# ANALYSIS OF ANTREAN SYSTEM FOR OPTIMIZATION OF PATIENT SERVICES IN THE KECAMATAN KOJA PUSKESMAS

**[1st] Eriska, [2nd] Dr. H. Supriyatin SY,MM**
Sekolah Tinggi Ilmu Ekonomi Indonesia, Jakarta
Jln Pramuka Jaya Sari No. 23 RT 13/RW 02, Kelurahan Rawasari
Kecamatan Cempaka Putih, Jakarta Pusat, 13240
eriskawijaksono22@gmail.com

***Abstract -*** This study aims to describe the patient registration queue system in order to optimize services at the registration counter of the BPJS Puskesmas, Koja District.

This study used a descriptive strategy research type with the method of observation and analysis tools used, namely M / M / S which was carried out at the Koja sub-district health center. The sampling in this study was the time of observation carried out at the Koja sub-district health center while the population taken in this study was patient services at the registration counter of the Koja District Health Center BPJS. Primary data and secondary data are needed in this research. The data was obtained through observations and interviews with officers and the results of the data were processed manually and using Pom for windows 3.0 software and secondary data was taken from the profile of the Koja District Health Center.

The results of this study indicate that the queuing system used by the Koja District Health Center BPJS Registration Counter is a Multi channel-Single Phase queuing system. The queue performance at the BPJS Registration Counter is not optimal with the number of Counter (M) officers as many as 2 officers and a standard service time of 2 minutes.
***Keywords: service optimization, queuing theory, registration, Operations Management***

***Abstrak–***Penelitian ini bertujuan untuk menggambarkan sistem antrean pendaftaran pasien guna optimalkan pelayanan di loket pendaftaran BPJS Puskesmas Kecamatan Koja.

Penelitian ini menggunkan jenis penelitian strategi deskriptif dengan metoda observasi dan alat analisis yang digunakan yaitu M/M/S yang dilakukan di puskesmas kecamtan koja.pengambilan sampel dalam penelitian ini adalah waktu observasi yang dilakukan di puskesmas kecamatan kojasedangkan populasi yang diambil dalam penelitian ini adalah pelayanan pasien pada loket pendaftaran BPJS puskesmas kecamatan koja.Jenis data yang dibutuhkan dalam penelitin ini data primer dan data sekunder. Data tersebut didapat melalui obserasi dan wawancara pada petugas dan hasil dari data tersebut diolah dengan manual dan menggunakan *software Pom for windows 3.0*dan data sekunder diambil dari profil Puskesmas Kecamatan Koja.

Hasil penelitian ini menunjukan bahwa sistem antrean yang digunakan oleh Loket Pendaftaran BPJS Puskesmas Kecamatan Koja adalah sistem antrean *Multi channel-Single Phase.* Kinerja antrean di Loket Pendaftaran BPJS

belumoptimal dengan jumlah petugas Loket (M) sebanyak 2 orang petugas danstandar waktu pelayanan 2 menit

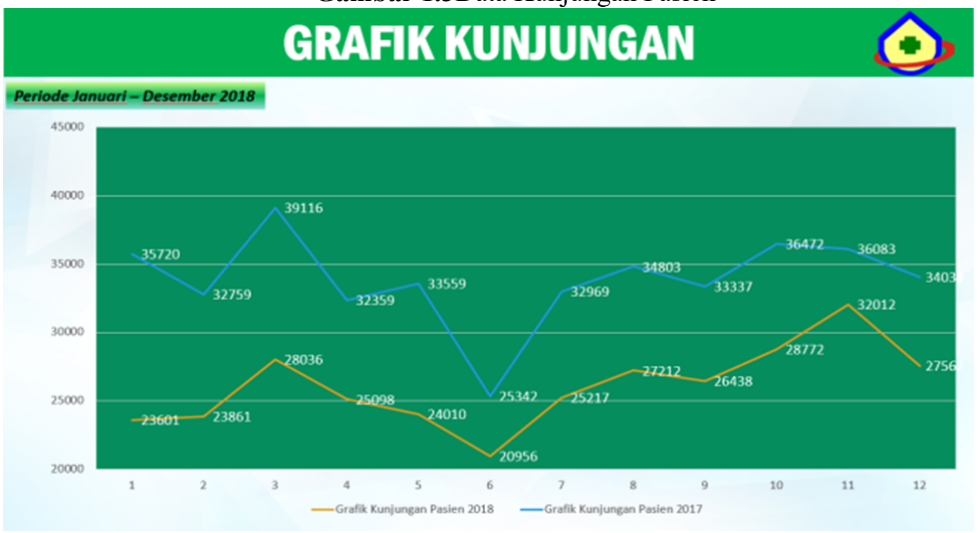
***Kata kunci : optimalisasi pelayanan, teori antrean, pendaftaran,Manajemen Operasi***

## I. PRELIMINARY

Puskesmas is one of the service businesses in the field of health services, several factors can determine its success in the operational process, namely: service quality, systems in service, technology and order in the services provided by the Puskesmas. Basically Puskesmas have the same goal, namely to provide health care and medication for every patient. One of the business entities engaged in the health sector, of course, the puskesmas has a vision and mission to provide services and help people get the best medical services. To realize this vision and mission, the puskesmas must continue to improve the services provided to patients.

Data kunjungan pada Gambar 1.3 menunjukkan kenaikan kunjungan pasien dari tahun 2017 sampai tahun 2018. Grafik kunjungan mencatat sebanyak 3.403 pasien yang datang untuk mendapat layanan kesehatan di Puskesmas Kecamatan Koja pada bulan Desember 2018.

**Gambar 1.3**Data Kunjungan Pasien




*Sumber:puskesmaskecamatankoja1.wordpress.com(2017-2018)*

The number of patient arrivals at the Koja Subdistrict Health Center greatly affects the comfort of the patients themselves. Each month there is an increase and decrease, when the high level of arrivals at certain times causes long and long queues. The main problem faced by the Koja Subdistrict Health Center is one that causes patients not to wait for long periods of time. Patients often assess the quality of the queuing system at the Koja District Health Center based on the length of waiting time or the lack of speed of service in providing services to patients. The Koja Subdistrict Health Center must carefully determine the patient's needs. Because there is a problem with the queue system, a systematic research is carried out to analyze the optimization of the queue. So that the queues can be overcome or reduced even prevented so that patients at the Koja District Health Center can assess optimal service. The optimal queue system in the world of health is very important.

The services provided by the puskesmas include medical and non-medical workers. Especially at the time of service to patients. Patients who want to seek treatment must go through several stages that will be carried out for the service stage. The first step is that the patient takes the queue number through the machine provided, then waits until he gets his turn to the officer at the registration counter. The queue occurs because the service facilities provided are not proportional to the number of patients who need registration services. This condition can result in the accumulation of patients in the registration section, this is not in line with the Government's appeal to avoid crowds to prevent Covid-19 transmission. Therefore, researchers are interested in conducting research on Queuing System Analysis to Optimize Patient Services at Puskesmas Koja District, North Jakarta .

### 1.1. Formulation of the problem

Long queues will cause inconvenience for patients so that the service provided is less than optimal. For this reason, it is necessary to analyze and select a better queuing system to be applied to the Koja District Health Center to optimize patient services. The main problem in this research is whether the queue system performance at the BPJS registration counter at the Koja District Health Center is currently optimal?

