86 Service Efficiency Analysis of the Outpatient Department (OPD) of a public hospital in the Philippines by Service Quality Model and Queuing Theory

Essey Misaki V. Andres, Franz C. Dator, Pamela Rose A. Juan,
Joeyette Therese E. Macato, John Carl R. Mendevil
Industrial Engineering Department
Technological Institute of the Philippines – Manila
memvandres@tip.edu.ph, mfcdator@tip.edu.ph, mprajuan@tip.edu.ph
mjtemacato@tip.edu.ph, mjcrmendevil@tip.edu.ph

Janina Elyse A. Reyes
Industrial Engineering Department - Adviser
Technological Institute of the Philippines
jereyes.ie@tip.edu.ph

Abstract

The time spent on the queue to get consulted by a doctor affects the patient's satisfaction on the services provided by a hospital. Just like in the OPD of a public hospital in the Philippines, the researchers have observed poor queueing system where some patients are dissatisfied. To provide solutions to the existing problem, the researchers utilized SERVQUAL scale, five quality dimensions: tangibles, reliability, responsiveness, assurance, and empathy to assess service quality. Queueing theory and Promodel process simulation were also used to analyze the current queueing system and propose new layout. The result obtained shows a negative gap exists between the expectation and the observation of the patients with the service of the OPD in each dimension, which are tangibles (-0.4733), reliability (-0.2311), responsiveness (-0.1675), assurance (-0.3289), and empathy (-0.2258). In implementing the proposed layout, the results obtained were an 86% increase in the number of patients accommodated, a decrease of 40%, 6%, and 46% in the average time of patients in the system, in operation, and in the waiting time of patients, respectively, compared to the existing process. It has been demonstrated that the recommended layout model can improve the hospital's service quality while cutting down patient waiting time.

Keywords
SERVQUAL scale, Promodel process simulator, Queuing theory, OPD

1. Introduction
The pandemic has incredibly strained healthcare systems, with rapid shifts in demand for inpatient care. Caring for COVID-19 patients while continuing to treat other patients is a complex planning challenge. A critical aspect of the Philippines' response to this crisis is ensuring safe and timely care for COVID-19 patients and those with other conditions. With that, hospitals have been busy since the start of the pandemic until now. The window of external service of hospitals is the outpatient department (Shan et al. 2013), and they are trying their best to provide the medical services possible. With the rise of the pandemic, multiple challenges in providing immediate responses to patients have been a considerable concern. Waiting time is a global problem in the healthcare industry (Algiriyage et al. 2014). Patients spend a significant amount of time before a physician sees them. In most developing countries, as several studies have shown, patients spend 2-4 hours in outpatient departments before seeing a doctor (Ofilli et al. 2005). The average length of long queues varies by country; even within a country, it varies by hospitals or clinics. Unnecessary waiting time increases frustration and stress for the patients. Also, long queues are subjecting the hospital to be overcrowded. One of the critical aspects of Hospital Administration is the Outpatient Department (OPD). It involves patients treated without staying in the hospital and going home after treatment. OPD oversees the function of the hospital, which is being the first contact between the patient and the hospital staff.

Service quality plays a vital role in the healthcare sector, especially in a country like the Philippines, which has a vast population and crowded cities. With the Philippines' colossal population and overcrowded cities, it faces significant challenges in controlling various diseases and undergoing major improvements as it strives to keep pace with growing population demands and cope with multiple conditions. A tool that can be utilized in determining the satisfaction and problems concerning the queue of an institution is the queuing theory. Queuing theory is a mathematical analysis concerned with the facility's scheduling, arrival, and service time, often used by hospitals with excess capacity to accommodate (Ameh et al. 2013). This tool can also be used to improve the setting of the institution to provide much better service and minimize time spent by the patients that receive the service in the OPD.

