Control Chart in the Service Industry: A Case Study in a University Health Clinic

Johan K. Runtuk

Department of Industrial Engineering, Faculty of Engineering, President University, Bekasi, West Java, Indonesia.

Corresponding author:
Email: johan.runtuk@president.ac.id

Abstract.

This study analyzes the service quality of a University health clinic in Bekasi, West Java, Indonesia. A control chart and capability analysis will be employed to analyze the services' quality, especially registration processing time and the drug defect per month. This study uses the CUSUM and EWMA control charts for detecting the small shifts in the processing time. The findings revealed that the current processes are in control and capable of meeting the current service level. There is only one point outside the upper limit. But it can be ignored/deleted since the assignable cause causes that event. Based on the control P and NP charts, drug defect per month is also in control. This study gives direction for the Clinic to improve the service quality.

Keywords: *Clinic, control chart, processing time, defect, service quality.*

1. INTRODUCTION

Research on the application of quality management in the service industry continues to grow, including quality control. Initially, quality control was widely applied and developed in the manufacturing industry [1]. However, its application is starting to be widely used in the service industry. For example, [2] and [3] discussed the application of statistical methods to improve quality in service industries.

Health service is a service industry that continues to grow, so it is required to continue to improve the quality of its service processes. Therefore, the discussion regarding the implementation of quality control to support health services has also begun to be discussed. [4] conducted a study on the implementation of quality control in hospitals and found that quality control can improve hospitals' service processes. [5] applied process capability analysis and simulation to enhance process flow in hospitals. Furthermore, [6] conducted a literature review on applying statistical process control to improve healthcare services. Specifically, [7] conducted a literature review on the application of control charts in hospitals. This means that the health care system has realized that customers demand service with standards and pays attention to customer satisfaction.

This study aims to analyze the quality of the service process at a university health clinic. This Clinic serves students and the surrounding community so that there

are many queues at the Clinic at certain times. This study focuses on controlling the quality of service processes in the Clinic. It uses the control charts to evaluate whether the process is in control or not. The Capability processes are also carried out to determine whether the process can produce output according to the specified specifications. By controlling the service process's quality, the Clinic can identify quality problems that occur and immediately make improvements to increase customer satisfaction.

II. METHODS

This research is a quantitative study, which analyzes data using statistical methods for quality control. The method used includes control chart analysis (for data types of variables and attributes) and process capabilities. Data on the type of variables in this study were the registration processing time. A total of 125 data were used in the analysis. The attribute data in this study is the number of drugs defect per month.

III. RESULT AND DISCUSSION

Control Chart for Variable

The data used for this control chart is the registration processing time by the receptionist when the patient arrives at the Clinic. The data is measured in minutes. There are 25 samples, and each sample has five subgroups. The normality test is conducted using the MINITAB. The result stated that the data is following normal distribution, because the P-value is more than 0.05, which is 0.065. Fig. 1 shows the $\overline{X}$ and R chart of the data.

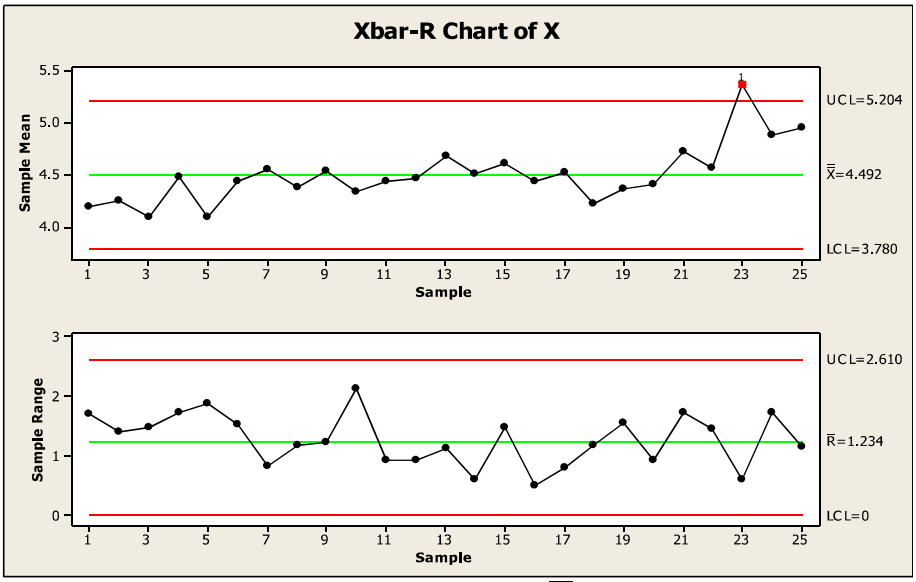

Fig. 1. Control chart for $\overline{X}$ and R

Based on Fig. 1, it can be seen on the $\overline{X}$ control chart that there is one data out of control, which is then considered as an assignable cause. It occurred because the

receptionist's computer is lag and lost connection when inputting the patient's data. It caused the patient's service at that time is longer than the usual time due to the computer must be restarted again. Meanwhile, the R chart shows that the process variability within the subgroups is in control.