Based on the main problems that exist, the problem formulations to be discussed in this study are

1. What queuing system model is applied by the Koja Subdistrict Health Center at the outpatient BPJS Admission counter?
2. How is the performance of the queuing system at the BPJS Outpatient Admissions Unit counters?
3. Has the queuing system at the BPJS counter at the outpatient admissions unit of the Koja Subdistrict Health Center provide optimal service?

### 1.2. Research purposes

Based on the problem formulation above, this study aims to determine:

1. The queuing system model used at the registration counter of the BPJS Puskesmas, Koja District, Outpatient Admission Unit.
2. The performance of the antren system at the registration counter of the BPJS Puskesmas, Koja District.
3. Optimization of patient registration services at the BPJS counter of the Outpatient Admissions Unit of the Koja District Health Center.

## II. LITERATURE REVIEW

### 2.1. Operation management

Operations management is one of the main functions of an organization and as a whole relates to all other business functions. All organizations market, finance and produce. Operations management is the study of decision making in operations functions. Part of the company's expenses lies in the operations management function. However, operations management provides opportunities to increase profits and services to the community (Heizer and Render, 2016: 3).

### 2.2. Service quality management

According to Lupiyoadi (2013: 212) quality is a combination of traits and characteristics that determine the extent to which output can meet customer needs. Customers who determine and assess how far these traits and characteristics can meet their needs

## 2.3. Understanding queuing theory

According to Tjutju Tarliah and Ahmad Dimyati (2017: 349) queuing theory is a theory that concerns the mathematical study of queues or waiting lines. The formation of these waiting lines is of course one of the common phenomena that occurs when the need for a service exceeds the capacity available to provide that service. Decisions regarding these capacities must be determined, although in fact it is impossible to make an accurate prediction about when the units requiring the service will come and / or how long it will take to administer the service.

## 2.4. Kompen queue system

According to Heizer and Render (2016: 855) there are four kinds of rules in the queue, namely:

(1) *First Come First Serve (FCFS),* is a queuing discipline that is used in several places where customers who come will be served first. Queues like this are widely used, among others, in queues for cinema ticket services, banks, and others.
(2) *Last Come First Serve (LCFS),* is the discipline of queuing where the last customer received the previous service.
(3) *Shortest Operation Times (SOT),* is a service system where customers who require the shortest service time get the first service.
(4) *Service in Random Order (SIRO),* is a service system where customers may be served randomly (random), no matter who comes first.

## 2.5. Queue Performance Measurement

This queuing model serves as a consideration for managers to make decisions that provide a balance between service costs and waiting line costs. Queue analysis can obtain many measures of queuing system performance as follows (Heizer and Render, 2016: 857)

## 2.6. Excellent service

In the development of the world of services today, the term service excellence is known. The term prime servant, which is defined as concern for customers by providing the best service to facilitate the ease of fulfilling their needs from realizing their satisfaction, so that they are always generous to the company (Barata, 2004). To achieve excellent service, the company must have certain skills, including good and neat appearance, being friendly, showing passion and always being ready to serve, calm at work, not being proud because they feel needed, mastering their work both tasks related to the or his department or understand and understand sign language (customer gesture0 and have the ability to handle customer complaints in a professional manner (Atmadjati, Arsita 2018:

## 2.7. Organizational culture

According to Kreitner and Kinicki in Supriyatin (2013: 230) organizational culture is a form of assumption that is owned, implicitly accepted by the group and determines which part of the group feels, thinks and reacts to its various environments. Edgar Schein in Fred Luthans (2006: p. 124) states that organizational culture is a basic assumption pattern created, discovered or developed by certain groups when they adjust to external problems and internal integration that have worked quite well and are considered valuable, and because it is taught to new members as the correct way to realize, think and feel the connection with the problem

## 2.8. Relationship between Research Variables

This study uses one independent variable. An independent variable is one or more variables (independent variables) without making considerations and looking for relationships with other variables. In this study, the independent variable used is queuing theory which can be measured by five queue performance measures, namely:

1. The probability that there are 0 patients in the system or the possibility that the counter is unemployed.
2. Average number of patients in the system.
3. Average time spent in the system.
4. Average number of paisen in line.
5. Average time spent in the system.

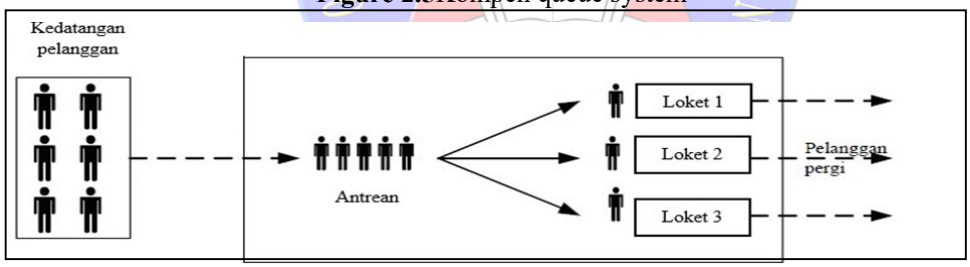
## 2.9. Hypothesis Development

This research is a descriptive study which aims to explain or describe independent variables so that in this study, the formulation of research hypotheses is not required. In this descriptive study, researchers used quantitative and qualitative approaches by making observations to determine the arrival rate of patients at the registration booth in order to measure the performance of the current queuing system.

## 2.10. Variable Conceptual Framework

Queuing is something that very often occurs in operational activities, therefore, there is a theory that can be used by operational managers to measure how well a queue is performing. In order to measure the performance of a queue, the operations manager needs to know the three main components contained in the queue system so that a queue performance measure can be generated. The three main components of the queuing system are customer arrivals, queuing discipline, and service facilities.

**Figure 2.5**Kompen queue system




*Source: Heizer and Render (2016)*

Based on the picture above, it can be seen that customers come and form a waiting line or queue. The arrival of these customers is part of the first queue system component. Then the customer gets a turn to be served by a counter that is provided, in this case there are rules regarding who has the right to be served first. This rule is commonly called queuing discipline, queuing discipline is the second major component in the queuing system. Furthermore, customers are served by a customized counter, in other words, customers are served by service facilities provided by the company. Service facilities are the third main component contained in the queuing system.

After knowing the three main components in the queuing system, then it can be measured how much the queue performance is. According to Heizer and Render (2016: 857) there are several measures of queuing system performance, including:

1. Probability that there are 0 customers in the system
   The probability that there are 0 customers in the system shows how likely it is that the server or service facility is idle. If it can be seen that the probability there are 0

customers in the system, it can also be determined how many servers or service facilities are effective to optimize service
2. Average number of subscribers in the system
   The average number of subscribers in the system is the average number of customers starting from queuing up to being served every hour.
3. Average time spent by customers in the system
   The average time a customer spends in the system shows how much time the customer spends from queuing to being served.
4. Average number of customers in line
   The average number of customers in the queue shows the average number of customers who are waiting their turn to be served each hour.
5. Average time spent in line by a customer
6. Queuing theory can measure how long a customer spends while in a waiting line or queue.

## III. RESEARCH METHOD

### 3.1. Research Strategy

Based on the background of the problem to be studied, the research strategy used in this study is a descriptive strategy. Descriptive strategy is a type of research by formulating and interpreting existing data so that it provides a clear picture of the object under study in general or generalizations. Included in descriptive statistics is the presentation of data with tables, graphs, pie charts, pictograms, calculation of mode, median, mean, percentage, and standard deviation (Sanusi, 2014: 116).