Objectives

The general objective of this study is to determine the service efficiency and the existing problems in the OPD of a public hospital in the Philippines by using service quality scale and queuing theory. Utilizing SERVQUAL, queuing theory, and Promodel process simulation to assess the existing problems with the service quality and queue of the OPD of the hospital and focus on the following specific goals:
\Use the SERVQUAL scale to determine patient satisfaction in various service quality dimensions.
To determine the root cause of the problem with the queuing system.
To conduct a time study on the OPD stations of a public hospital in the Philippines.
Provide solutions for the improvement of the queuing system of the OPD by SERVQUAL and queuing model,

2. Literature Review

Queuing Theory

Queuing theory is the study of waiting lines and queues, which is often applied in computer fields, control of inventory, patient scheduling in hospitals, etc. (Aziati & Hamdan 2018). Cho et al. (2017) stated in their study that queuing theory can be applied to a wide range of areas of medicine, from waiting time and utilization analysis to the relationship between appointment systems and queuing. Algiriyage et al. (2014) utilized queuing theory in assessing existing problems in an outpatient department in Sri Lanka where they were able to determine the root cause of the problems where a queue is involved, which is the assumption that the doctor's time is more valuable than the patient's time. In an article by Yusuf et al. (2015), queuing theory was used to assess problems with queuing in a bank operation. Several factors were determined in the study, such as staff, working environment, productivity, and customer waiting time and waiting environment that can affect the overall operation of the bank, which can also be observed in hospitals.

However, in the case of the healthcare service, it is often overlooked. Based on a study by Savanth et al. (2017), it is stated that one of the hospital's major problems is the lack of an effective method to manage the patient queue. In another study by Yaduvanshi et al. (2019), queuing theory was used in the outpatient department of a large multi-specialty hospital to determine the existing problems in the said department, which were long queues indicating lack of coordination, poor management, and inadequate resources that affect the quality of service in hospital operations. Adeleke et al. (2009), used queuing theory and determined how the problems with the queue affect the patient's satisfaction in a hospital in Nigeria.

Aside from using queuing theory to assess problems in healthcare systems, several studies have also utilized the said tool to improve systems and services. In Kalwar et al. (2017), queuing theory and discrete event simulation were utilized to be able to address some of the existing problems and improve the healthcare system in a hospital in Pakistan. In an article by However, in the case of the healthcare service, it is often overlooked. According to a study by Alenany & El-Baz (2017), the use of the Queuing Network Analyzer (QNA) algorithm and discrete event simulation to model is to analyze the influx of different classes of patients into a hospital and to be able to understand and generate a model to improve the service of the healthcare facility.

Promodel Process Simulation

Promodel is a simulation tool that is used to accurately model and design systems and test different scenarios to get the best possible solution to the problem they are solving. In a study by Siska & Morena (2014), Promodel process simulation was utilized to design and improve the patient service system of a hospital, where an increase in performance was seen because of the process optimization. In another study by Mandahawi et al. (2010), they used promodel in designing a discrete event simulation (DES) to create a design for Six Sigma to be implemented in a

hospital to reduce waiting time in a hospital's emergency department. Discrete event simulation using promodel also helped personnel understand the problems present in the processes involved in their system (Nielsen et al. 2008). DES in Promodel can also be used as a decision-making tool to test the improvements and optimization that will be made in the processes involved in the system (Arafeh et al. 2018).

The use of Promodel simulation helps different industries to assess and verify the improvements made in their services if they do help them or not. The study by Abad et al. (2016) is an example where they used Promodel simulation to verify if the enhancement they made produced a much better outcome compared to the old system of a convenience store in the Philippines. Another study by Hussein et al. (2017) utilized DES in Promodel and six sigma to assess the improvements made and eliminate the possible problems that might occur when it is applied in the system.

Patient Satisfaction

Patient satisfaction or dissatisfaction is a complex phenomenon related to patient expectations, health status, individual characteristics, and health system characteristics. Patient satisfaction is a useful measure to provide an indicator of the quality of care and should be measured frequently. The purpose of this study was to analyze and compare patient satisfaction in hospital outpatient departments (Mohd & Chakravarty, 2014). Patient satisfaction is often related to the quality of service provided by the hospital. According to Chang et al. (2013), the perceptions of interpersonal-based medical service encounters positively influence service quality and patient satisfaction. Perception of service quality among patients positively influences their trust.

