in the process of service of internal medicine polyclinic was the waiting or the waiting time for the doctor's examination that took longer. The following table 5 is a proposed improvement of kaizen

Table 5. Kaizen's proposal for waste waiting

No	Factor	Causes of The Problem	Kaizen Proposal
1	Man	The arrival of the doctor is often late for the opening hours of polyclinic practice.	Apply discipline to nurses and doctors by providing rewards and punishments. Assessment from the hospital management periodically and routinely and conduct assessments to measure the performance of nurses and doctors so that it can be given reward or punishment.
		Patient consultation time is not given a time limit so the service time of 1 patient could take a long.	Provide clear rules for service and consulting issues. If the patient wants a longer consultation, then it could be directed to check at the doctor's home practice schedule.
		Waiting for medical records from the admissions section to be given to polyclinic nurses.	Give directly to the patient after registration so they don't need to wait for the polyclinic nurse.
		Doctors are still visiting inpatients so it can't be on time for polyclinic's opening hours.	Make a fixed schedule of the doctor visits to inpatients so that there is no delay in doctors to start the outpatient services in polyclinic.
2	Environment	The occurrence of patient accumulation during peak hours.	Restriction of registration hours with the purpose of registration quota so that it does not exceed the service capacity.
		The patient is busy with cell phones.	Provide a comfortable, spacious waiting room so that patients do not get bored while waiting in line so they don't get busy with their mobile phones.
3	Materials/Information	The results of the supporting examination took a long time.	Supporting examination if needed could be done early so that at the time of opening hours, they do not have to wait for the results of the supporting examination.
		The reservation system is done with patients coming directly to the hospital/not done online.	Optimal preparation of reservation system. Reservations can help hospitals optimally allocate available capacity. With online reservation, there will be a more conditioned quota of patients per day that can be served
		Manual information delivery has not been integrated in work station.	Integrate the hospital management information systems for a better service for the patients, improve the employee working conditions and higher accuracy in diagnosis because the system is inputted directly into each workstation.
4	Method	The patients arrived late so they missed the queue and had to wait again.	Patients who have already registered should be informed about their estimated time of arrival in accordance with the order of registration number received so that they don't have to wait a long time to get the doctor's examination.
		The queue number is missed because of the lack of attention when the nurse calls the queue number.	The patient call should be done in 2 ways, the nurses call the patients and add a queue number display on the monitor in front of the checkroom to display the queue number that has been served.

## 6. Conclusion

The total cycle time for the whole process is 1987,76 seconds. And with the creation of value stream mapping, it can also be seen the total lead time (average time for the whole process or from the beginning to the end of a series of processes). The total lead time of the outpatient service process of internal medicine polyclinic is 7560,07 seconds.

Based on the research, it can be concluded that the value-added activity is 26,28% or less than 30% which means that there is still waste in the service activities. From the results of the spread of questionnaire of 10 wastes, there is 1 critical waste that is waste of waiting or the waiting time for the doctor's examination.

The root cause of waste problems is analyzed using the fishbone diagrams so that the root cause of the problem in terms of humans, methods, environment, and materials/information can be obtained. From the human factor, there are factors of the late arrival of the doctors, the long consultation time, and the doctor conducting the inpatient visit. From the method factors, there are the factors of the late arrival of patients and missing up the queue numbers. From the environmental factors, there are the factors of the accumulation of patients during peak hours and they are busy with mobile phones. And from the material/information factor, the factors are the manual reservation system, the manual information delivery and the long wait of supporting examination results.

The improvement efforts were made to overcome the causes of waiting problems for human factors by applying discipline to nurses and doctors and creating a fixed schedule of doctor visits. Improvement of environmental factors by restricting the registration hours and by providing a spacious and comfortable waiting area. Improvement efforts for the factor of material/information are done by giving a proposed improvement of developing an optimal reservation system and integrating the hospital management information system. As for the factor of the method, the improvement is done by providing information to patients who have registered about the estimated time of arrival and adding a queue number monitor in front of the checkroom so that the patient knows the queue number being served.

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