### 3.2. Population and Sample Research

Population is the entire collection of elements that show certain characteristics that can be used to make conclusions. So, the collection of elements shows the number, while certain characteristics show the characteristics of the collection (Sanusi, 2014: 87). The population in this study was patient care at the registration counter of BPJS Pukesmas, Koja District since its establishment until now.

The research sample is part of the number of characteristics possessed by the population (Sanusi, 2014: 87). The sample in this study was the time of observation carried out at the registration counter of the District Health Center BPJS

Koja. Loket pendaftaran BPJS Puskesmas Kecamatan Koja beroperasi pada hari senin sampai sabtu sehingga terdapat 6 hari kerja dalam 1 minggu. Untuk dapat mewakili kondisi loket dalam 1 bulan peneliti memilih 2 minggu waktu observasi agar lebih efektif dan efisien. Oleh karena itu, sampel yang dipilih pada penelitian ini adalah 12 hari kerja.

### 3.3. Metode Analisis Data

#### 3.3.1. Pengolahan data

Dalam penelitian ini, data yang telah terkumpul dari hasil observasi atau pengamatan mengenai tingkat kedatangan dan tingkat pelayanan pasien pada Loket pendaftaran BPJS Puskesmas Kecamatan Koja serta pengukuran kinerja antrean diolah secara manual dan menggunakan SoftwarePOM for Windows Versi 3.0.

### 3.3.2. Penyajian data

Data yang diperoleh dalam penelitian ini akan disajikan dalam bentuk tabelsehingga memudahkan pembaca dalam membaca, memahami dan menganalisisdata yang disajikan.

### 3.3.3. Statistical analysis of data

Statistical analysis of data in accordance with the queuing system conditions applied at the Koja District Health Center BPJS registration counter currently is data analysis using Model B (M / M / S). To measure the performance of multiple line queues (M / M / S) can use the following formula (Heizer and Render, 2016: 863).

1. Probability that there are 0 patients in the system
   The probability that there are 0 patients in the system can be measured using the following formula:

$$P_0 = \frac{1}{\left[\sum_{n=0}^{M-1} \frac{1}{n!}\left[\frac{\lambda}{\mu}\right]^n\right] + \frac{1}{M!}\left[\frac{\lambda}{\mu}\right]^M \frac{M.\mu}{M.\mu-\lambda}} \quad for \quad M.\mu > \lambda \quad \text{..... (3.1)}$$

2. Average number of patients in the system
   To measure the average number of patients in the system, you can use the formula:

$$L = \frac{\lambda\left(\frac{\lambda}{\mu}\right)^M}{(M-1)!(M.\mu-\lambda)^2} P_0 + \frac{\lambda}{\mu} \quad \text{..... (3.2)}$$

3. Average time spent in the system
   To measure the average time spent by patients in the system can use the formula:

$$W_s = \frac{L_S}{\lambda} \quad \text{..... (3.3)}$$

4. Average number of patients in line
   To measure the average number of patients in the queue, you can use the formula:

$$L_q = L_s - \frac{\lambda}{\mu} \quad \text{..... (3.4)}$$

5. Average time spent in line for patients
   To find out the average time spent in line by patients, you can use the formula:

$$W_q = \frac{L_q}{\lambda} \quad \text{..... (3.5)}$$

Information :
λ = Average patient arrival rate at the service unit (patient / hour)
μ = Average level of service to patients in the service unit (patient / hour)
*M* = Number of servers opened (units)
P0 = probability there are no customers in the system
Ls = Average number of patients in the system (patients / hour)
Ws = Average time spent by patients in the system (patients / hour)
Lq = Average number of patients in line (patients / hour)
Wq = Average time spent in queue for patients (patients / hour)

## IV. RESULTS AND DISCUSSION

### 4.1. Description of Research Object

Puskesmas kecamatan koja, merupakan salah satu pusat kesehatan Masyarakat, puskesmas ini terletak di kecamatan koja, Jakarta Utara. Puskesmas ini merupakan salah

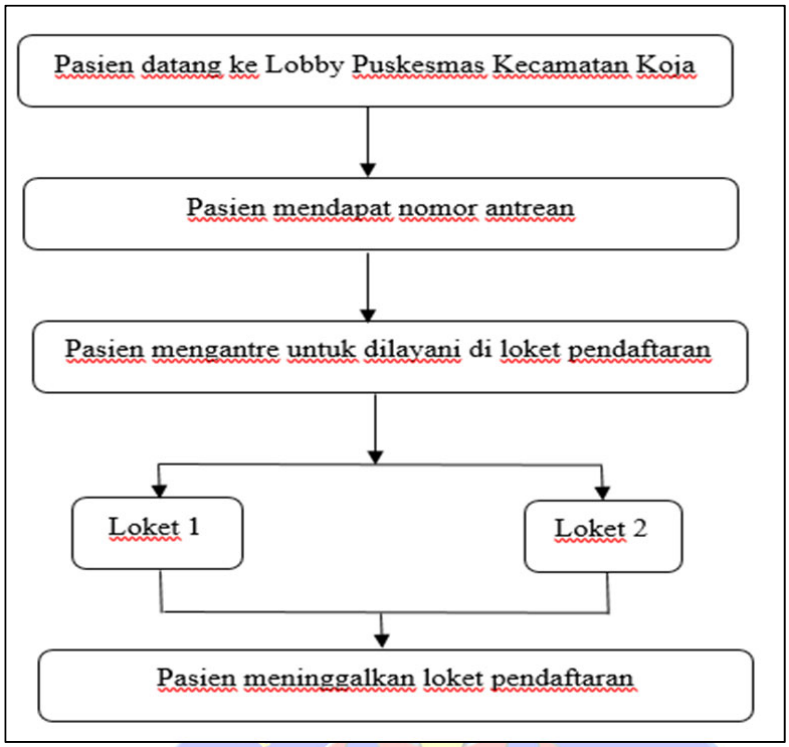
satu dari beberapa Puskesmas di wilayah DKI Jakarta yang melayani layanan perawatan Methadon bagi pecandu narkoba. Selain perawatan kepada pecandu narkoba, puskemas ini telah dilengkapi dengan layanan rawat inap dengan kapasitas 10 tempat tidu untuk pasiennya, 2 tempat tidur pasien khusus Gizi buruk /TFC dan 2 tempat tidur untuk ruang tindakan &observasi: poliknik yang elayani pasien dalam poli umum, poli gigi, Ruang bersalin, Poli kasih, Spesialis anak, Spesialis Penyakit Dalam, Poli KIA/KB; layanan penunjangberupa laboratorium, rontgen, fisoterapi dan layanan Gawat Darurat 24 Jam. Bagi pasiennya, puskesmas ini juga menyediakan layanan senam hamil bagi ibu hamil setiap senin sampai rabu dan laynan terhdapa lansia.

