CHAPTER V

ANALYZE PHASE

5.1 Waiting Time Analysis

The first critical parameters which will be considered carefully in the analyze phase is straight forward to the Waiting Time (W/T) for particular functions in the medical service core process of PMC. Six medical functions starting from Registration, OPD, Laboratory, X-Ray, Finance to the Pharmacy directly get involve with the existing service processes and presently contribute the Total Waiting Time of 65 minutes as the average for overall medical service duration. The total number of time; therefore, must be individually considered prior to particular functions on how each of which consumes time unnecessarily. The Pareto Chart, one of the most famous Lean Six Sigma tools, which has been generally applied for separating the collected data, will be used to categorize the vital few parameters that mostly impact the Total Waiting Time duration.

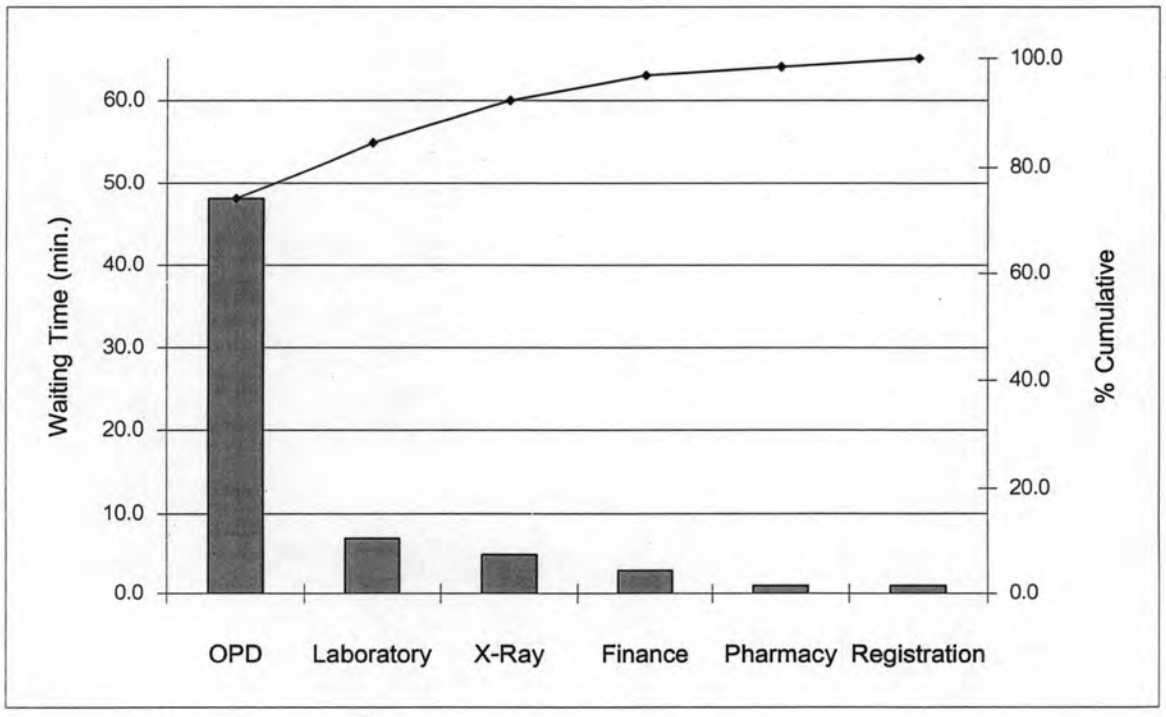