Patients do have their own preferences in choosing hospitals where they want to receive treatment that will satisfy their needs. However, in a study by Tateke et al. (2012), once patients do not get their desired service, dissatisfaction is guaranteed to be given to the hospital. In the same study, the researchers stated that whether the hospital is public or private, they should continue to work to improve the competencies of their personnel, especially health professionals, to win the satisfaction of the customers and have a physical structure that better fits the expectancies of the patients.

Service Quality

Service quality is conducted in developed countries due to their early recognition of its importance to the country's economy. Understanding the concept and the factors influencing service quality is vital to ensure success. The International Organization for Standardization (ISO) do also have an imposed standard with regards to monitor the service provided by hospitals which is under ISO 9001. Under the ISO 9001, we have the three C's, which are the consistency of delivery of service, customer satisfaction, and continual improvement that hospitals can use as a guide to ensure the quality of service they provide the patients (Khurmi 2021). To determine the efficiency of service of companies in different industries, Service quality models are used to enlighten and to provide guidance for future improvements (Akhade et al. 2013). In a study by Bautista & Tangsoc (2016), the perspectives of patients, health workers, and the hospital, which are the stockholders of several private hospitals in the Philippines, were gathered and analyzed using a multi-perspective approach to determine different factors that affect the service quality of the hospitals. In hospitals, another indicator that they offer a good quality of service is having a short waiting time (Scenzano et al. 2005). Waiting time is also considered as a factor that influences the quality of service offered by an institution (Aeenparast et al. 2012). Additionally, prolonged stay of patients leads to a negative impact to the hospital when it comes to assessing the quality of service they offer.

The service quality tool, or SERVQUAL, is often used to determine the quality of service of institutions, including hospitals, is the service quality tool, or SERVQUAL. Based on the study conducted by Mehmet et al. (2017), the service quality scale, or SERVQUAL scale, was utilized to assess the service quality of a hospital and the expectations of the patients. There are five dimensions used under the service scale, which are reliability, tangibles, responsiveness, assurance, and empathy. The result of this study shows that tangibles, or the physical condition and equipment, means that the hospital where the study was conducted has good facilities that the patients liked. In another study by Zarei et al. (2012), service quality is perceived as a critical aspect for developing patients' loyalty and determines the medical institution's service excellence from the patients' viewpoints and the relative significance of pleasant dimensions in predicting the patient's loyalty. With the use of SERVQUAL, the importance of building a strong relationship between patients and the health facility practitioners/personnel, and the need for hospital personnel to be responsive, credible, and empathetic while managing patients.

3. Methods

This study is an applied research study which focused on determining the service efficiency of the OPD of a public hospital in the Philippines. The researchers used a combination of quantitative and qualitative approaches in conducting the study. The 5-point Likert scale was used for sensitivity and satisfying normal distribution for the parametric tests in conducting the service quality (SERVQUAL) survey that was utilized to gather the satisfaction level of the patients in the OPD of a public hospital in the Philippines. One-way ANOVA and Tukey's pairwise comparison will be used to assess which of the five dimensions will have the highest and lowest effect on the satisfaction of the respondents. Service quality (SERVQUAL) questionnaire survey is used in the collection of data. The dimensions of the survey are the following: (i) Reliability; (ii) Tangibles; (iii) Responsiveness; (iv) Assurance; (v) Empathy. In this way, the instrument obtains valid responses in understanding the expectations and problems encountered by the respondents with the service offered. Another instrument used is observation through time-study. Fixed attributes were also included in the survey aside from the five-point Likert scale for the five dimensions. Time studies are used to determine the time spent in different service delivery points in the outpatient department (OPD) until they are attended by a physician and receive the medical care they need. The study was conducted to evaluate the operational and service efficiency of hospital X for optimization and improvements.

Promodel process simulation was also utilized to better understand and assess each process in the OPD, and the methods involved in gathering the data needed. The researchers also conducted a time-study that was employed to gather other important data that will then be used in queuing theory.