Puskesmas kecamatan koja memiliki visi yaitu menjadi Puskesmas Terbaik Kebanggaan DKI Jakarta. Dan memiliki Misi Meningkatkan kualitas dan kompetensi sumber daya manusia secara berkelanjutan, menigkatkan mutu pelayanan kesehatan masyarakat secara menyeluruh, meningkatkan sarana dan prasarana tepat guna, meningkatkan suasana kerja yang nyaman dan harmonis dan menjalin dan mengembangkan kemitraan dengan lintas sektor dan instansi terkain

## 4.2. Deskripsi Data

The queuing system applied by the Outpatient BPJS Registration Counter is a Multi Channel Single Phase queuing system (multiple line system, one stage). Where there are two counters serving patients, but there is only one stage of service that the patient passes to complete registration. The arrival pattern of patients is not related to one another or it is usually called the arrival pattern is random. In carrying out registration services, BPJS counter officers have a standard service time (respond time) of 2 minutes to serve each patient at the counter. Arrival data is obtained by observing at the registration counter from 03 August 2020 to 07 August 2020.

There are many patients who start waiting to get services at the BPJS registration counter. Patient arrivals can be seen from 06.00 WIB even though the queue number is obtained at 7 am and service at the BPJS counter starts at 07.00 WIB until 14.00 WIB. The flow of patient services at the BPJS Registration Counter can be seen in the image below. Figure 4.1 Flow of Patient Services at the BPJS Registration Counter

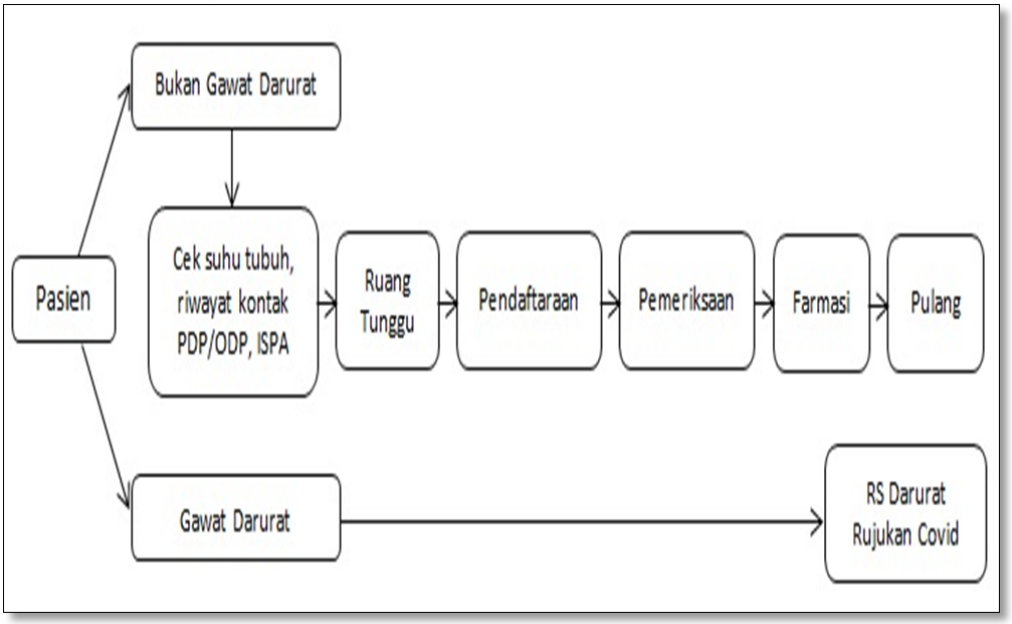



*Source: Observations at the Koja District Health Center BPJS Registration Counter (2020)*

Health services have undergone several changes in the service system due to the current Covid-19 pandemic, so there are several health protocols that must be followed to prevent the occurrence of Covid-19 transmission.

Berdasarkan Surat Edaran Menteri Kesehatan Nomor HK.02.01/MENKES/303/2020 tentang Penyelenggaraan Pelayanan Kesehatan Melalui Pemanfaatan Teknologi Informasi dalam rangka Pencegahan Penyebaran Covid-19 tentang pemanfaatan media online untuk reservasi atau pendaftaran guna meminimalkan jumlah pasien yang hadir pada layanan kesehatan dalam upaya pencegahan Covid-19. Pelayanan medik didasarkan pada Standar Prosedur Operasional (SPO). Pelayanan medik dimodifikasi demi mencegah penularan Covid-19, diantaranya yaitu menerapkan proses skrining untuk setiap pengunjung yang datang, mengubah alur pelayanan dan menyediakan ruang khusus untuk pemerikasaan ISPA, mengubah posisi tempat duduk dan memberikan jarak minimal 1 meter. Berikut merupakan alur pelayanan di Puskesmas sesuai dengan aturan selama masa pandemi (Covid-19).Pasien harus melakukan pemeriksaansuhu tubuh serta memberikan pernyataan apakah memiliki riwayat kontak langsung dengan PDP/ODP Covid-19sebelum mendapatkan pelayanan. Alur pelayanan puskesmas dimasa pandemic Coivid-19 dapat dilihat pada Gambar 4.2.

**Figure 4.2** Puskesmas Service Flow (Covid-19)




*Source: yankes.kemkes.go.id (2020)*

### 4.3. Analysis of Research Results

According to the observations that the researchers have done, the queue line design or queuing system currently implemented by the Koja District Health Center is a Multi Channel-Single Phase queuing system, where there are two counters serving patients but there is only one service stage that the patient passes.

The pattern of patient arrival is random, because patient arrivals are not tied to one another. In performing their duties, counter officers have a standard service time (respond time) of less than 2 minutes to serve each patient. The queuing discipline applied is First Come First Served (FCFS), which means that the patient who comes first will be served first.

The following data were obtained from the results of observations regarding the patient arrival rate at the BPJS Puskesmas registration counter in Koja District.

**Table 4.1.** Level of Patient Service at the Koja District Health Center

| Date | Number of Services | Operational hour | Number Counter | Average (μ |
|---|---|---|---|---|
| 03/08/2020 | 44 patients | 7 hours | 2 | 6.29 |
| 04/08/2020 | 51 patients | 7 hours | 2 | 7.29 |
| 05/08/2020 | 21 patients | 7 hours | 2 | 3 |
| 06/08/2020 | 39 patients | 7 hours | 2 | 5,57 |
| 07/08/2020 | 41 patients | 7 hours | 2 | 5.86 |

*Source: Observations at the Koja District Health Center (2020)*

In providing services to its patients, the Koja District Health Center provides registration services at the BPJS Outpatient registration counter 1 week or 5 working

days. The data collection process is carried out by recording and observing the number of arrivals.

**Table 4.2**. The arrival rate of patients from the Koja sub-district puskesmas

| Date | Number of arrivals | Operationa hours | Number counter | Average (λ |
|---|---|---|---|---|
| 03/08/2020 | 47 patients | 7 hours | 2 | 6.71 |
| 04/08/2020 | 51 patients | 7 hours | 2 | 7.29 |
| 05/08/2020 | 22 patients | 7 hours | 2 | 3.14 |
| 06/08/2020 | 39 patients | 7 hours | 2 | 5,57 |
| 07/08/2020 | 46 patients | 7 hours | 2 | 6.57 |

*Source: Observation results at the Koja sub-district puskesmas (2020)*

In the data Tables 4.1 and 4.2 it can be seen the level of arrival and level of service to the patient. On Monday, the arrival rate was recorded as 47 patients, while the service level was 44 patients who were served at the counter.