Process Capability Ratio for Variable Data

The Clinic has set the registration processing time between three to five minutes. Based on that information, the process capability can be measured. Fig. 2 depicts the result of the capability process using Minitab.

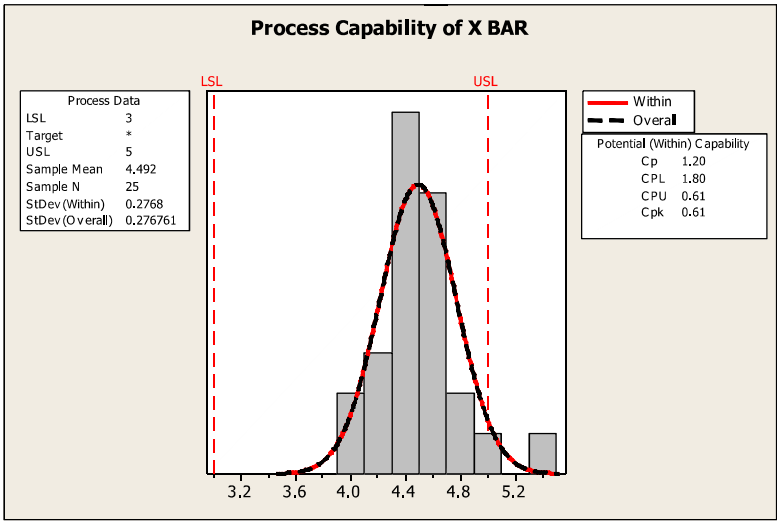

Fig. 2. Process capability ratio of X

Based on Fig. 2 can be seen that Cp is 1.2, which is more than 1. Thus, it can be concluded that the process is capable of meeting the specification of registration processing time. Nevertheless, based on Cpk, the process capability is inadequate. The value of Cpk < Cp, which is 0.61 < 1.2, so the process is off-center. As it could see, the diagram of the data tends to right. Processing time for registration tends to reach the upper limit, which is five minutes. This indicates that although the receptionist can carry out the registration process according to the specified time, however, the completion of the process tends to be at its maximum limit. This indicates the need for a system or support tool that can make it easier for receptionists to register patients.

Control Chart for (Cumulative Sum) CUSUM

The CUSUM control chart is used to detect the shifting in processing time. The CUSUM control chart for variable data can be seen in Fig. 3.

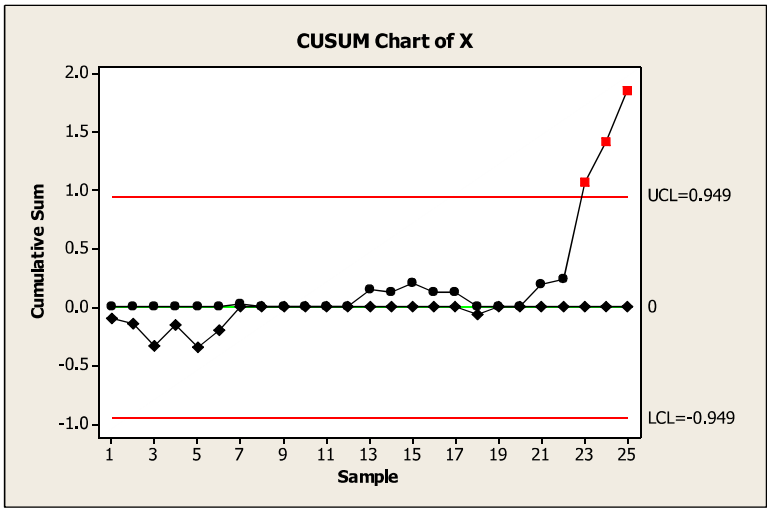

Fig. 3. CUSUM control chart

From Fig. 3 we can conclude that the process has shifted start from sample 23 until 25. Even though there is no significant problem, but any increase in the process is already detected quickly. Maybe it because of the system's error and make the next service from sample 23 get increased.

Control Chart for Attribute

The data used for this control chart is the defect of drugs, which is always input every month to this Clinic. From the interview, the drugs that come from the supplier are approximately 250 for each month. Based on the interview result and the data, the P and NP Chart is developed as depicted in Fig. 4 and Fig. 5, respectively.