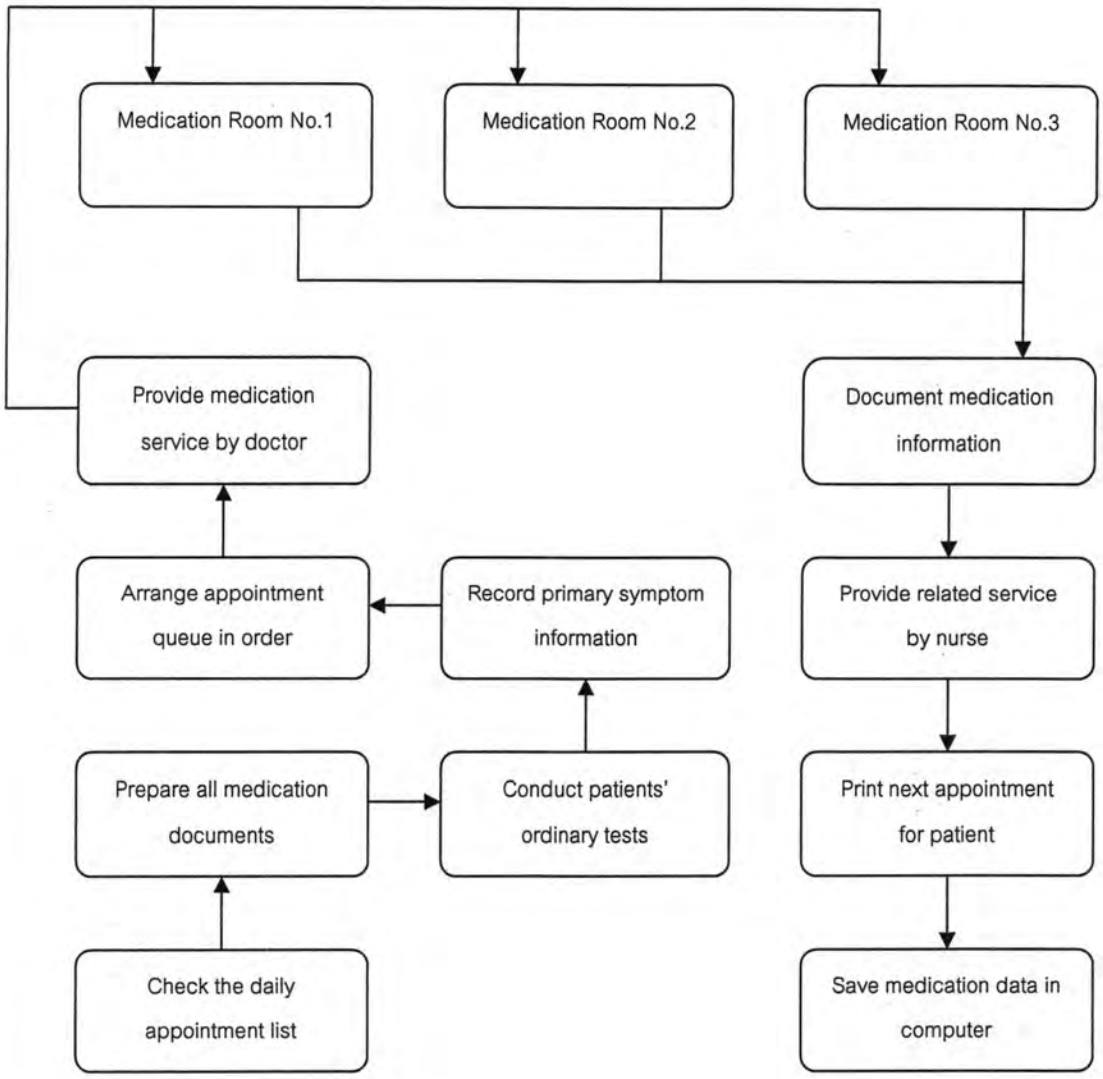


Figure 5.1: Pareto Chart for Waiting Time Parameter

The basic concept of Pareto Chart has been regularly conducted under the "20:80 Rule" which means that 20 percent of the considering factor on X axis called "Vital Few" would definitely contribute 80 percent of the interesting result on Y axis. In the same way, the other 80 percent of the considering factor on X axis called "Trivial Many" would certainly contribute the rest 20 percent of the interesting result on Y axis. From the average Total Waiting Time of 65 minutes overall, the only one function (20%) which eventually consumes the longest Waiting Time of medical service duration (80%) is OPD. 48 minutes is the total time that the clinic do not add any value to their patients and customers who just be waiting until the medication will be performed. Another 17 minutes come from the other five functions where do not causes any impact to the overall process that much.