On Tuesday, the arrival rate of patients from 07.00-14.00 WIB is available 51 patients were the same as patients served by the registration counter, namely 51 patients. On Wednesday, the arrival rate of patients was 22 patients, while patients who received counter service were 21 patients.

On Thursday the arrival rate to the counters was 39 patients and the counters were serving services equal to the arrival rate of 39 patients. On Friday, the arrival rate of patients was 46 patients and counters provided services to only 41 patients.

**Table 4.3**. The arrival rate of patients at the Koja sub-district puskesmas (person / hour).

| Period of time | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| N 07.00-08.00 | 15 patients | 25 patients | 6 patients | 10 patients | 2 21 patient |
| 08.01-09.00 | 3 patients | 7 patients | - | 7 patients | 1 16 patient |
| 09.01-10.00 | 13 patients | 9 patients | 6 patients | 5 patients | 5 5 patients |
| 10.01-11.00 | 4 patients | 4 patients | 4 patients | 2 patients | - |
| 11.01-12.00 | 2 patients | 4 patients | 2 patients | 6 patients | 1 |
| 12.01-13.00 | 6 patients | 2 patients | 2 patients | 4 patients | - |
| 13.01-14.00 | 6 patients | - | 2 patients | 5 patients | - |
| total | 47 patients | 51 patients | 22 patients | 39 patients | 46 patients |

*Source: Observation results at the Koja sub-district puskesmas (2020)*

Based on the results of observation data carried out 5 working days it can be concluded that the level of arrival and service level,Tertinggi yaitu pada hari selasa. Petugas yang aktif atau berada di loket terdapat 2 orang dan selalu berada di loket pelayanan hanya saja banyak waktu yanng melonggar untuk pelayanan pasien yang dilayani di loket pendaftaran BPJS. Sedangkan pada saat kondisi seperti ini yaitu covid 19 ada nya penurunan dan kenaikan yang tidak stabil pada tingkat kedatangan pasien.

### 4.4. Analisis Data

Berdasarkan data yang telah terkumpul, maka dapat diukur kinerja antrea pada loket pendaftaran pasien BPJS Puskesmas Kecamatan Koja kinerja sistem antrean pada loket setiap harinya selama 5 hari pengamatan dengan respon time 2 menit. Untuk dapat mengukur kinerja antrean maka perlu diketahui terlebih dahulu nilai M, λ, dan μ setelah itu baru dapat diketahui nilai P0, Ls, Lq, Ws, Wq. M menunjukkan jumlah server atau loket

yang aktif, λ menunjukkan tingkat kedatangan rata-rata dalam satuan waktu dan μ menunjukkan tingkat pelayanan rata-rata dalam satuan waktu.

### 4.4.1. Kinerja sistem antrean pada Loket Pendaftaran BPJS Puskesmas Kecamatan koja

**(Senin, 03 Agustus 2020)**

Berikut adalah ukuran kinerja sistem antrean yang diperoleh dari pengamatan di Loket Pendaftaran BPJS Puskesmas Kecamatan.

$M$ = 2 *server*

$\lambda = \frac{47}{7}$ = 6,71 pasien/jam atau 6 sampai 7 orang pasien perjam.

$\mu = \frac{44}{7}$ = 6.29 patients / hour or 6 to 7 patients per hour

Qualify (*steady state*) or stable condition

$\left(\rho = \frac{\lambda}{M.\mu} < 1\right)$

$\left(\rho = \frac{6,71}{2.6,29} < 1\right)$

$\rho$= 0.5333

This means that ρ has met the steady state conditions, it can be said that the average arrival rate does not exceed service capacity.

1. Probability that there are 0 patients in the system (unemployment rate *server* /no service)

$P0 = \frac{1}{\left[\sum_{n=0}^{M-1} \frac{1}{n!}\left[\frac{\lambda}{\mu}\right]^n\right] + \frac{1}{M!}\left[\frac{\lambda}{\mu}\right]^M \frac{M.\mu}{M.\mu-\lambda}}$

$P0 = \frac{1}{\left[1+\frac{1}{1!}\left(\frac{6,71}{6,29}\right)^1 + \frac{1}{2!}\left(\frac{6,71}{6.29}\right)^2 + \frac{2(6,29)}{2(6.29)-6,71}\right.}$

P0 = 0.3043

This means that the probability of no patient being served in the queue system is 0.3043 or 30.43%.

2. Average number of patients in the system

$L_s = \frac{\lambda.\mu\left(\frac{\lambda}{\mu}\right)^M}{(M-1)!(M.\mu-\lambda)^2} P_0 + \frac{\lambda}{\mu}$

$L_s = \frac{6,71x6,29\left(\frac{6,71}{6,29}\right)^2}{(2-1)!(2x6,29-6,71)^2} 0.3043 + \frac{6,71}{6,29}$

$L_s$ = 1.4909

This means that the average number of patients in the system is 1.4909 people or 1 to 2 people in the system.

3. Average time the patient waits in the system

$W_s = \frac{L_S}{\lambda}$

$W_s = \frac{1,4909}{6,71}$

Ws = 0.2221

This means that the patient's average time spent waiting in the system is 0, 2221 or for 13.33 minutes.

4. Average number of patients in line

$L_q = LS - \frac{\lambda}{\mu}$

$L_q = 1,4909 - \frac{6,71}{6.29}$

$L_q$= 0.4241

This means that the average number of patients waiting in line is 0.4241 people or 1 to 2 people waiting in line.

5. Average waiting time for patients in line

$W_q = \frac{Lq}{\lambda}$

$W_q = \frac{0,4241}{6,71}$

$W_q$= 0.0632

This means that the patient's average time spent waiting in line is 0 , 0632 or for 3.79 minutes.

### 4.4.2. The performance of the queuing system at the BPJS Registration Counter

**(Tuesday, August 04, 2020)**

The following is a measure of the performance of the queuing system obtained from observations at the Koja District Health Center BPJS Registration Counter

$M$ = 2 *server*

$\lambda$ = $\frac{51}{7}$ = 7.29 patients / hour or 7 patients per hour

$\mu$ = $\frac{51}{7}$ = 7.29 patients / hour or 7 patients per hour

Qualify (*steady state*) or stable condition

$\left(\rho = \frac{\lambda}{M.\mu} < 1\right)$

$\left(\rho = \frac{7,29}{2.7,29} < 1\right)$

$\rho$= 0.5

This means that ρ has met the steady state conditions, it can be said that the average arrival rate does not exceed service capacity.

1. Probability that there are 0 patients in the system (unemployment rate *server* /no service)

$P0 = \frac{1}{\left[\sum_{n=0}^{M-1} \frac{1}{n!}\left[\frac{\lambda}{\mu}\right]^n\right] + \frac{1}{M!}\left[\frac{\lambda}{\mu}\right]^M \frac{M.\mu}{M.\mu-\lambda}}$

$P0 = \frac{1}{\left[1+\frac{1}{1!}\left(\frac{7.29}{7,29}\right)^1 + \frac{1}{2!}\left(\frac{7,29}{7,29}\right)^2 + \frac{2(7,29)}{2(7,29)-7,29}\right.}$

P0 = 0.3

This means that the probability of no patient being served in the queue system is 0.3 or 30%.