4. Data Collection

The researchers utilized a non-probability sampling technique in conducting the study. Purposive sampling technique was utilized to gather data from the patients in the OPD of hospital X to be able to provide the researchers detailed and more accurate data about the service efficiency and satisfaction they have for the said department. The sample size was calculated using the total number of patients that visited the OPD of the hospital in October 2022 which is 1,425 patients with a margin of error of 5%. The researchers used the Slovin's formula:(1)

$$\boldsymbol{n = \frac{N}{(1 + N(e^2))}}$$

Wherein:
n = Number of Samples
N = Total Population
e = Margin of Error
The total computed sample size by the researchers is 312 which was the number of the respondents needed to be surveyed for this study. From the respondents of the survey, 40 participants were observed to gather data that was used for the time study.

5. Results and Discussion

5.1 Numerical Results

Mean-Gap Analysis

Table 1. Mean-gap analysis

SERVQUAL Dimension	Mean (Expected)	Mean (Observed)	Gap (Observed-Expected)
Tangibles			
1. Availability of Medicine	4.1887	3.3082	-0.8805
2. Accurate Medicine by doctors	4.4245	4.1478	-0.2767
3. Ease of obtaining medicine	4.1069	3.5314	-0.5755
4. Good reception area	4.4623	4.3019	-0.1604
Total SERVQUAL gap	**4.2956**	**3.8223**	**-0.4733**
Reliability			

SERVQUAL Dimension	Mean (Expected)	Mean (Observed)	Gap (Observed-Expected)
5. Keeps given appointment	4.5189	4.2296	-0.2893
6. Good communication	4.4371	4.1289	-0.3082
7. Give thorough physical examination	4.4403	4.2358	-0.2044
8. Proper medication was given by staff	4.4182	4.2956	-0.1226
Total SERVQUAL gap	**4.4536**	**4.2225**	**-0.2311**
Responsiveness			
9. Retrieves record promptly	4.5566	4.3019	-0.2547
10. Assists patients	4.3648	4.2704	-0.0943
11. Staff are respectful	4.4308	4.2107	-0.2201
12. Offer prompt service	4.3679	4.2673	-0.1006
Total SERVQUAL gap	**4.4300**	**4.2626**	**-0.1675**
Assurance			
13. Availability of laboratory results	4.1132	3.4623	-0.6509
14. Adhere confidentiality	4.4434	4.2736	-0.1698
15. Has adequate staff	4.3491	3.8994	-0.4497
16. Staff can answer my queries	4.4340	4.2516	-0.1824
17. Recommend OPD	4.4686	4.2767	-0.1918
Total SERVQUAL gap	**4.3616**	**4.0327**	**-0.3289**
Empathy			
18. Staff paid attention	4.5472	4.2107	-0.3365
19. Good cooperation	4.4465	4.2736	-0.1730
20. Staff are polite	4.4057	4.2075	-0.1981
21. Staff are compassionate	4.4717	4.2264	-0.2453
22. Staff listened	4.4497	4.2736	-0.1761
Total SERVQUAL gap	**4.4642**	**4.2384**	**-0.2258**
Over-all SERVQUAL gap	**4.4010**	**4.1157**	**-0.2853**

A mean-gap analysis was used to determine if there is an existing gap between the expectations of the patients and what they have experienced in each dimension. A negative gap indicates that the patients' perceptions are higher than what they have received. Meanwhile, a positive gap indicates that the patient has received better service than expected. The table 4-2, shows the gap between the mean of the scores obtained based on the expected and observed in the five dimensions of the SERVQUAL scale. For tangibles, there is a gap of -0.4733 based on the expected and observed mean scores given by the patients in respect to the mentioned dimension. This dimension obtained the highest total gap from the five given dimensions. The attribute has the highest mean gap of -0.6869. This attribute states the availability of medicine in the OPD, and this implies that there is no readily available medicine in the OPD that they need. With the reliability dimension, there is a total of -0.2311 gap which indicates that the expectation of the patients regarding this factor was not met by the hospital.