Because the OPD function continually cause enormous Waiting Time as long as 48 minutes, which has been initially considered as the non value-added service duration, it should be put into detail analysis on how the function spends a lot of time before performing its medication processes. The Flow Process Chart, thus, will be used as the second Lean Six Sigma tools both for exploring every step of medical service processes or sub processes and verifying all of possible bottle necks or weak points in those particular functions. The chart normally composes of two sections; Graphical and Analysis. The Graphical section will clearly illustrate how each step has been put into order while the Analysis section will inclusively contain most of the information needed for improvements.

According to the following Figure, OPD function which has been completely displayed in the Graphical section on the top of the chart can be implicitly considered as the continuous flow process characteristics. The Analysis section contains deeper information about OPD Functional Activity, Distance between activities in meters, Duration in progress in minutes, Different kind of activities in symbols and some important remarks. The longest service duration definitely focus on the activity called "Arrange appointment queue in order" that consumes as long as 48 minutes. The symbol D illustrate that there is no value-added activity during the queue arrangement. It should be put into serious consideration to find out the factors that causes the patients to be waiting so long before receiving medication service from doctor who just performs his task in 8 minutes as the average.



No.	Functional Activity	Distance (meter)	Duration (minute)	○	⇨	□	D	▽	Remark
1	Check the daily appointment list	1	0.5			■			
2	Prepare all medication documents	0.5	1	●					
3	Conduct patients' ordinary tests	1	1	●					
4	Record primary symptom information	0.5	0.5					▽	
5	Arrange appointment queue in order	4	48				D		FIFO
6	Provide medication service by doctor	3	8	●					
7	Document medication information	3	0.5					▽	
8	Provide related service by nurse	2	1	●					
9	Print next appointment for patient	1	0.5	●					
10	Save medication data in computer	1	1					▽	
	TOTAL		62	11.5	0	0.5	48	2	

Figure 5.2: Flow Process Chart for OPD Function

Because the queue arrangement activity absolutely add no value to the clinic by leaving the patients to wait for medication process from doctor as frequent, the Prioritization Matrix which is one of the famous qualitative tools will be exclusively applied in this stage to understand how strong the particular potential cause relates to the Waiting Time. Each of which will be carefully rated by the Project Manager, Champion and OPD Head to specify level of relationships between those variables. All of possible potential causes would be considered as the Key Process Input Variables (KPIVs) that intensively contributes high impact to the Waiting Time as the Key Process Output Variable (KPOV) of the project.

Input Variable		Output Variable: Waiting Time			Total Score
Category	Key Factor	Project Mgr	Champion	OPD Head	
People	Missing document transfer	5	9	5	225
	Incapable document control	5	5	5	125
	Wrong medication record	5	1	5	25
Equipment	Inefficient information system	9	5	1	45
	Data recording redundancy	5	5	1	25
Process	Unlimited number of patient	9	9	9	729
	Same duration appointment	9	9	5	405
	Uncontrollable of walk-in	9	5	9	405
Environment	Insufficient medication rooms	5	5	9	225
	Unclear functional signs & labels	1	1	5	5

1=Low or No Relation, 5=Regular Relation, 9=Strong Relation

Figure 5.3: Prioritization Matrix for Waiting Time Parameter

Referring to above Figure, Long Waiting Time of Queue Arrangement has been reflected by four major categories of potential causes; People, Equipment, Process and Environment. The key essential factors are mostly come from Process category where contains the factors which have been rated with the highest score. Unlimited Number of Patient lead to the heavy traffic, especially, in the rush hour such early morning and after work while the Same Duration Appointment extend the row of patient who will be waiting in front of the doctor office. Moreover, the Uncontrollable of Walk-in people increases the pressure of patients who make an appointment in advance. Therefore, the most appropriate solution must be developed to mitigate or even eliminate these kinds of problems.