2. Average number of patients in the system

$L_s = \frac{\lambda.\mu\left(\frac{\lambda}{\mu}\right)^M}{(M-1)!(M.\mu-\lambda)^2} P_0 + \frac{\lambda}{\mu}$

$L_s = \frac{7,29x7,29\left(\frac{7,29}{7,29}\right)^2}{(2-1)!(2x7,29-7.29)^2} 0.3 + \frac{7,29}{7,29}$

$L_s$ = 1.3333

This means that the average number of patients in the system is 1.3333 people or 1 to 2 people in the system.

3. Average time a patient waits in line

$W_s = \frac{L_s}{\lambda}$

$W_s = \frac{1,3333}{7,29}$

Ws = 0.1828

This means that the patient's average time spent waiting in the system is 0, 1828 or for 10.97 minutes.

4. Average number of patients in line

$L_q = LS - \frac{\lambda}{\mu}$

$L_q = 1.3333 - \frac{7,29}{7,29}$

$L_q = 0.3333$

This means that the average number of patients waiting in line is 0.3333 people or 1 to 2 patients waiting in line.

5. Average waiting time for patients in line

$W_q = \frac{Lq}{\lambda}$

$W_q = \frac{0,3333}{7,29}$

$W_q = 0.0457$

This means that the average time spent by patients waiting in line is 0.0457 or 2.7434 minutes.

### 4.4.3. The performance of the queuing system at the BPJS Registration Counter (Wednesday, August 4, 2020)

The following is a measure of the performance of the queuing system obtained from observations at the Koja District Health Center BPJS Registration Counter.

$M$ = 2 *server*

$\lambda$ = $\frac{22}{7}$ = 3.14 patients / hour or 3 to 4 patients per hour

$\mu$ = $\frac{21}{7}$ = 3.00 patients / hour or 3 patients per hour

Qualify (*steady state*) or stable condition

$\left(\rho = \frac{\lambda}{M.\mu} < 1\right)$

$\left(\rho = \frac{3,14}{2.3,14} < 1\right)$

$\rho$= 0.5233

This means that ρ has met the steady state conditions, it can be said that the average arrival rate does not exceed service capacity.

1. Probability that there are 0 patients in the system (unemployment rate *server* /no service)

$P0 = \frac{1}{\left[\sum_{n=0}^{M-1} \frac{1}{n!}\left[\frac{\lambda}{\mu}\right]^n\right] + \frac{1}{M!}\left[\frac{\lambda}{\mu}\right]^M \frac{M.\mu}{M.\mu-\lambda}}$

$P0 = \frac{1}{\left[1+\frac{1}{1!}\left(\frac{3,14}{3,00}\right)^1 + \frac{1}{2!}\left(\frac{3,14}{3,00}\right)^2 \frac{2.(3,00)}{2(3,00)-3,14}\right.}$

P0 = 0.3129

This means that the probability of no patient being served in the queue system is 0.3129 or 31.29%.

2. Average number of patients in the system

$L_s = \frac{\lambda.\mu\left(\frac{\lambda}{\mu}\right)^M}{(M-1)!(M.\mu-\lambda)^2} P_0 + \frac{\lambda}{\mu}$

$L_s = \frac{3,14x3,00\left(\frac{3,14}{3,00}\right)^2}{(2-1)!(2x3,00-3,14)^2}$ 0, 3129+ $\frac{3,14}{3,00}$

$L_s$ = 1.4414

Artinya adalah jumlah rata-rata pasien dalam sistem sebanyak 1,4414 orang atau 1 sampai 2 orang dalam sistem.

3. Rata-rata waktu pasien menunggu dalam antrean

$W_s = \frac{L_S}{\lambda}$

$W_s = \frac{1,4414}{3,14}$

Ws = 0,4590

Artinya waktu rata-rata yang dihabiskan pasien untuk menunggu dalam sistem sebesar 0,4590 atau selama27,54menit.

4. Rata-rata jumlah pasien dalam antrean

$L_q = LS - \frac{\lambda}{\mu}$

$L_q = 1,4414 - \frac{3,14}{3,00}$

$L_q = 0,3947$

Artinya jumlah rata-rata pasien yang menunggu dalam antrean sebanyak 0,3947 orang atau 1 orang pasien yang menunggu dalam antrean.

5. Rata-rata waktu menunggu pasien dalam antrean

$W_q = \frac{Lq}{\lambda}$

$W_q = \frac{0,3947}{3,14}$

$W_q = 0,1257$

Artinya waktu rata-rata yang dihabiskan pasien untuk menunggu dalam antrean sebesar 0,1257 atau selama 7,54 menit.

### 1.4.4. Kinerja sistem antrean pada Loket JKN Pendaftaran BPJS (Kamis, 6 Agustus 2020)

Berikut adalah ukuran kinerja sistem antrean yang diperoleh dari pengamatan di Loket Pendaftaran BPJS Puskesmas Kecamatan Koja.

$M$ = 2 *server*

$\lambda$ = $\frac{39}{7}$ = 5,57 pasien/jam atau 5 sampai 6 orang pasien per jam

$\mu$ = $\frac{39}{7}$ = 5,57 pasien/jam atau 5 sampai 6 orang pasien per jam

Memenuhi syarat (steady state) atau kondisi stabil

$\left(\rho = \frac{\lambda}{M.\mu} < 1\right)$

$\left(\rho = \frac{5,57}{2.5,57} < 1\right)$

$\rho$=0,5

Artinya ρ sudah memenuhi kondisi steady state, dapat dikatakan rata-rata tingkat kedatangan tidak melebihi kapasitas pelayanan.

1. Probabilitas terdapat 0 pasien dalam sistem (tingkat menganggur *server*/tidak ada pelayanan)

$P0 = \frac{1}{\left[\sum_{n=0}^{M-1} \frac{1}{n!}\left[\frac{\lambda}{\mu}\right]^n\right] + \frac{1}{M!}\left[\frac{\lambda}{\mu}\right]^M \frac{M.\mu}{M.\mu-\lambda}}$

$P0 = \frac{1}{\left[1 + \frac{1}{1!}\left(\frac{5,57}{5,57}\right)^1 + \frac{1}{2!}\left(\frac{5,57}{5,57}\right)^2 \frac{2(5,57)}{2(5.57)-5,57}\right.}$

P0 = 0,3

Artinya adalah probabilitas tidak ada pasien yang dilayani dalam sistem antrean sebesar 0,3 atau sebesar 30%.

2. Rata-rata jumlah pasien dalam sistem

$L_s = \frac{\lambda.\mu\left(\frac{\lambda}{\mu}\right)^M}{(M-1)!(M.\mu-\lambda)^2} P_0 + \frac{\lambda}{\mu}$

$L_s = \frac{5,57x5,57\left(\frac{5,57}{5,57}\right)^2}{(2-1)!(2x5,57-5,57)^2}0,5+\frac{5,57}{5.57}$

$L_s$ = 1,3333

Artinya adalah jumlah rata-rata pasien dalam sistem sebanyak 1,3333 orang atau 1 sampai 2 orang pasien dalam sistem.

3. Rata-rata waktu pasien menunggu dalam antrean

$W_s = \frac{L_s}{\lambda}$

$W_s = \frac{1,0454}{5,57}$

Ws = 0,2393

Artinya waktu rata-rata yang dihabiskan pasien untuk menunggu dalam sistem sebesar 0,2393 atau selama 14,36 menit.