The attribute 8 which is about the accurate medication given by the staff got the lowest gap (-0.1226) among the attributes which means that most staff got accurate medication from the staff. Responsiveness dimension also has a mean gap of -0.1675, which is the lowest obtained gap among the dimensions which means that most patients were satisfied with their service specifically with this dimension. Attribute 9 under responsiveness, had the highest gap of -0.2547. This attribute discusses how immediate their records were collected in the hospital, and based on the result, their expectation with how quick this process will be was not met by the OPD staff. The table also shows the presence of a gap with the assurance dimension with the total of -0.3289. Out of all the attributes, the mean under attribute one of assurance got the highest gap which is attribute 13 (-0.6509), between other attributes which means the OPD has poor performance when it comes to immediately releasing the laboratory result of the patients. Lastly, the empathy dimension. The result for this factor implies that there is a -0.2258 gap between the service quality in terms of the

empathy factor with the service offered by the OPD of hospital X. The overall gap with the perception and observation of the patients in the service provided by the OPD is -0.2853.

Paired T-Test

- Null hypothesis: There is no existing gap in the mean of the difference of the expected and observed of each dimension.
- Alternative hypothesis: There is an existing gap in the mean of the difference of the expected and observed of each dimension.

Table 2. Result of Paired T-test

Dimension	T-Value	P-Value	Mean	StDev	SE Mean	95% CI for μ_difference
Tangibles	-11.01	**0.000**	-0.4470	0.7692	0.0433	(-0.5623, -0.3917)
Reliability	-8.00	**0.000**	-0.2341	0.5197	0.0293	(-0.2917, -0.1765)
Responsiveness	-5.78	**0.000**	-0.1683	0.5167	0.0291	(-0.2255, -0.1110)
Assurance	-10.36	**0.000**	-0.3308	0.5665	0.0319	(-0.3936, -0.2680)
Empathy	-8.14	**0.000**	-0.2273	0.4957	0.0279	(-0.2823, -0.1723)

μ_difference: mean of observed-expected

Paired t-test was utilized to determine if the existing gap between each dimension are significant. The table shows the result of paired t-tests for each dimension. Tangibles (p=0.000), Reliability (p=0.000), Responsiveness (p=0.000), Assurance (p=0.000), and Empathy (p=0.000) all have a p-value less than 0.05, therefore, we reject the null hypothesis and conclude that there is an existing gap between the expectation of the patients from their observation with the different dimensions in the service provided by the OPD of hospital X. Based on the gap determined and shown in Table 4-3, the service provided by the OPD, especially with the release of laboratory results, shows that they are not satisfied with the overall service they got.

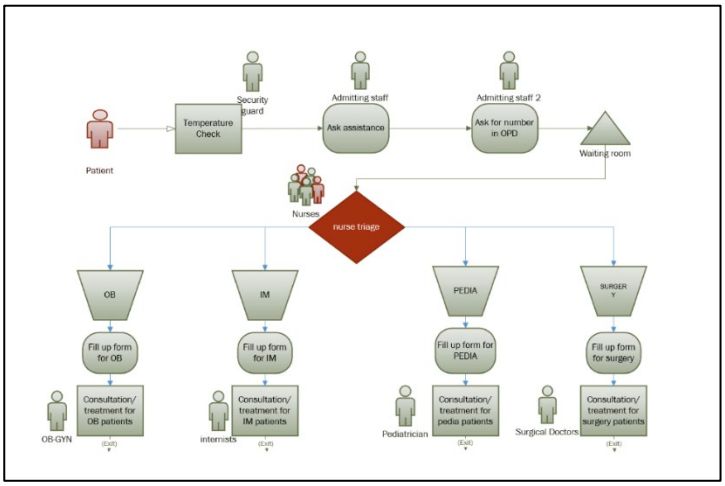

Figure 1. Existing process layout in Process Simulator

Figure 1 shows the activities in the OPD and the number of personnel that is assigned per activity. Since the OPD have a single shift, each shift there are nine people that assists and provides service to the patients. There are one security guard, two admitting staff, two nurses in the triage, and four doctors for each type of service offered by the OPD. The process in the OPD includes checking of temperature upon entry. Next, the admitting staff assists patients in entering the OPD and guiding them to the station where they can get their queue numbers. After waiting for a while in the waiting room/area, the nurses in the nurse triage will interview and get their vital signs. The nurse will also guide them to which of the services they should get. From the nurse triage, the patients will need to fill-up forms

before the check-up. After that, they will wait again to be called by the doctor, and once called, they can get the consultation they need and will check for the availability of their laboratory results. Additionally, the OPD operates for 8 hours, and many patients usually come in the morning since the hospital imposes a first come, first served policy. Like other hospitals, the OPD of hospital X only has a single 8-hour day shift since this department is for patients that can be diagnosed or treated without the need to stay overnight.