5.2 Cycle Time Analysis

The Cycle Time (C/T) for individual functions of the medical service core process will be carefully focused as the second critical parameters which directly contribute impact to the overall service duration of PMC.

All of the six medical functions as shown in the prior section which certainly deal with the present service processes typically consume the Total Cycle Time of 130 minutes as the average for overall medical service duration. Its key consideration would be different form the Waiting Time (W/T) parameter because most of the activities are adding value to the medication process. The summation of time should be specifically analyzed according to individual functions on how each of which consumes time without value-added activities where multiple kinds of wastes would be existed in particular area. The Pareto Chart which has been generally applied for separating the collected data will be in place as same as the Waiting Time analyzing approach in order to illustrate the vital few parameters that impact the Total Cycle Time extensively.

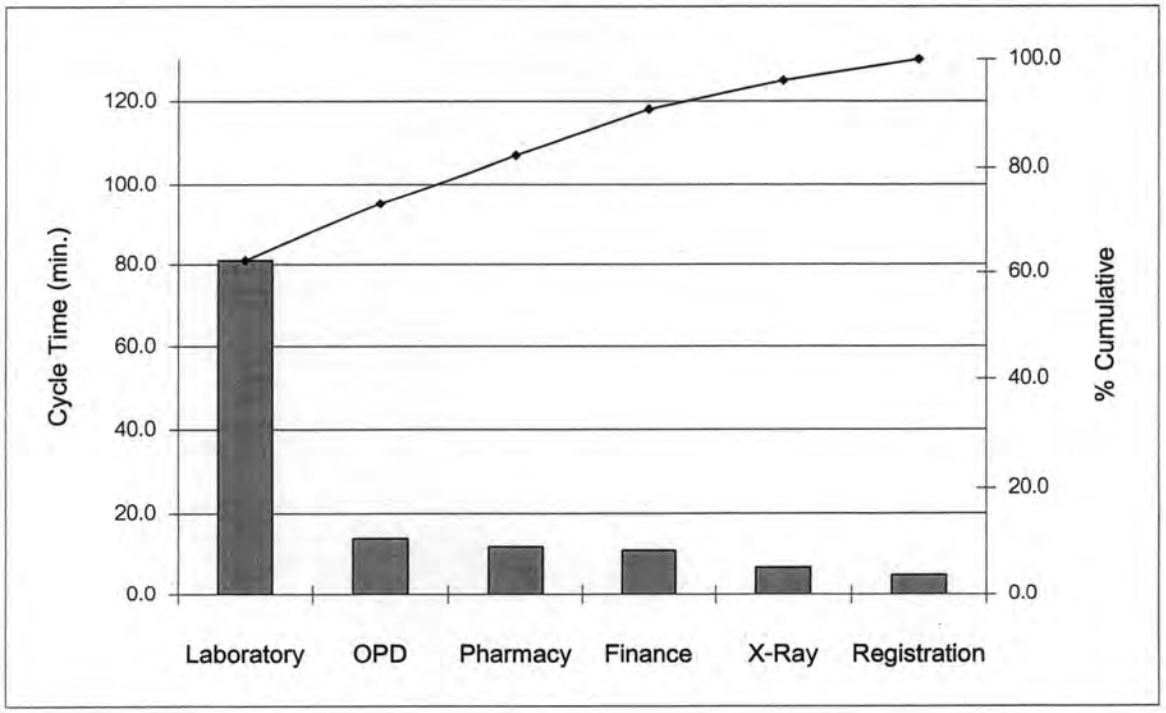
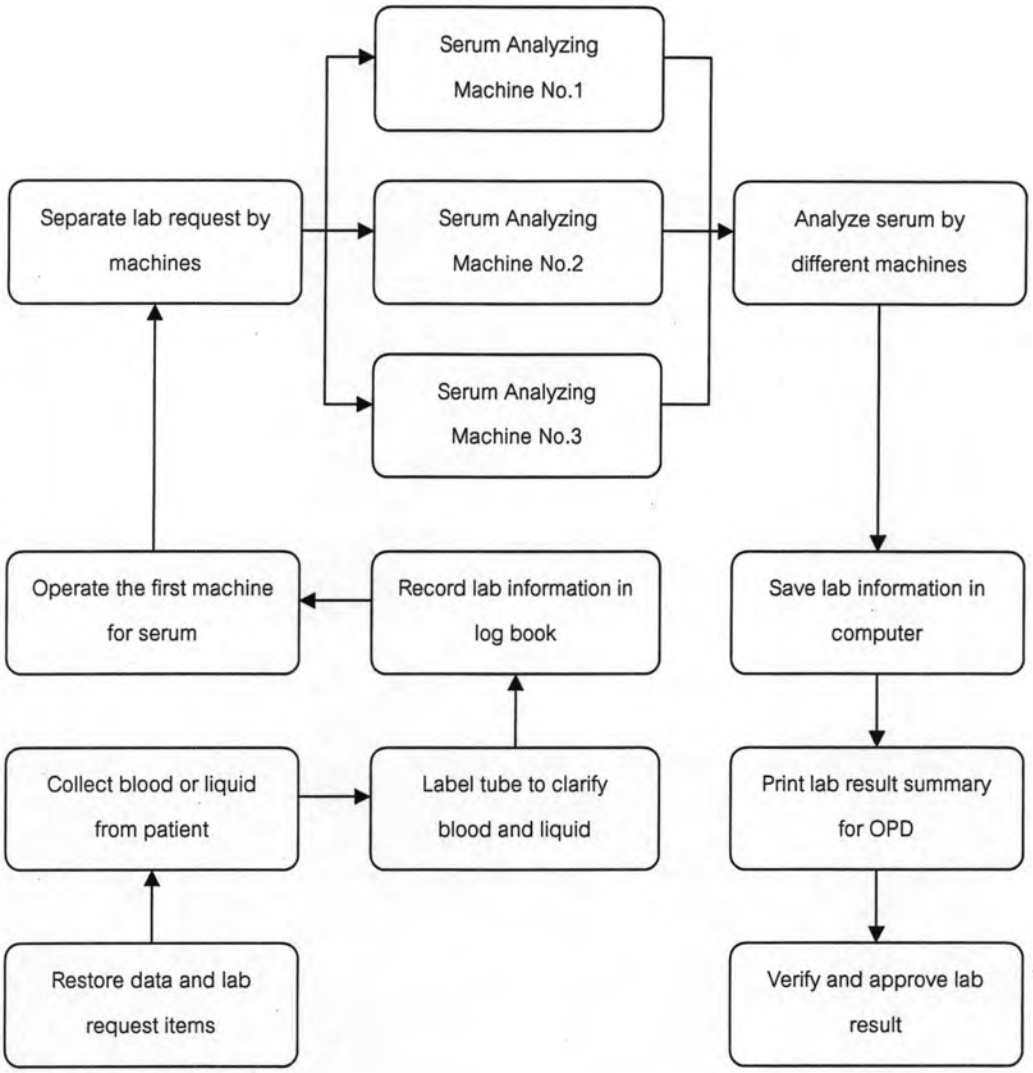


Figure 5.4: Pareto Chart for Cycle Time Parameter

Referring to the "20:80 Rule" of Pareto chart principle, 20 percent of the considering factor on X axis or the Medical Function would definitely contribute 80 percent of the interesting result or Cycle Time duration. From the average Total Cycle Time of 130 minutes overall, two specific functions (20%) which eventually spend most of the cycle time for medical service duration (80%) are Laboratory and OPD where operate their activities for 81 minutes and 14 minutes respectively. By the way, almost 14 minutes in OPD function exclusively reflect to the time that doctors and nurses provide their medication services to patients; therefore, this duration will not be considered as the non value-added activities as certain. In contrast, 81 minutes in Laboratory function where possibly contains a number of wasteful tasks would be a huge opportunities for improvements indeed.