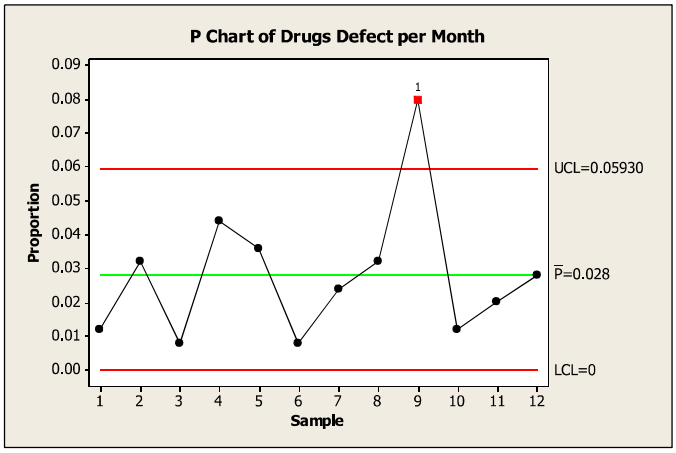

Fig. 4. P control chart

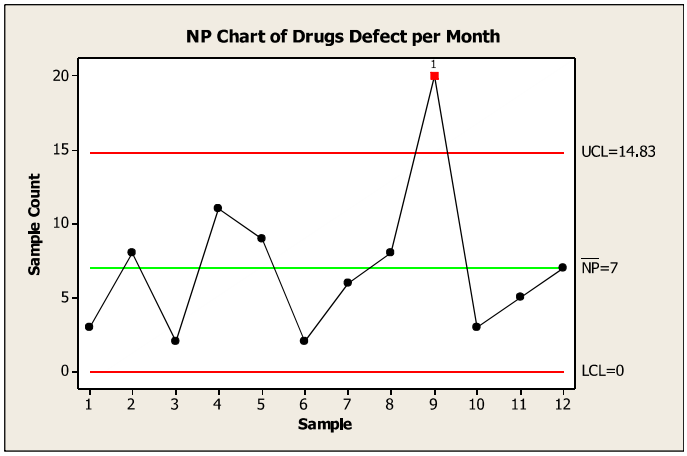

Fig. 5. NP control chart

Based on Fig. 4 and Fig. 5 can be seen that there is an assignable cause there. Based on the investigation, in that time, the drug defect occurred while in shipping. The drugs with the kind of tablet are pressed with other things or drugs which has more weight. So, the drug of the tablet is crushed a little bit, and it counts as the defect. Maybe the sender of the drugs is not paid attention while loading the drugs into the truck.

Revision for Control Chart Variable

Based on the control chart for the variables, it can be seen that there is one sample that exits the upper limit. Therefore, further investigation was carried out to determine the cause of this occurrence. The investigation results show that this happens by assignable causes so that the data can be deleted, and the control chart is revised. Meanwhile, the revised control chart for the variables is shown in Fig. 6.

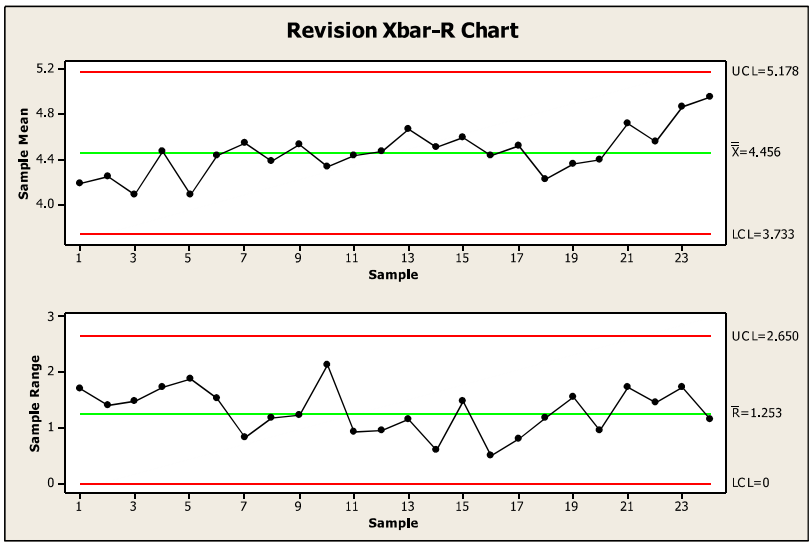

Fig. 6. Revision of control chart for variable

Fig. 6 indicates that the process is in control. This means that the processing time for registration can be said to be within control limits. However, if we look at the $\overline{X}$ control chart, we can see an increase in processing time in the final sample. The investigation results showed that the cause of increasing processing time is the computer's bad performance for the registration process. This provides information to the Clinic about the need for equipment maintenance to support services to patients.

IV. CONCLUSION

This study shows a control chart application at a university health clinic. Based on the chart, it can be concluded that the service quality in the Clinic is controlled and can meet the specified service specifications. The control chart also detects irregularities in the results for a certain period. This indicates that there was a problem with the service at that time. Therefore, control charts provide information to immediately identify the root cause of the problem and take corrective action.

Although the time for the patient registration process has been said to be controlled, and the service is capable of providing the process according to standards, there are still things that can be improved by the Clinic. The time set by the Clinic for the re-registration process is between three and five minutes. In the future, the Clinic is expected to reduce the range or variance of services by reducing the maximum time limit for registration processing to four minutes. This improvement will increase patient satisfaction at the Clinic.

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