Process Simulation Results

Table 3. Result of Simulation and Summary of Entity States of current process layout

Total Patients accommodated	Average Time in System (Min)	Average Time in Operation (Min)	Average waiting time (Min)	Percent of patient moving in process	Percent of patient waiting	Percent of patient in operation
33	280.69	42.11	238.58	1.78	69.04	15.03

The table 3 shows the total number of patients that the current process of the OPD can accommodate, which is 33 patients. The average time in the system obtained is 280.69 minutes, or 4 hours and 41 minutes, while the average time in operation is 42.11 minutes. Subtracting the total time in operation from the total average time in the system per patient, we obtain 238.58 minutes, or 3 hours and 59 minutes, which is the total average waiting time of a patient. The average time of patients moving in logic or moving based on processes is 1.78%, according to the summary of entity states. 69.04% of patients are waiting while 15.03% are in operation. The result shows that more patients spend their time waiting than those who are undergoing surgery.

Table 4. Activity Utilization of current process layout

Station	Activity Utilization (%)
Temperature Check	40.76
Ask assistance	99.46
Ask for number in OPD	92.16
Nurse triage	**49.40**
Consultation/ treatment for OB patients	53.63
Consultation/ treatment for IM patients	19.95
Consultation / treatment for Pedia patients	22.36
Consultation/ treatment for surgery patients	12.21

Table 4 shows the percentage utilization per activity in the OPD of the hospital. Assuming that the arrival of patients is continuous, it can be observed that both ask assistance and OPD number stations have high percentage utilization. It means that the admitting staff assigned to both activities were the most productive ones and could accommodate every patient that arrived. 49.40%, on the other hand, is the utilization of nurse triage, the station where two nurses are assigned and where all the patients should go before seeing the doctors in IM, OB, Pedia, and surgery. Since this activity is vital in the operation of the OPD, 49.40% utilization should be improved so that the following activities, which are the consultations, can also increase. As a result, more patients will be able to get the treatment that they need.

5.2 Proposed Process Layout

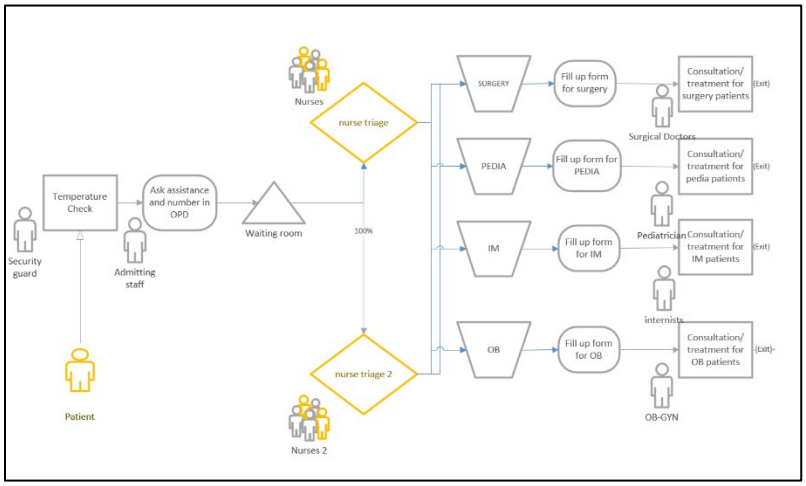

Figure 2. Proposed OPD process layout

The researchers created three alternative layouts. Before choosing the best layout, the researchers decided to use decision making tools such as TOPSIS ranking method and Analytical Hierarchy Process or the AHP method, where the results obtained after simulating the layouts in the process simulator were used, and with the help of one of the hospital staff, the layout in figure 2 was chosen. It can be observed that an additional triage is present in the proposed process. Also, addition of more nurses will help the OPD, but considering that the hospital is new, and the number of health workers in the Philippines is limited (Baclig 2021), the researchers propose adding only two additional nurses to be assigned to another triage based on the proposed process layout.