Since the Laboratory function continually contribute extensive cycle time as long as 81 minutes throughout the process where some of activities could be implicitly considered as the non value-added service duration, the deeper analysis should be conducted to understand how the function spends a lot of time to perform particular activities. The Flow Process Chart, again, will be used as the key tool both for exploring every step of medical service processes or sub processes and verifying all of possible bottle necks or weak points in Laboratory function. Two sections of the chart will clearly illustrate how each of which has been connected to provide the blood and liquid analysis for the doctors or professionals' diagnosis and medication.

According to the following Figure, Laboratory function which has been definitely performed in the Graphical section on the top of the chart can be clearly considered as the continuous flow process characteristics as same as the OPD function but different in detail, while, the Analysis section complementally contains most of the interesting information about activities inside. The longest service duration points out two activities called "Operate the first machine for serum" and "Analyze serum by different machines" which consumes as long as 28 minutes and 35 minutes respectively. Both of which directly refer to the service duration that come from the working cycle of analyzing machines for different purposes such as Serum Separating Machine, Serum Analyzing Machine so it would be challenge that how could the machine cycle time can be improved efficiently.



No.	Functional Activity	Distance (meter)	Duration (minute)	○	⇨	□	D	▽	Remark
1	Restore data and lab request items	1	2					▽	
2	Collect blood or liquid from patient	1	3	●					
3	Label tubes to clarify blood and liquid	1	2	●					
4	Record lab information in log book	1	3					▽	
5	Operate the first machine for serum	0.5	28	●					
6	Separate lab request by machines	5	3		⇨				3 M/C
7	Analyze serum by different machines	5	35	●					
8	Save lab information in computer	3	3					▽	
9	Print lab result summary for OPD	0.5	1	●					
10	Verify and approve lab result	3	1			■			
	TOTAL		81	69	3	1	0	8	

Figure 5.5: Flow Process Chart for Laboratory Function

Even though the medical analysis activities of particular machines which consume the longest service duration within the Laboratory function intensively add value to the clinic by analyzing blood and liquids for doctors and professionals to provide the most appropriate medications to their patients, but there still have been opportunities that must be critically explored to find out the most important factors from the existing process. Prioritization Matrix which has been formerly used in the Waiting Time analysis will be applied, again, in this part not only to recognize relationships between different kinds of potential causes and the Cycle Time but also identify Key Process Input Variables (KPIVs) for this function.

Input Variable		Output Variable: Cycle Time			Total Score
Category	Key Factor	Project Mgr	Champion	Lab Head	
People	Missing document transfer	1	1	5	5
	Wrong laboratory record	1	5	5	25
Equipment	Limitation of machine standard	5	9	5	225
	Low number of lab machines	5	1	9	45
	Insuffucient computer hardware	9	5	5	225
Process	Large batch size analysis	9	9	9	729
	Redundancy of responsibility	9	9	5	405
Environment	Small area for many machines	1	5	5	25
	Unclear functional signs & labels	1	1	1	1
	Insufficient light for analysis	1	1	5	5

1=Low or No Relation, 5=Regular Relation, 9=Strong Relation

Figure 5.6: Prioritization Matrix for Cycle Time Parameter

Long Cycle Time of Machine Analysis can be also categorized by the same four groups of potential causes as the Waiting Time parameters. The key essential factors are exclusively come from Process category where mostly include the factors that have been rated with the highest score by responsible team. Large batch size analysis of equipments contribute time losses which highly increased by waiting for a number of specimens before starting machines' operation, especially in the case that a number patients who have made appointment in the afternoon arrive in the morning, the specimens have to wait for longer batch. The Redundancy of Responsibility of employees in the laboratory would be the last factor that could unfortunately lead to the confusion and, finally, the unnecessary time loss.