4. Rata-rata jumlah pasien dalam antrean

$L_q = LS - \frac{\lambda}{\mu}$

$L_q = 1,0454 - \frac{5,57}{5,57}$

$L_q$= 0,3333

Artinya jumlah rata-rata pasien yang menunggu dalam antrean sebanyak 0,3333 orang atau 1 orang pasien yang menunggu dalam antrean.

5. Rata-rata waktu menunggu pasien dalam antrean

$W_q = \frac{Lq}{\lambda}$

$W_q = \frac{0,0454}{5,57}$

$W_q$= 0,0598

Artinya waktu rata-rata yang dihabiskan pasien untuk menunggu dalam antrean sebesar 0,0598 atau selama 3,59 menit.

### 4.4.5. Kinerja sistem antrean pada Loket Pendaftaran BPJS

**(Jumat, 7 Agustus 2020 )**

Berikut adalah ukuran kinerja sistem antrean yang diperoleh dari pengamatan di Loket Pendaftaran BPJS Puskesmas Kecamatan Koja

$M$ = 2 *server*

$\lambda$ = $\frac{46}{7}$ = 6,57 pasien/jam atau 6 sampai 7 orang pasien per jam

$\mu$ = $\frac{41}{7}$ = 5,86 pasien/jam atau 5 sampai 7 orang pasien per jam

Memenuhi syarat (steady state) atau kondisi stabil

$\left(\rho = \frac{\lambda}{M.\mu} < 1\right)$

$\left(\rho = \frac{6,57}{2.5,86} < 1\right)$

$\rho$=0,5605

Artinya ρ sudah memenuhi kondisi steady state, dapat dikatakan rata-rata tingkat kedatangan tidak melebihi kapasitas pelayanan.

1. Probabilitas terdapat 0 pasien dalam sistem (tingkat menganggur *server*/tidak ada pelayanan)

$P0 = \frac{1}{\left[\sum_{n=0}^{M-1}\frac{1}{n!}\left[\frac{\lambda}{\mu}\right]^n\right]+\frac{1}{M!}\left[\frac{\lambda}{\mu}\right]^M\frac{M.\mu}{M.\mu-\lambda}}$

$P0 = \frac{1}{\left[1+\frac{1}{1!}\left(\frac{6,57}{5,86}\right)^1+\frac{1}{2!}\left(\frac{6,57}{5,86}\right)^2\frac{2(5,86)}{2(5.86)-6,57}\right.}$

P0 = 0,2815

Artinya adalah probabilitas tidak ada pasien yang dilayani dalam sistem antrean sebesar 0,2815 atau sebesar 28,15%.

2. Rata-rata jumlah pasien dalam sistem

$L_s = \frac{\lambda.\mu\left(\frac{\lambda}{\mu}\right)^M}{(M-1)!(M.\mu-\lambda)^2} P_0 + \frac{\lambda}{\mu}$

$L_s = \frac{6{,}57 \text{x} 5{,}86\left(\frac{6{,}57}{5{,}86}\right)^2}{(2-1)!(2\text{x}5{,}86-6{,}57)^2} 0{,}2815 + \frac{6{,}57}{5.86}$

$L_s$ = 1,6349

Artinya adalah jumlah rata-rata pasien dalam sistem sebanyak 1,6349 orang atau 1 sampai 2 orang passien dalam sistem.

3. Rata-rata waktu pasien menunggu dalam antrean

$W_s = \frac{L_s}{\lambda}$

$W_s = \frac{1{,}6349}{6{,}57}$

Ws = 0,2488

Artinya waktu rata-rata yang dihabiskan pasien untuk menunggu dalam sistem sebesar 0,2488 atau selama 14,93 menit.

4. Rata-rata jumlah pasien dalam antrean

$L_q = LS - \frac{\lambda}{\mu}$

$L_q = 1{,}6349 - \frac{6{,}57}{5{,}86}$

$L_q$= 0,5137

Artinya jumlah rata-rata pasien yang menunggu dalam antrean sebanyak 0,5137 orang atau 1 orang pasien yang menunggu dalam antrean.

5. Rata-rata waktu menunggu pasien dalam antrean

$W_q = \frac{Lq}{\lambda}$

$W_q = \frac{0{,}5605}{6{,}57}$

$W_q$= 0,0782

Artinya waktu rata-rata yang dihabiskan pasien untuk menunggu dalam antrean sebesar0,0782 atauselama4,69 menit.

Dari analisis data yang telah dilakukan maka dapat diketahui kinerja sistem antrean pada loket pandaftaran BPJS Puskesmas Kecamatan Koja dalam bentuk tabel 4.3

**Tabel 4.3.** Ukuran Kinerja Sistem Antrean pada Loket Pendaftaran Pasien BPJS

| Tanggal | Ukuran Kinerja Antrean | | | | | Steady State ρ< 1 |
|---|---|---|---|---|---|---|
| | P0 | Ls | Ws | Lq | Wq | |
| 03-08-2020 | 0.3043 | 1,4909 | 13,33 | 0,4241 | 3,79 | 0,5333 |
| 04-08-2020 | 0,3 | 1,3333 | 10,97 | 0,3333 | 2,74 | 0,5 |
| 05-08-2020 | 0,3129 | 1,4414 | 27,54 | 0,3947 | 7,54 | 0.532 |
| 06-08-2020 | 0,3 | 1,3333 | 14,36 | 0,3333 | 3,59 | 0,5 |
| 07-08-2020 | 0,2815 | 1,6349 | 14,93 | 0,5137 | 4,69 | 0,5606 |
| Rata-rata | 0,2997 | 1,4467 | 16,226 | 0,3998 | 4,47 | 0,5233 |

*Sumber: Data diolah (2020)*

From the data above, it can be seen that the probability of not having a patient in the system (P0) is 29.97%, the average number of patients in line (Lq) is 0.3998 patients, the average time spent by patients in the system (Ws) is equal to 16.226 minutes and the average time spent in line (Wq) of 4.47 minutes.

To assess that a queuing system is running optimally, it must meet the indicators contained in it. According to Arissetya et al. (2014: 367) this indicator must meet the steady state requirements where in this study the value of ρ is 0.1886. This shows that the average patient arrival rate does not exceed service capacity. The second indicator is the probability of the server being idle (P0) must be below 50% (Adiyani et al., (2014: 367). Where in this study (P0) is 29.97%.

This shows that the probability of the server being idle is in accordance with the second indicator. The less time the service facilities or servers are idle, it can be said that the performance of the officers is good. According to Septiani et al. (2017: 10) the last indicator can be seen from the average patient waiting time in the system (Ws) must be in accordance with the standard time set by the Koja District Health Center, which is less than 2 minutes. In this case, the average time spent by patients in the system has met the third indicator, namely (Ws) of 0.2704 seconds. Based on the three queuing system indicators above, it can be concluded that the performance of the queuing system at the BPJS Counter at the Koja District Health Center is currently optimal.

### 4.5. Simulasi Jumlah Loket

Berdasarkan analisis hasil penelitian dapat diketahui bahwa probabilitas terdapat 0 pasien dalam sistem cukup besar sehingga peneliti melakukan perbandingan dengan kinerja sistem antrean jika terdapat 3loket. Berikut peneliti jabarkan analisis data untuk kinerja antrean dengan 3 loket.