Table 5. Result of Simulation of proposed process layout alternatives

Alternatives	Total Patients accommodated	Average Time in System (Min)	Average Time in Operation (Min)	Average waiting time (Min)	Percent (%) of patient moving in process	Percent (%) of patient waiting	Percent (%) of patient in operation
Proposed Layout	62	168.28	39.56	128.72	3.57	51.18	23.53

The result from the process simulator for the proposed process layout, or layout 1, shows that the OPD will be able to accommodate 62 patients while spending 168.28 minutes, or 2 hours and 48 minutes, in the system and an average of 39.56 minutes in operation. Subtracting the time in operation from the total average time in the system, we get 128.72 minutes, or 2 hours and 8 minutes of total waiting time. It also shows that 3.57% of patients are moving logically, while 51.18% are waiting and 23.53% are undergoing surgery. Table 6 shows the result of the simulation and the utilization per station of the proposed process layout alternatives. Proposed layout 1, where there will be two triages that can occupy a single patient each, had the highest utilization in the nurse triaging stations with 96.35% and 98.13%.

Table 6. Activity Utilization of proposed process layout

Station	Activity Utilization (%)
Temperature Check	24.54
Ask assistance	50.16
Nurse triage	96.35
Nurse triage 2	98.13
Consultation/ treatment for OB patients	82.15
Consultation/ treatment for IM patients	47.47

Consultation / treatment for Pedia patients	39.42
Consultation/ treatment for surgery patients	27.30

5.4 Comparison of Results of Current and Proposed process layout

Table 7. Comparison of the result of two layouts

Process Layout	Total Patients accommodated	Average Time in System (Min)	Average Time in Operation (Min)	Average waiting time (Min)
Existing	33	280.69	42.11	238.58
Proposed	62	168.28	39.56	128.72
Percent Difference	**86%**	**-40%**	**-6%**	**-46%**

To minimize the time spent by patients in the OPD, the researchers developed a layout considering the limited number of health workers in the hospital, the difficulty of hiring health workers and the hospital is still new. Based on the table above, there is an 86% increase in the total number of patients that the OPD can accommodate in the proposed process compared to the existing process. A decrease of 40% and 6% in time spent in the system and time spent in operation respectively, can be attained in imposing the proposed process layout compared to the existing process layout. Additionally, patients will experience a decrease in waiting time by 46% or by 1 hr and 50mins with the proposed process layout.

Table 8. Comparison of the Result of Summary of Entity States

Process Layout	Percent of patient moving in process	Percent of patient waiting	Percent of patient in operation
Existing	1.78	69.04	15.03
Proposed	3.57	51.18	23.53
Percent Difference	**101%**	**-26%**	**57%**

The percent of patients in move logic increased by 101% in the proposed system layout shown in the table above. The percentage of patients waiting decreased by 26% which indicates that there are fewer patients spending their time waiting. Lastly, 57% increase of patients in operation can be observed from the table which indicates that more patients are in operation in the proposed system compared to the existing system.

Table 9. Comparison of the Activity Utilization of Existing and Proposed process layout

Station	Activity Utilization (%)		Percent Difference
	Existing	Proposed	
Temperature Check	40.76	24.54	**-40%**
Ask assistance	99.46	50.16	**-50%**
Ask for number in OPD	92.16	-	**-**
Nurse triage	49.40	96.35	**95%**
Nurse triage 2	-	98.13	**-**
Consultation/ treatment for OB patients	53.63	82.15	**53%**
Consultation/ treatment for IM patients	19.95	47.47	**138%**
Consultation / treatment for Pedia patients	22.36	39.42	**76%**
Consultation/ treatment for surgery patients	12.21	27.30	**124%**

Table 9 shows that comparison of the activity utilization of the existing and proposed process. It can be observed that the process of asking numbers was removed in the proposed process since it can be on the same station as the activity asking assistance. The researchers also propose that the admitting staff assigned to giving the number in the OPD will be the guide that will monitor the queuing so that first-come, first-served will be strictly observed, which is one of the main problems mentioned by the patients. The table shows that the activity utilization of temperature checking and asking for assistance decreased while the remaining activities increased. In the nurse triage, both have high percentage

utilization for the proposed process. An increase of 95% utilization was obtained in one of the triages in the proposed compared to the existing one. Additionally, an increase of 53%, 138%, 76%, and 124% was obtained in the activity utilization in the proposed treatment or consultation of the OB, IM, Pedia, and surgery services, respectively. Furthermore, this indicates that the doctors' idle time decreased since the percentage utilization of the activities they are in increased.