**Tabel 4.4.** Hasil Simulasi Rata-rata Dengan 2 Server, 3 Serverdan 4 Server (5 Hari Pengamatan)

| Ukuran Kinerja Sistem Antrean | 2 Server | 3Server | 4 Server |
|---|---|---|---|
| SteadyState ρ< 1 | 0,52 | 0,3487 | 0,26 |
| Probabilitas 0 pasien dalam sistem (P0) | 0,29 | 0,3145 | 0,29 |
| Rata-rata jumlah pasien dalam antrean (Lq) | 0,39 | 0,15 | 0,00 |
| Rata-rata jumlah pasien dalam sistem (Ls) | 1,44 | 1,10 | 1,05 |
| Rata-rata waktu yang dihabiskan dalam antrean (Wq) | 4, | 0,61 | 5,4 |
| Rata-rata waktu yang dihabiskan dalam sister (Ws) | 16,2 | 12,37 | 11,85 |

*Sumber : Data diolah (2020)*

Based on data from the comparison of the number of servers or simulation service counters using 3server, it has met the steady state requirements, namely the first indicator which is equal to 0.3487. This value also describes the level of server activity increasing from the actual conditions. This also reduces the probability level of not having a patient

in the system (P0), which is 31.45%. This value shows that the officer unemployment rate is the same as the result of the analysis using 2 servers, namely 29.97%. However, (P0) with 3server has met the second indicator, which is below 50%. However, with 3 servers or counter officers operating, the service time becomes faster, seen from the average number of patients in the queue (Lq) has decreased, which is 0.2061 patients and the average patient in the system (Ls) is 1.1020 patients . The mean time spent in queue (Wq) was 0.026 seconds and the mean time spent in the system (Ws) was 0.027 seconds.
If an increase in the number of officers operating at the Koja District Health Center BPJS Counter is made, the level of service will be faster so that many patients can be served every day. The value of ρ or also called the level of activity is followed by an increase in the probability that there are no patients in the system or the server's unemployment level has met the steady state requirements, which is 0.2616. This is the officer (P0), which is 29.58%. However, there was a decrease in the average number of patients in the queue (Lq), namely 0.0085 patients and the average patient in the system (Ls) of 1.0554 patients. The mean time spent waiting in line (Wq) was 0.005 and the average time spent waiting in the system (Ws) was 0.1975 seconds

## V. SIMPULAN DAN SARAN

Conclusion

The conclusion from the results of research that researchers have conducted at the Koja District Health Center regarding the queuing system and the performance of the queuing system at the BPJS Registration Counter, it was found that:
1. The queuing system model used at the BPJS Registration Counters at this time is the Multi Channel-Single Phase queuing system model or also known as the M / M / S model, namely there are 2 counters capable of serving patients and only one stage of service that the patient must pass. to complete registration.
2. The performance of the system at the registration counter of the BPJS Puskesmas, Koja District, can currently use 2 servers, it is known that the probability of no patient in the system (P0) is 29.97%, the average number of patients in line (Lq) is 0.3998 patients, The average time spent by patients in the system (Ws) was 16.22 minutes, and the average time spent in queuing (Wq) was 4.47 minutes.
Based on the data analysis that has been carried out, it is known that the queuing system at the registration counter at the BPJS Puskesmas Koja District is not optimal.

5.2. Suggestion

1. To create optimal service for patients, the Koja District Health Center needs to increase the number of counters so that the optimal number of counters is 3 or 4 counters.
2. Koja sub-district puskesmas must be able to handle patients who do not take queue numbers and manage better.
3. In addition, additional counters and additional officers are needed so that service at the counters is faster so that there is no accumulation of patients sitting in line to prevent the transmission of covid19

5.3. Limitations of Research and Further Research Development

The limitation in this study is that the observation time is too short, so the data collected is not too much. Researchers hope that in future studies the observation time is not too short, so that the data obtained is much more.

## DAFTAR REFERENSI

Adiyani, F. I., Sugito, dan T. Wuryandari. 2013. Analisis Pasien Rawat Inap Berdasarkan Kelas Perawatan di RSUP Dr. Kariadi Semarang dengan Metode Antrian. Jurnal Gaussian, 2 (4), 323-33.

Aslan, Imran. 2015. Applications of Queues in Hospitals in Istanbul. Journal of Social Sciences (COE and RJ-JJS), 4 (2), 771-794.

Afrane, S. dan A. Appah. 2014. Queuing Theory and The Management of Waiting-time in Hospitals: The Case of Anglo Gold Ashanti Hospital in Ghana. International Journal of Academic Research in Business and Social Sciences, 4 (2), 35-44.

Dimyati, Tarliah dan Akhmad Dimyati 2017. Operations Research Model-model Pengambilan Keputusan. Bandung : Sinar Baru Algensindo.

Fauzia, Ulfa, Elsa P Setiawati, dan Emma S Surahman. 2017. Analysis of Waiting Time for Filling Prescription in Hospital Pharmacy. Pharmacology and Clinical Pharmacy Research, 2 (3), 75-77

Heizer, Jay dan Barry Render 2016. Manajemen Operasi: Manajemen Keberlangsungan dan Rantai Pasokan (Hirson Kurnia, Ratna Saraswati, dan David Wijaya : Penerjemah). Jakarta : Salemba Empat.

Irawan, Heri Tri, Iing Pamungkas, dan Muzakir. 2018. Penerapan Model Antrian Pada Apotek Puskesmas Ingin Jaya Kabupaten Aceh Besar. Jurnal Optimalisasi, 4 (1), ISSN : 2477-5479 E. ISSN : 2502-0501, 54-41.

Kasmir. 2016. Bank dan Lembaga Keuangan Lainnya. Jakarta : Rajawali Pers.

Lovelock, Christopher, Jochen Wirtz, dan Jacky Mussry. 2013. PemasaranJasa(Dian Wulandari dan Devri Barnadi Putera : Penerjemah). Jakarta : Erlangga.

Wati, Risa. 2017. Sistem Antrian Pelayanan Pasien pada Puskesmas Kelurahan Setiabudi Jakarta Selatan dengan Menggunakan Metode Waiting Line. Jurnal Techno Nusa Mandiri, 14 (2), 91-96.

Sanusi, Anwar. 2014. Metodologi Penelitian Bisnis. Jakarta : Salemba Empat.

Septiani, A. S., P. A. Wigati, dan E. Y. Fatmasari. 2017. Gambaran Sistem

Antrian Pasien dalam Optimasi Pelayanan di Loket Pendaftaran Instalasi Rawat Jalan Rumah Sakit Umum Fatmawati. Jurnal Kesehatan Masyarakat, 5 (4), 1-14.

Tjiptono, Fandy. 2019. Pemasaran Jasa. Yogyakarta : ANDI.

Veonita, V., T. Aspranti, dan P. Sopiah. 2017. Analisis Sistem Antiran

Pendaftaran BPJS pada Instalasi Rawat Jalan dengan Menggunakan

Metode Multi Channel-Multi Phase untuk Meminimumkan Waktu Tunggu di Rumah Sakit Jiwa Provinsi Jawa Barat. Jurnal Prosiding Manajemen, 3(2), 854-860.

Wihdaniah, Syarifah, Maat Pono, dan Musran Munizu. 2018. Analisis Kinerja Sistem Antrian Dalam Mengoptimalkan Pelayanan Pasien Rawat Jalan Di RSUD HAJI MAKASSAR. Jurnal Bisnis, Manajemen dan Informatika, 14 (3),2679-2704.