6. Conclusion

Based on the survey results and observations, the service provided by the hospital's OPD did not meet the patients' expectations in the various dimensions of the SERVQUAL scales. The expectations of patients were proven to be higher than what the patients had experienced. On the other hand, although the dimensions equally affected the quality of service provided by the hospital, the patients had high expectations for the reliability dimension. However, responsiveness got the highest score after they experienced the service in the OPD. Meanwhile, the dimension with the lowest mean score for both the expected and observed values is the tangibles dimension and the dimension that the hospital should prioritize to increase the satisfaction of patients with their service. The researchers identified medicine availability as the reason this dimension received a lower score than the others. Additionally, the delay in the release of laboratory results was found to be an attribute with which the patients were not satisfied.

The process identified nurse triage as the main bottleneck of the operation. Most patients spend more time in this process, while the next patients, since the hospital has a "first-come, first-served" policy, need to wait for their turn in the triage. The average wait time for patients before receiving the service that they required was determined to be three hours. Overall, they need to stay in the system for more than 4 hours, including their time in operation. The main issue in the OPD has been identified as a lack of healthcare workers, which is why patients must wait longer for the services they require.

By imposing the proposed process layout and having additional health workers, the researchers were able to determine the difference between the existing and proposed layout in terms of the patient's time and state in the system. It is found that there is an 86% increase in the total number of patients that the OPD can accommodate under the proposed system. Also, there is a 40%, 6%, and 46% decrease in the time of patients in the system, in operations, and in waiting. According to the current state of the patients, there is a 101% increase in the percentage of patients who are moving in logic, a 57% increase in the percentage of patients who are in operation, and a 26% decrease in the percentage of patients who are waiting.

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Biography

Joeyette Therese E. Macato is a 4th -year student from Technological Institute of the Philippines - Manila, taking up a Bachelor of Science in Industrial Engineering, Certified Lean Six Sigma Yellow Belt practitioner. Former 3rd-year representative and a current member of Junior Philippine Institute of Industrial Engineers 2021-2022. Member of TIP-Inhinyera 2022-2023.

Essey Misaki V. Andres is in his 4th -year at the Technological Institute of the Philippines-Manila, taking up a Bachelor of Science in Industrial Engineering. Current member of the Junior Philippine Institute of Industrial Engineering 2022-2023 and TIP-Inhinyera 2022-2023.

John Carl R. Mendevil is a 4th -year student from Technological Institute of the Philippines - Manila, taking up a Bachelor of Science in Industrial Engineering. Member of Junior Philippine Institute of Industrial Engineers 2022-2023 and a former member of TIP-Inhinyera 2021-2022.

Franz C. Dator is a 4th -year student from Technological Institute of the Philippines - Manila, taking up a Bachelor of Science in Industrial Engineering, Certified Lean Six Sigma Yellow Belt practitioner. Former member of Junior Philippine Institute of Industrial Engineers 2021-2022 and a current member of TIP-Inhinyera 2022-2023.

Pamela Rose A. Juan is a 4th -year student from Technological Institute of the Philippines - Manila, taking up a Bachelor of Science in Industrial Engineering, Certified Lean Six Sigma Yellow Belt practitioner. She is also a current member of Junior Philippine Institute of Industrial Engineers 2022-2023.

Janina Elyse A. Reyes is an Associate Professor at the T.I.P. Industrial Engineering Department. She graduated from the University of the Philippines Diliman where she earned her bachelor's degree in Industrial Engineering and Operations Research. She then studied at Mapua University for her Master's Degree in Engineering Management.